

Facts, Myths, and Evolving Research Agenda on the Mechanization of the African Agricultural Sector

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Abstract:
Governments agencies, development specialists, and private businesses have introduced agricultural mechanization as a critical priority throughout Africa. However, because state-led mechanization efforts in the past have failed, industrialization has been largely ignored in the literature. Popular theories like "mechanization causes to unemployment" have arisen in this empirically deficient environment. nine of these claims are examined, and it turns out that the majority of them are either backed by little or no evidence. Thus, they can be referred to as "myths." The potential benefit of agricultural automation in Africa to ensure global food security may be undermined by such fallacies, which have an impact on policies and initiatives. We suggest a research program with the goal of settling disputes and promoting evidence-based regulations for sustainable and equitable agricultural mechanization.
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1. Introduction:

The least automated agricultural systems can be found in Africa (Mechanization, 2016). Because of this, agricultural labor productivity, which is a key factor to determine farmers' incomes and, ultimately, the security of their food and nutrition, has been stagnant throughout time (Fuglie & Rada, 2013). During the 1960s and 1970s, the state made significant attempts to encourage modernization, frequently involving the importation of public machines, but these initiatives largely failed due to governance issues (P. Pingali, 2007). This led to the belief that Africa was still not ready for mechanized agriculture, which caused mechanization to be neglected in development practice and academics as a result (Diao et al., 2012; Mechanization, 2016). This is altering as a result of the resurgence of agriculture on Africa's development agenda and the resulting resurgence of interest in automation. Governments strive to make agriculture more appealing to young people, in particular by overcoming the "hoe and cutlass" culture (Mockshell & Birner, 2015). The world's top farm equipment businesses acknowledge Africa as a growing market, and development agencies have started to push mechanization (Mechanization, 2016).

The growing interest in mechanization is a result of several new driving forces. In several nations, labor shortages in soil preparation have been caused by intensive agriculture and rising rural wages (Diao, Cossar, Houssou, & Kolavalli, 2014; Diao et al., 2012). (Cossar, 2016) claims that increased market access and population pressure have resulted in areas of agriculture that are heavily automated, such as some districts in Ghana where up to 80% of farmers utilize machines. Mechanized farming is positively connected with rising rural incomes and the price of working animals in Ethiopia (Berhane, Dereje, Minten, & Tamru, 2017). Additionally, prices have decreased as a result of rising imports of machinery from China and India (Mechanization, 2016). According to (Jayne et al., 2019), the "growth of medium-

scale farmers" offers new opportunities for the tractor rental sector, which could profit from mobile applications similar to "Uber" that lower transaction costs (Daum et al., 2021).
Alongside new initiatives and prospers to further mechanization in Africa, a rising corpus of practical research has been conducted on the subject, as will be mentioned below. Nevertheless, the subject has been ignored for ten years, and it still affects the public discussion. As a result, a number of claims have been made in the public discourse, including "mechanization causes poverty" and "smallholder farmers cannot gain from industrialization." As we demonstrate, the majority of these claims are supported by contradictory or little evidence, which is the reason we refer to them simply as "myths." 1 These fallacies about mechanization can confuse policies and strategies.

Many arguments center on the idea that industrialization shouldn't be encouraged due to its detrimental consequences on the economy, society, and environment. For instance, the International Labor Organization (ILO) predicted that mechanization could lead to jobless as early as 1973. (Daum & Birner, 2020). Given the growing youth population in Africa and the ensuing need to create thousands of jobs, this issue is still being addressed and has to be thoroughly evaluated (Bank, 2016). Other topics include soil degradation and the marginalization of small-scale farmers (Malabo, 2018). Additionally, some claims support industrialization but lack supporting data. One such is the assertion that automation won't happen unless authorities import a lot of machinery. Such misconceptions might influence ineffective industrialization techniques.

This paper aims to investigate the empirical support for some mechanization-related claims that are heavily discussed in the development of culture. We enquire as follows: Which claims are backed up by evidence, and which don't? Which simple depictions of complicated issues necessitate further study in order to be solved? We use historical data and a review of the empirical studies on mechanization in Africa to address these problems. We develop recommendations for future research and action to address agricultural technology in Africa depending on the examination of the nine hypotheses.

