Bangladesh Investment Development Authority

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DIVERSIFYING INVESTMENTS IN BANGLADESH: AGRICULTURAL MACHINERY INDUSTRY

Diversifying Investments in Bangladesh:

Agricultural Machinery Industry

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List of Abbreviations

2 WT / 3 WT	2-Wheeler Tractor / 3-Wheeler Tractor
AI	Artificial Intelligence
AIT	Advance Income Tax
AT	Advance Tax
B2C	Business-to-Consumer
BADC	Bangladesh Agricultural Development Cooperation
BARI	Bangladesh Agricultural Research Institute
BBS	Bangladesh Bureau of Statistics
BDT	Bangladeshi Taka
BEZA	Bangladesh Economic Zones Authority
Bil	Billion
CAGR	Compound Annual Growth Rate
CD	Customs Duty
COVID-19	Coronavirus Disease of 2019
CSA	Climate Smart Agriculture
CSISA-MEA	Cereal Systems Initiatives for South Asia Mechanization Extension Activity
DAE	Department of Agricultural Extension
DAY-NRLM	Deen Dayal Antyodaya Yojana - National Livelihoods Mission
FAO	Food and Agriculture Organization
FDI	Foreign Direct Investment
FGD	Focus Group Discussion
FOB	Free on Board
FTF	Feed the Future
FY	Fiscal Year
GDP	Gross Domestic Product
GED	General Economic Division
GoB	Government of Bangladesh
HP	Horsepower
HS Code	Harmonized System Code
ICOR	Incremental Capital-Output Ratio
IDRA	Insurance Development and Regulatory Authority
IPA	Investment Promotion Agencies
KII	Key Informant Interviews

KYC	Know Your Customer
LDC	Least Developed Countries
LSPs	Local Service Providers
MFI	Microfinance Institution
MoA	Ministry of Agriculture
MoF	Ministry of Finance
MSPs	Mechanization Service Providers
NBFI	Non-Banking Financial Institution
NGO	Non-Governmental Organization
OECD	The Organization for Economic Cooperation and Development
PAYG	Pay-As-You-Go
PPP	Public-Private Partnership
PTO	Power Take-off Device
RD	Regulatory Duty
RMG	Ready-made Garments Sector
SD	Supplementary Duty
SEZ	Special Economic Zone
SME	Small and Medium-sized Enterprises
SOP	Standard Operating Procedure
SRO	Statutory Regulatory Order
TTI	Total Tax Incidence
UCLA	University of California Los Angeles
UN	United Nations
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Programme
USD	United States Dollar
VAT	Value Added Tax
WEF	World Economic Forum

Executive Summary

Bangladesh's transition from Least Developed Country (LDC) in 2026, and parallel attainment of development ambitions such as the Sustainable Development Goals (SDGs) call for boosting investments to build economic resilience and diversification. Increasing the volume and quality of investments is possible through incentivizing the shift from traditional sectors to innovative, high-value-added sectors. Although Bangladesh has undergone substantial structural transformation, the agriculture sector still offers promising investment opportunities since sustained agriculture production necessitates mechanization of farm activities. The desired rise in agricultural productivity to match growing food consumption due to fast urbanization and income growth is creating a market for agricultural equipment in Bangladesh. In this context, this study estimates the growth and investment potential of the agricultural equipment sector, conducts a comparative assessment of the domestic sector with competing countries, identifies opportunities for agricultural machinery, and proposes policies to raise investment in agricultural equipment in Bangladesh.

The agricultural machinery market size in Bangladesh stood at USD 1.16 billion in 2023. The size of the domestic industry of agricultural machinery stands at around USD 232 million. Aligned with Bangladesh's development goals, and aspirations to graduate from LDC and become a high-income country in 2041, under the optimistic scenario of 9.56 per cent growth of the agricultural equipment sector, estimations suggest that an annual investment worth up to USD 1,083.74 million will be required. An expanding domestic market for agricultural equipment, strong demand drivers, and prospects of using advanced technology present ample possibilities for high returns for domestic and foreign investors. Investment in agricultural equipment will also contribute towards technological upgrading and innovation-led competitiveness of the economy in which foreign direct investment (FDI) will be a key stimulus.

Nevertheless, the growth of the domestic agricultural machinery industry is subject to considerable competition as Bangladesh is significantly dependent on imports of agricultural equipment. The dominant competitors in the domestic and international market and mobilization of FDI are China and India. Augmenting the competitiveness of the local manufacturers to cater to domestic and foreign demands, as well as ushering in foreign joint ventures will mandate streamlining trade policies which will incentivize local production. Capacity development of local manufacturers is imminent wherein an agro-entrepreneurs foundation can be formed to provide training and finance to entrepreneurs and group private sector, government, and development partners to implement policies for developing the backward and forward-linked industries of the sector. Besides, FDI in the sector can be generated by expediting the establishment of special economic zones (SEZs) where agricultural equipment manufacturing is concentrated.