2. Mechanization theories in Africa:

There are several mechanization theories in Africa. One of the most popular is the technological determinism theory. According to this theory, the development of technology is the primary driver of social and economic change. The theory argues that technological advancements lead to increased efficiency and productivity, which in turn leads to economic growth. Therefore, the adoption of mechanization in agriculture will result in increased productivity and economic growth in Africa (Ahmed, 2022; Ahmed & Miller, 2022). Another theory is the cultural determinism theory. This theory argues that cultural factors, such as beliefs, values, and traditions, play a significant role in shaping economic behavior. According to this theory, the slow adoption of mechanization in Africa can be attributed to cultural factors that favor traditional farming methods. For example, some African cultures view farming as a way of life and not just a means of making a living. Therefore, they prefer to use traditional methods of farming, such as hand tools and animal power (Ruttan, 1977). The political economy theory is another mechanization theory in Africa. This theory argues that political and economic factors influence the adoption of technology. According to this theory, governments in Africa have not invested enough in mechanization because they are more focused on maintaining political power. Additionally, mechanization requires significant capital investments, which many African countries cannot afford due to their economic constraints (Diao et al., 2014).

3. Challenges Facing Mechanization in Africa:

Despite the benefits of mechanization, there are several challenges facing its adoption in Africa. One of the main challenges is the high cost of machinery. Most African farmers cannot afford to buy or lease expensive machinery, which limits their access to mechanization. Additionally, the high cost of spare parts and maintenance further increases the cost of owning and operating machinery (Daum & Birner, 2017; Daum, Buchwald, Gerlicher, & Birner, 2018). Another challenge is the lack of infrastructure to support mechanization. Mechanization requires a reliable source of energy, such as electricity or fuel, which is not available in many rural areas of Africa (Al Hosani, Fathelrahman, Ahmed, & Rikab, 2022). In addition, poor road networks make it difficult to transport machinery from one location to another, limiting its use to areas with good infrastructure (P. L. Pingali, Bigot, & Binswanger, 1987).

Another challenge is the lack of skilled labor. Mechanization requires skilled operators who can operate and maintain machinery. However, there is a shortage of skilled labor in Africa, which limits the adoption of mechanization. Additionally, there is a lack of training programs to train farmers on how to use and maintain machinery (H. Binswanger, 1986),. Another challenge facing mechanization in Africa is the lack of adequate infrastructure to support mechanized farming. Most rural areas in Africa lack good roads, electricity, and water supply, which are necessary for the use of machinery. The absence of these basic amenities makes it difficult for farmers to use machinery effectively(Ahmed & Miller, 2022). Moreover, the availability of spare parts and maintenance services for machinery is a challenge in Africa. When machinery breaks down, it can be challenging to find the necessary spare parts and skilled labor to fix the machinery. This can lead to prolonged downtime, which can impact productivity and profitability (G. Mrema, Kienzle, & Mpagalile, 2018).

3.1 Possible Solutions:

To overcome the challenges facing mechanization, several solutions can be implemented. One solution is the development of appropriate technologies that are affordable and easy to use. This can be achieved through research and development programs that focus on developing machinery that meets the needs of African farmers. For example, machinery that is designed to operate in areas with poor infrastructure and that can be easily repaired using locally available spare parts (Daum & Birner, 2017; Daum et al., 2018). Another solution is the provision of financing options to enable farmers to acquire machinery. Governments and financial institutions can provide loans and grants to farmers to enable them to purchase or lease machinery (Ahmed, Miller, & Ahmed, 2023). Additionally, governments can provide tax incentives to encourage the private sector to invest in mechanization (Malabo, 2018). Training programs can also be implemented to train farmers on how to use and maintain machinery. This can be done through partnerships between governments, research institutions, and private sector organizations. Training programs can be offered at agricultural colleges and universities, as well as through extension services (Mechanization, 2016).