1. Introduction

Bangladesh has demonstrated a remarkable growth narrative with its unmatched GDP growth (over 6 per cent consistently), being dubbed as an emerging "Asian Tiger." As the country advances to transform itself into a trillion-dollar economy and the ninth-largest consumer market in the world in the coming decades (Munir et al., 2022), the country aims to emerge as an investment hub. A diversified and conducive investment environment is critical to realize the ambitious vision of becoming an upper-middle-income country by 2031 and a high-income nation by 2041.

The Government of Bangladesh (GoB) has aimed to raise the investment-GDP ratio in the latest national budget for FY2023-24. The public investment-GDP ratio is expected to increase to 6.30 per cent and the private investment-GDP ratio to 27.40 per cent in FY2023-24 (Ministry of Finance [MoF], 2023).[1] Public investment is set to rise with the expansion of growth-stimulating projects. In contrast, the facilitation of investment in economic zones, improvement in logistics, and financial management will contribute to the recovery of private investment. However, over the years, investments have largely been concentrated in the traditional sectors,[2] while those with high potential and considerable growth possibilities remain beyond investors' purview.

Agricultural equipment is one of the untapped markets in Bangladesh. The growing importance of agribusiness justifies the need for investment facilitation in agricultural equipment. Agribusinesses produce 70 million metric tons of output annually accounting for 14 per cent of GDP (Lawrence & Khan, 2021). Although the contribution of the agriculture sector to GDP has declined over the past two decades, the sector remains vital for food security and poverty alleviation (Asian Development Bank [ADB], 2023) and employs 45 per cent of the population (British International Investment [BII], 2023) in Bangladesh. Access to electricity, expanded connectivity and the use of agriculture equipment are driving the growth of the rural economy as farm activities undergo modernization. Designated as one of the priority sectors in the Industrial Policy 2022, the agriculture equipment sector is eligible for a 20-90 per cent tax break to incentivize investments in the next decade (U.S. Department of State, 2023). The National Agricultural Mechanization Policy 2020 is one of the vital policies propelling farm mechanization in Bangladesh (Rahman et al., 2021).

Increasing the use of agricultural equipment can result in faster cultivation, greater production, lower market prices and environmental conservation. Besides, attracting Foreign Direct Investments (FDI) in the agriculture equipment sector can help diversify the country's RMG-reliant investment portfolio and contribute to achieving the FDI target of 3 per cent of GDP by FY2024-25. The global USD 155.68 billion agricultural equipment market is expected to grow at 5 per cent between the year 2022 and 2030 (Grand View Research, 2022), and the geographical location of Bangladesh will enable easy export to markets in the Indo-Pacific region.

In this context, this paper aims to estimate the growth potential of the agricultural machinery manufacturing industry in Bangladesh, the investment required to sustain the projected growth, and the dynamics of the domestic market. While admittedly the domestic agricultural machinery manufacturing sector is at a nascent stage and yet to evolve export orientation, considering its high competitiveness potential, this paper identifies the competitors in potential export markets and FDI mobilization. Furthermore, the paper analyzes the current investment policy regime to identify barriers to mobilizing domestic and foreign investment in the sector and explores sustainable policy solutions based on international best practices.

[1] A remarkable increase in the investment-GDP ratios: public investment from 6 per cent and private investment from 21.80 per cent in FY23.

[2] Manufacturing sector obtained the highest share of net FDI inflow in FY22, within which textile and wearing had the largest share at 20.10 per cent.

1.1 Methodology

The methodology of the policy research report consists of a review of secondary literature and data, key informant interviews (KII), and focus group discussions (FGD). Secondary data analysis provided estimations of growth and investment potentials of the agricultural machinery manufacturing sector. The literature review and the findings from the KIIs and FGDs highlighted the demand and supply side aspects.

The literature review helped the study develop a comprehensive understanding of the use of agricultural equipment in Bangladesh, the state of the agricultural machinery manufacturing industry in Bangladesh, and the dynamics of domestic and global markets. Through analysis of publicly available data, the study forecasts sectoral growth and the investment size required to achieve that growth. Furthermore, data from the ITC Trade Map was analyzed. The research team also conducted KIIs and FGDs with relevant stakeholders. The KIIs were crucial for developing an in-depth understanding of the agricultural equipment manufacturing sector, demand and supply side dynamics, and policy bottlenecks. The study conducted a total of 15 KIIs (Annex 2).