The Way Forward for Mechanization in Africa is to overcome the challenges facing mechanization in Africa, several solutions can be implemented. First, governments can provide subsidies and credit facilities to small-scale farmers to purchase machinery. This can enable them to invest in machinery and improve productivity (Juma, 2016). Secondly, the development of infrastructure in rural areas can facilitate the use of machinery in farming. Governments can invest in roads, electricity, and water supply in rural areas to support mechanized farming. Thirdly, the development of a local manufacturing industry for machinery in Africa can ensure the availability of spare parts and maintenance services. This can reduce downtime and improve productivity (Al Hosani et al., 2022).

4. Examples of Mechanization from some African Countries:

Agriculture is the backbone of many African economies, providing employment for millions of people and contributing to food security. However, traditional farming practices using manual labor have limited productivity, leading to low yields and income for farmers. Farming mechanization has the potential to increase agricultural productivity, create job opportunities, and boost economic growth. This part Table 1 will explore African countries that have embraced technology in agriculture and are using farming mechanization to improve productivity and economic growth.

Table 1. Level of Mechanization in Some African Countries

Country	Level of Mechanization
South Africa	South Africa is one of the leading countries in Africa in terms of farming mechanization. The country has a well-established agricultural sector, with large commercial farms that use advanced farming equipment such as tractors, combine harvesters, and irrigation systems. The country has a well-developed infrastructure, including good roads, electricity, and water supply, which supports farming mechanization (Mechanization, 2016).
Egypt	Egypt is another African country that has embraced farming mechanization. The country has a long history of agriculture, dating back to the ancient Egyptian civilization. Today, the country has a modern agricultural sector that uses advanced technology, including drip irrigation systems, greenhouses, and tractors. The government has also invested in research and development in agriculture, leading to the development of new technologies and practices that improve productivity and sustainability (G. Mrema et al., 2018).
Nigeria	Nigeria is Africa's most populous country and has a vast agricultural sector. The country has a significant number of small-scale farmers who rely on manual labor to farm. However, in recent years, the government has encouraged farming mechanization, offering incentives to farmers who purchase tractors and other farming equipment. The country has also seen an increase in private sector investment in agriculture, leading to the development of modern farming technologies (Houssou, Diao, & Kolavalli, 2014).
Kenya	Kenya is one of the leading countries in East Africa in terms of farming mechanization. The country has a significant number of small-scale farmers, and the government has initiated several programs to promote the adoption of modern farming technologies. These include the provision of subsidized credit facilities for farmers to purchase farming equipment, the establishment of demonstration farms to showcase modern farming technologies, and the development of irrigation systems (P. L. Pingali et al., 1987).
Ethiopia	Ethiopia is another African country that has made significant progress in farming mechanization. The country has a vast agricultural sector, with a large number of small-scale farmers. In recent years, the government has encouraged the adoption of modern farming technologies, including tractors, irrigation systems, and other farming equipment. The country has also seen an increase in private sector investment in agriculture, leading to the development of modern farming practices and technologies (Fuglie & Rada, 2013).
Tanzania	Tanzania is another East African country that has embraced farming mechanization. The country has a significant number of small-scale farmers who rely on manual labor

	to farm. However, in recent years, the government has encouraged the adoption of modern farming technologies, offering incentives to farmers who purchase tractors and other farming equipment. The country has also seen an increase in private sector investment in agriculture, leading to the development of modern farming technologies (P. Pingali, 2007).
Ghana	Ghana is one of the leading countries in West Africa in terms of farming mechanization. The country has a significant number of small-scale farmers, and the government has initiated several programs to promote the adoption of modern farming technologies. These include the provision of subsidized credit facilities for farmers to purchase farming equipment, the establishment of demonstration farms to showcase modern farming technologies, and the development of irrigation systems (Daum et al., 2021).
Ivory Coast	Ivory Coast is a West African country that has made significant progress in farming mechanization. The country has a vast agricultural sector, with a large number of small-scale farmers. In recent years, the government has encouraged the adoption of modern farming technologies, including tractors, irrigation systems, and other farming equipment. The country has also seen an increase in private sector investment in agriculture, leading to the development of modern farming practices and technologies (Jayne et al., 2019).
Senegal	Senegal is another West African country that has embraced farming mechanization. The country has a significant number of small-scale farmers, and the government has initiated several programs to promote the adoption of modern farming technologies. These include the provision of subsidized credit facilities for farmers to purchase farming equipment, the establishment of demonstration farms to showcase modern farming technologies, and the development of irrigation systems (Daum et al., 2021).
Zimbabwe	Zimbabwe is a southern African country that has made significant progress in farming mechanization. The country has a well-developed commercial farming sector that uses advanced farming equipment such as tractors, combine harvesters, and irrigation systems. However, the country also has a significant number of small-scale farmers who rely on manual labor to farm. In recent years, the government has encouraged the adoption of modern farming technologies, offering incentives to farmers who purchase tractors and other farming equipment (Fuglie & Rada, 2013).

5. Impact of Mechanization on Employment in Africa:

Mechanization has been found to lead to job loss in Africa. As machines replace human labor, many people who were previously employed in agriculture lose their jobs. According to the African Development Bank, mechanization in Africa has led to a decline in employment in the agricultural sector. For example, in Nigeria, it is estimated that the use of tractors has led to a reduction of 33% in labor requirements in agriculture (Sheahan & Barrett, 2017). Moreover, a study conducted by the Food and Agriculture Organization (FAO) found that mechanization in sub-Saharan Africa has led to a shift in employment from agriculture to non-agricultural sectors, such as manufacturing and services (FAO, 2016). The unemployment rate rises with mechanization if the cultivable area can be increased and the demand for agricultural products is elastic. Similar to this, when technology boosts output, as it does, for example, with pump irrigation, more labor is needed. The lack of workers, which is brought on by a shift to the manufacturing industry, may also be addressed by mechanization. However, when incentives rather than a lack of labor are the driving force for modernization, "cutbacks in the working farming population can be enormous" (H. Binswanger, 1986). There aren't many researchers that look at how

automation affects jobs in Africa, and those that do tend to find mixed results. However, the non-agricultural sectors may not have the capacity to absorb the large number of unemployed people, especially in rural areas where there are few employment opportunities (P. Pingali, 2007).

5.1 Factors Contributing to Job Loss:

Several factors contribute to the job loss caused by mechanization in Africa. One of the main factors is the high cost of machines. Most farmers in Africa cannot afford to buy machines, and the few who can, face difficulties in maintaining them due to the lack of spare parts and technical expertise. As a result, many smallholder farmers cannot compete with large-scale farmers who have access to modern machines and are able to produce more efficiently and cost-effectively (G. Mrema et al., 2018).

Another factor that contributes to job loss is the lack of appropriate policies and support from governments. In many African countries, there is a lack of policies that support smallholder farmers in accessing modern technologies and financing. This hinders the adoption of modern technologies, including mechanization, which could lead to increased productivity and employment opportunities (G. C. Mrema, Baker, & Kahan, 2008).

Moreover, the lack of appropriate skills and knowledge in operating and maintaining machines is another factor contributing to job loss. Many smallholder farmers lack the skills and knowledge to operate and maintain modern machines, which limits their ability to compete with large-scale farmers. This leads to a situation where only a few people benefit from mechanization, while the majority lose their jobs (Adu-Baffour, Daum, & Birner, 2019).

5.2 Possible Solutions for Employment loss:

To address the challenges associated with mechanization in Africa, there is a need for a comprehensive approach that involves different stakeholders, including governments, farmers, researchers, and development partners. Here are some possible solutions:

1. Government support: Governments should develop policies that support smallholder farmers in accessing modern technologies and financing. This could be achieved through subsidies, grants, and other forms of financial assistance (P. L. Pingali et al., 1987).
2. Skill development: There is a need for training programs that equip smallholder farmers with the necessary skills and knowledge in operating and maintaining modern machines. This could be achieved through partnerships between governments, research institutions, and private sector actors (Mechanization, 2016).
3. Collaborative Mechanization: Farmer groups and cooperatives can pool resources to acquire and share machinery for their agricultural activities. This promotes collaboration and sharing of knowledge, reduces the cost of mechanization and increases employment opportunities (G. C. Mrema et al., 2008).
4. Development of a local machinery industry: Governments can invest in the development of a local machinery industry to produce and supply affordable and appropriate machines. This can be achieved through partnerships between governments, the private sector, and research institutions (Daum & Birner, 2020).