The study aimed to understand the demand-side dynamics of the agricultural equipment sector through FGDs. Identifying and analyzing the demand side issues allowed the study to explore the business-customer relationship, which is crucial for any investment decision. The number of participants in the FGDs in Bogura and Pabna (Ishwardi) were respectively 28 and 17 (Annex 3). In determining the location of the FGDs, the study considered mainly two factors: proximity to the hub of agricultural machinery manufacturing and crop intensity. Over the years, Bogura has become a hub of agricultural machinery manufacturing (Bhuiyan, 2019). Discussions with farmers of Bogura can therefore yield highly significant insights concerning B2C relationships, last-mile delivery issues, and relevant demand-side challenges. On the other hand, it takes less than 3 hours from Ishwardi, Pabna, to reach Bogura. Thus, these two locations are highly favourable regarding proximity to the agricultural machinery manufacturing hub. On the other hand, the use of agricultural equipment can enhance crop intensity (Verma, 2006), and therefore, crop intensity can be considered as a signal for farm mechanization. In 2015-16, the cropping intensity in Bogura and Pabna were respectively 248 and 230 (Nasim et al., 2017). However, in 2019, the cropping intensity in Bogura and Pabna were respectively 224 and 243 (BBS, 2019). Thus, a contrasting trend emerges in these two areas, which are close to the agricultural machinery manufacturing hub. Therefore, the FGDs with farmers in these two areas can shed light on the demand-side issues prevailing in the agricultural equipment sector.

2. Agricultural Equipment in Bangladesh: An Emergent Sector for Investment

The use of agricultural equipment will be essential not only for enhancing agricultural productivity and yield but also to lighten the burden of labor shortage and rising labor costs, shrinking land availability and plot sizes for cultivation, and the palpable risks posed by climate change to agriculture. The growing importance of agricultural equipment to reduce food insecurity and maintain lower commodity prices presents opportunities for investments.

2.1 The Agricultural Equipment Sector: Supply and Demand-side Context

The current market size of agricultural equipment in Bangladesh stands at USD 1.16 billion. The annual domestic production of agricultural equipment is estimated to be USD 232 million. There are around 70 foundries, 800 manufacturing workshops, 1,500 spare parts manufacturing workshops, and 20,000 repair and maintenance workshops in the agricultural equipment manufacturing sector (Alam et al., 2017). These enterprises mainly produce small or medium size machines. Some enterprises also import large machines like tractors and combine harvesters. Many of the enterprises operating in the sector are, therefore, SMEs.

The supply chain of the domestic agricultural machinery manufacturing sector can be categorized across five stages: importing, trading, casting, wholesaling, and retailing. Raw materials like pig iron, hard coke, silicon, ship-breaking scraps, furnace oil, etc. are imported which are then traded to foundries cum machine shops. The machine shops assemble either full-furnished equipment/machinery or spare parts. Through a network of wholesalers and retailers, the produced machinery or spare parts are placed in various market channels (Alam, et. Al., 2017).

Around the world, smallholder farmers are constrained by i) ill-suited farm size for large machinery (Harman, 2016; Krupnik et al., 2013; Maass-Wolfenson, 2013) and ii) limited financial capacity due to the high cost of machinery (Clarke, 2000; Holtkamp & Lorenz, 1990; Mottaleb et al., 2016; Mrema et al., 2008; Sims et al., 2016). Furthermore, in Bangladesh, the short window of the seasonal period for the usage of machinery contributes to the subdued demand of farmers for owning a machine (Kohl, 2016).

In this scenario, the demand-side limitations imposed upon the agricultural machinery market are surpassed by the presence of the Local Service Providers (LSPs) or Mechanization Service Providers (MSPs) model. Whereas in developed countries, owner-operator systems are predominant in farm mechanization, across South and East Asian Countries, there have emerged LSPs who invest in scale-appropriate machinery and provide services for a fee (Justice & Biggs, 2013; Mottaleb et al., 2016). In Bangladesh, it has been found that household heads with more inclination towards risk-taking, comparatively higher schooling, and agriculture as their major occupation are more likely to move into the machinery service trade (Mottaleb et al., 2017).

In the Feed the Future (FTF) project zone in Barisal and Khulna division, it has been found that most LSPs own only one machine and are reluctant to hire operators and do so only during the busy time of the year (Kohl, 2016).

The Local Service Providers (LSPs) are an integral element of the supply chain of agricultural machinery. The LSPs purchase machinery from the manufacturers/importers and then, along with their usage, rent it out to

other farmers. They go the last mile to the farmers and deliver the required machine services, connecting the manufacturer/importer with their customer base. The industry stakeholders frame the LSPs in a two-way relationship: Manufacturers/Importers to LSPs and LSPs to farmers.

According to industry stakeholders, for the Local Service Providers (LSPs), although there is considerable risk in up-front investment, they are willing to assume the risk due to the scope of profitability. From the perspective of the LSPs, the profitability scope is clearly defined, as there is excessive demand for their service, particularly during cropping or harvesting season (Kohl, 2016).

Imports dominate the agricultural equipment market in Bangladesh. Tractors, combine harvesters, reapers, transplanters, diesel engines, power tillers and water pumps are imported from different countries. At present, 60,000 units of tractors and 700,000 units of power tillers are being used in the fields. The investment requirements for purchasing a tractor are BDT 1,400,000, a power tiller is BDT 185,000, a rice planter is BDT 480,000, and a combine harvester is BDT 1,750,000. The domestic production of agricultural equipment comprises threshers, corn shellers, sprayers, and other small machinery meeting 20 per cent of the demand for equipment.

2.2 Stylized Facts on the Investment Potential of the Agricultural Equipment Sector in Bangladesh

Agricultural labor shortage and high wages induced by the economic transition of Bangladesh have created a greater demand for agricultural equipment. The structural transformation of the economy is demonstrated by the declining share of agriculture in the Gross Domestic Product (GDP), from 14.06 per cent in 2015-16 to 11.61 per cent in 2021-22 (Bangladesh Bureau of Statistics [BBS], 2023). The gradual rise in the share of manufacturing and service sectors in GDP paralleled a shift in labor away from the agriculture sector; the percentage of total employment accounted for agriculture fell from 45.10 per cent in 2012-13 to 40.60 per cent in 2016-17. The gap between rural and urban wages for the agricultural, forestry and fishery sectors was narrow at only Tk. 466 in 2016-17. Furthermore, higher participation of females in the national labor force could explain the fall in the proportion of contributing family workers from 2012-13 to 2016-17 (BBS, 2018).

Dominance of small farm holdings does not eliminate the possibility of increased use of agricultural equipment. According to the Agriculture Census 2019, small farm holdings account for the majority of farm holdings in Bangladesh, with the share increasing from 52.91 per cent in 2008 to 91.70 per cent in 2019 (BBS, 2022). Simultaneously, cropping intensity rose from 172 per cent to 214 per cent over the same period. Generally, small farm holdings are considered suboptimal for use of machinery. However, the divisibility of agricultural production through outsourcing specific operations such as harvesting services can promote the use of agricultural equipment for small farms (Rashid & Jhang, 2022). For instance, like China, combine harvesters are transported over long distances in Bangladesh to better utilize various harvesting seasons and crops, enabling farmers to overcome the high cost of machinery purchase. Agricultural machinery is also linked to enhanced cultivated land productivity and production, especially for small farm holdings with low machinery use (Liu et al., 2022). Thus, agricultural equipment would facilitate employment and earnings for small farmers.

Enthusiastic young entrepreneurs in the agriculture sector would enable technology diffusion and use of agricultural equipment. The young generation, millennials in particular, have unleashed their entrepreneurial skills in the agriculture sector in Bangladesh, such as Oggro Dairy, a social enterprise producing a wide range of agricultural products (UN Web TV, 2021). The tech-savvy young entrepreneurs would give new impetus to the modernization of the agricultural sector through higher use of agricultural equipment. iFarmer, a youth-led tech-based company, is a classic example that maximizes small farm holding'' profitability by giving farmers access to markets, inputs, and finance (Walker et al., 2022).

Threats of climate change to the sustainability of agriculture in Bangladesh solidifies the case for use of environmentally friendly agricultural equipment. Rising sea levels and soil salinity are two of the climate change hazards for agriculture in Bangladesh. Increased salinity is expected to minimize land available for

farming and reduce the production of non-salt-resilient crops. The GoB is committed to undertaking a climate-resilient economic path (Ministry of Environment, Forest, and Climate Change, 2022). Development partners such as The World Bank have also assisted the government in devising agricultural policies considering the climate change factors (World Bank Group, 2019). Climate-smart agriculture would demand mechanized farming techniques by adopting electric tractors and rotavators, mechanical weeding through small-scale, battery-controlled machines to replace the unsustainable use of herbicides and reducing diesel usage in irrigation through solar pumps. Plus, there are unexploited opportunities in using equipment for addressing crop damage by pests and insects led by rising temperatures and humidity, wherein agricultural fogging machines could be adopted at a wider scale.[3]