6. Mechanization and small-scall farming in Africa:

Small-scale farming is the backbone of Africa's agriculture sector, providing livelihoods to millions of rural households. However, smallholder farmers in Africa face numerous challenges, including limited access to modern technologies, low productivity, and poor market linkages. Mechanization and industrialization have the potential to transform the smallholder farming sector in Africa by increasing

productivity, reducing labor costs, and improving market access. In this part Table 2, we explore how mechanization and industrialization can aid small-scale farmers in Africa.

Table 2. Mechanization effects on small-scall farms in Africa

Factor	Mechanization Effect
Increased Productivity	Mechanization involves the use of machines and equipment to perform tasks that were previously done manually. This can increase productivity by reducing labor costs and increasing the efficiency of operations. For smallholder farmers in Africa, this can translate into higher yields and more income. For example, in Nigeria, the use of tractors for land preparation increased maize yields by 60% (Kirui, 2019)
Labor-saving	Mechanization can reduce the labor burden on smallholder farmers, enabling them to devote more time to other income-generating activities or other aspects of their lives. This can also reduce the drudgery associated with manual labor, which can lead to improved working conditions and better health outcomes (Baudron et al., 2015).
Improved Access to Credit	Mechanization can also enable smallholder farmers to access credit, as mechanized farming is often seen as a more secure and profitable enterprise. This can enable smallholder farmers to access financing to purchase machinery and equipment, which can further improve productivity and profitability (Baudron et al., 2015).
Improved Quality of Produce	Mechanization can also improve the quality of produce by reducing post-harvest losses and improving processing and packaging. This can enable smallholder farmers to access higher-value markets, thereby improving their incomes (P. L. Pingali et al., 1987).
Increased Market Access	Industrialization can provide smallholder farmers with access to markets and value-added processing. By providing support for value addition, such as milling and processing facilities, industrialization can help smallholder farmers add value to their produce, increasing the price they receive and improving their profitability. This can also create employment opportunities in rural areas, as smallholder farmers can hire labor to help with processing and packaging (G. Mrema et al., 2018).
Creation of Employment Opportunities	Industrialization can also create employment opportunities for rural communities. This can include jobs in the processing and packaging of agricultural produce, as well as in the manufacturing and maintenance of machinery and equipment. By creating employment opportunities, industrialization can help to reduce rural-urban migration, which can lead to social and economic problems in urban areas (Sims & Kienzle, 2016).
Improved Access to Information	Mechanization and industrialization can also improve access to information and knowledge for smallholder farmers. By providing training and extension services, smallholder farmers can learn how to use machinery and equipment, and access information on best practices in agriculture. This can lead to improved productivity and profitability (Sims & Kienzle, 2016).
Reduced Drudgery	Mechanization can reduce the drudgery associated with manual labor, particularly for women. By reducing the labor burden, mechanization can improve working conditions and reduce health risks associated with manual labor (Ahmed, 2022).

Increased Resilience to Climate Change	Mechanization can also improve the resilience of smallholder farmers to climate change. By enabling farmers to plant and harvest crops more efficiently, mechanization can reduce the risks associated with climate-related disasters, such as droughts and floods (Ahmed & Miller, 2022).
Policy Support	mechanization and industrialization require policy support to be successful. Governments can provide support for the development of local machinery industries, as well as for research and development of appropriate technologies for smallholder farmers. Governments can also provide financing to smallholder farmers to enable them to purchase machinery and equipment and provide support for value addition and market access (Bigot, Bigot, & Binswanger, 1987).

7. Mechanization and Environmental damage:

Agriculture mechanization is frequently viewed as being detrimental to the environment. On page 70 of its 2008 book, (Campesina, 2008), for instance, issued a warning that "industrial agricultural production needs significantly more energy (and produces significantly more Carbon dioxide) to fuel its massive machineries." Wikipedia's article on "mechanized agriculture" states that industrialization "may cause environmental damage (such as deforestation, soil erosion, and pollution)". Africa is concerned that mechanization may lead to an increase in cropland, eradicating woodlands and savanna plants. This might significantly alter the local climate, cause a loss of biodiversity, and produce a lot of greenhouse emissions (Searchinger et al., 2015).

7.1 Types of Machinery Involved:

Mechanization involves a wide range of machines, equipment, and tools, each with its unique environmental impact. Some of the most common types of machinery involved in mechanization include (Takeshima, Nin-Pratt, & Diao, 2013):

1. Agricultural machinery - These are machines used in farming activities, such as tractors, plows, harvesters, and irrigation systems. These machines are known to cause soil erosion, soil compaction, and land degradation, leading to reduced soil productivity and water quality.
2. Industrial machinery - These are machines used in the manufacturing industry, such as conveyor belts, compressors, boilers, and turbines. Industrial machinery consumes significant amounts of energy and raw materials, resulting in pollution, emissions, and waste products that harm the environment.
3. Transportation machinery - These are machines used in the transportation industry, such as cars, trucks, trains, and airplanes. Transportation machinery is a significant source of greenhouse gas emissions, air pollution, noise pollution, and habitat destruction.
4. Construction machinery - These are machines used in the construction industry, such as bulldozers, cranes, excavators, and backhoes. Construction machinery contributes to deforestation, soil erosion, and land degradation, leading to the loss of habitat for wildlife and disruption of ecosystems.

7.2 Impacts of Mechanization on the Environment:

1. Pollution - Mechanization is a significant source of pollution, emitting toxic substances into the air, water, and soil. Agricultural machinery, industrial machinery, and transportation machinery emit gases such as carbon dioxide, sulfur dioxide, nitrogen oxides, and particulate matter, which contribute to air pollution. Industrial machinery also produces hazardous waste products, such as chemicals and heavy metals, which pollute the soil and water (Ströh de Martínez, Feddersen, & Speicher, 2016).

2. Climate Change - Mechanization is a significant contributor to climate change, with transportation machinery being the primary source of greenhouse gas emissions. These emissions trap heat in the atmosphere, leading to increased temperatures, sea level rise, and extreme weather events. Agricultural machinery also contributes to climate change through deforestation, which reduces the number of trees that absorb carbon dioxide from the atmosphere (Houssou et al., 2014).
3. Soil Degradation - Agricultural machinery, particularly heavy equipment such as tractors, plows, and harvesters, compacts soil, leading to reduced soil fertility and water retention. Soil compaction also makes it difficult for plant roots to penetrate the soil, reducing crop yields. Soil degradation can also lead to erosion, which carries away topsoil and nutrients, reducing soil productivity (Searchinger et al., 2015).
4. Deforestation - Mechanization in the construction industry leads to deforestation, which is the loss of forests and other natural habitats. Deforestation reduces the number of trees that absorb carbon dioxide from the atmosphere, leading to increased greenhouse gas emissions. Deforestation also leads to the loss of habitat for wildlife and disruption of ecosystems, leading to biodiversity loss (Winkler, Lemke, Ritter, & Lewandowski, 2017).
5. Habitat Destruction - Mechanization in the construction industry also leads to habitat destruction, as it involves the removal of natural habitats such as wetlands, forests, and grasslands. Habitat destruction disrupts ecosystems and reduces the number of species that can survive in the area (Fischer et al., 2018) .

8. Mechanization finance in Africa:

In many African countries, however, small-scale farmers often lack the resources to purchase and maintain agricultural machinery. In this part Table 3, we will discuss different ways to finance mechanization in Africa.

Table 3. Mechanization sources of finance in Africa

Source of finance	Mechanization Effect
Public Sector Financing	Governments can finance mechanization in Africa by investing in the development of infrastructure and providing subsidies to farmers. Infrastructure investments include roads, irrigation systems, and storage facilities, which can reduce transportation costs and post-harvest losses. Subsidies can help small-scale farmers access credit to purchase and maintain agricultural machinery. In Ethiopia, for example, the government has provided subsidies to farmers to purchase tractors and other machinery (H. P. Binswanger & Rosenzweig, 1986).
Private Sector Financing	Private sector financing can help to increase access to finance for small-scale farmers in Africa. Private sector investors can provide credit to farmers to purchase and maintain agricultural machinery. In addition, private sector companies can invest in the development of distribution networks to deliver agricultural machinery to rural areas. For example, John Deere, a global manufacturer of agricultural machinery, has partnered with several African companies to expand its distribution network in Africa (Middelberg, 2017).
Microfinance	Microfinance institutions (MFIs) can provide credit to small-scale farmers to purchase agricultural machinery. MFIs can also provide training on the use and maintenance of machinery. For example, the Small Enterprise Foundation in South

	Africa provides microfinance loans to farmers for purchasing machinery, including tractors and threshers. The organization also provides training on the use and maintenance of the machinery(Agyei-Holmes, 2016; Mechanization, 2016).
Donor Funding	Donor funding can be used to support the development of agricultural mechanization in Africa. Donor funding can be used to invest in infrastructure, provide subsidies to farmers, and provide credit to small-scale farmers. In addition, donor funding can be used to support research and development of new technologies and practices for agricultural mechanization. For example, the United States Agency for International Development (USAID) has provided funding for agricultural mechanization programs in several African countries (Ströh de Martínez et al., 2016).
Agricultural Value Chain Financing	Agricultural value chain financing involves providing finance to different players in the agricultural value chain, including farmers, processors, and traders. By financing the entire value chain, financing can be directed towards investments that benefit all actors in the chain. For example, financing can be provided for the purchase of machinery for processing agricultural products, as well as for transportation and storage facilities (Middelberg, 2017).
Asset Financing	Asset financing involves providing credit to farmers for the purchase of specific assets, such as tractors, harvesters, and other machinery. The asset being financed serves as collateral for the loan. This type of financing is particularly relevant for small-scale farmers who may not have sufficient collateral to obtain traditional bank loans. Asset financing can be provided by microfinance institutions, agricultural cooperatives, and other specialized lenders (Takeshima et al., 2013).
Crowdfunding	Crowdfunding involves raising funds from a large number of individuals through an online platform. Crowdfunding can be used to finance agricultural mechanization in Africa. For example, a farmer can launch a crowdfunding campaign to raise funds to purchase a tractor or other machinery. Crowdfunding can also be used to support agricultural mechanization projects that benefit the community, such as the development of irrigation systems or storage facilities (Kansanga, Mkandawire, Kuuire, & Luginaah, 2020).

9. Concluding

Empirical data is required as Africa prepares for agricultural mechanization to assure that policies and initiatives are not based on false assumptions. This essay examined nine well-known claims, most of which proved false or only partially correct. A new research agenda encompassing numerous important study fields are required to support Africa's efforts to mechanize, according to the examination of popular beliefs. What is the labor demand for mechanization? How can it be made sure that women and small household farmers profit? What possibilities does technology have in this regard? How might a mechanization-friendly environment be created? How may mechanization efforts be made to be ecologically sustainable?

Research that seek to address these types of issues must be informed by hypotheses of agriculture development and take into account the fact that financial fundamentals (such as land availability and rural wages), agro-climatic conditions (such as crops, soil types, and seasonal rainfall), and social goals of societies differ significantly among African nations. Effective program and policy design will depend on a site-specific analysis, which must be based on a solid comprehension of which institutional and technological solutions are appropriate in each circumstance while taking economic, agroclimatic, and social factors into account. With such a strategy, it will be possible to prevent some of the potential

drawbacks of mechanization, like unemployment, which can arise when mechanization is forcibly pushed in places where the framing conditions are not favorable.

Finding mechanized solutions that are sustainable in terms of the economy, society, and environment will be made easier by addressing these research areas. This review has demonstrated that there is a lack of knowledge of the trade-offs between various dimensions, which necessitates more multidisciplinary research. The study plan presented here was especially intended to address common myths; hence it is undoubtedly incomplete. However, we anticipate that the proposed research will offer suggestions for policy-relevant research and dispel widespread misconceptions about mechanization which may be stopping smallholder farmers from getting access to an advanced technologies that could significantly enhance their life quality and support global food security.

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