Derived demand for agricultural equipment from consumer agro-products will likely get a boost. The expansion in the population size of Bangladesh, increase in per capita income and rapid urbanization will not only mean more mouths to feed but also variation in the kinds of food demanded. Projections suggest that the population is expected to grow to 186 million by 2030 and 202 million by 2050, urbanization is happening at a rate of 3.5 per cent per annum, and demand for cereals is estimated to grow 21 per cent by 2030 and 24 per cent by 2050 (World Bank Group, 2019). Thus, augmenting agricultural productivity through the use of equipment is vital for self-sufficiency in agriculture production and ensuring maximum yield from limited arable land. Plus, the agricultural export market in Bangladesh is looking up, earning USD 1.16 billion in FY2021-22 (Food and Agriculture Organization of the United Nations [FAO], 2022). With increasing demand in the global market, the domestic agro-processing industry is expected to penetrate further into foreign markets and in the process elevate the demand for agricultural equipment (Lawrence & Khan, 2021).

2.3 Government Support Policies in the Agricultural Equipment Manufacturing Sector

To assess the investment potential of the agricultural machinery manufacturing sector, it is necessary to understand the demand and supply side implications of the policies discussed herein. Such an exercise also lays the basis for further exploration.

Table 1: Demand and Supply Side Implications of Investment Facilitating Policies

Demand-side Implications	Supply-side Implications
• Promotion of agricultural mechanization • Encouraging the farmers, irrespective of their farm size, to invest in agricultural equipment • Enabling consumers through subsidy and government support • Facilitating consumers and intermediary actors (local service providers) through facilitating access to finance • Creating headway for farmers in the agricultural equipment market through tariff measures which help to reduce the cost of agricultural equipment	• Facilitating access to finance for investors • Easing import of capital machinery and spare parts • Inducing technological transfer through lowering costs of import • Supporting market expansion and thereby raising demand • Encouraging investment through government buy-in

Source: Authors' compilation

Bangladesh has a sizeable agricultural equipment market that is anticipated to expand substantially as several investment opportunities await to be seized. The trend of market expansion for agricultural equipment has been on an upward trend (Alam, 2022). The numbers from leading firms in the private sector suggest the annual domestic market size to be USD 1160 million. This total size is composed of agricultural equipment and

[3] Agricultural fogging machines are used in Jessore, financed by the Ministry of Commerce and implemented by the Bangladesh Agricultural Development Cooperation (BADC).

spare parts worth USD 1025 million and an annual repair and maintenance service market of USD 135 million. Around 20 per cent of the domestic demand is met by local manufacturers. Due to the present demand-supply mismatch, the agricultural equipment market has the potential to grow rapidly. As opined by the private sector, agricultural researchers, and development partners, harvesting and post-harvesting stages offer unexplored investment possibilities for the equipment sector. Currently, 90 per cent of harvesting activities are not mechanized; reaper machines, power threshers[4] or combine harvesters constitute merely 10 per cent of equipment in harvesting.

Interestingly, there is a pressing demand for chili harvesting machines owing to labor crisis. Similarly, rice planters are yet to be popularized. There is also a growing need for agricultural equipment to address significant post-harvest losses. Along with mechanical reapers and combine harvester technologies, post-harvest loss can be minimized with dryer machines, storage facilities with installed air blowers[5], and technologies to determine optimal crop moisture levels after drying to inhibit fungus growth.

A widening agri-business landscape will drive investment in the agricultural equipment sector in Bangladesh. The emergence and innovative interventions of service providers, financial institutions, development partners and agri-product e-commerce platforms are mitigating challenges plaguing the agriculture industry's growth. Access to finance, one of the pressing barriers to farmer's adoption of machinery, is being eased by impact tech companies such as iFarmer that are linking farmers to finance, input markets, insurance, and output markets (iFarmer, n.d.). The startup is designing a dedicated program for mechanization that is expected to include mechanization experience centers to demonstrate the use and benefits of machinery to farmers, an iFarmer center which will connect farmers to local service providers via a digital app ensuring fair competition in the rental market and provide access to agro-insurance, agro-advisory and DAE officials.

Case Study 1: iFarmer

iFarmer, an impact tech company in Bangladesh aims to enable small-scale farmers to maximize their profits and enhance livelihoods. The startup can be showcased as an innovative solution to advancing agriculture mechanization and improving farmers' access to finance in Bangladesh.

Program for Farmers to Procure Machinery on Easier Terms

iFarmer collaborates with agricultural machinery companies such as Honda, Janata Engineering etc. to enable farmers to purchase small and medium-sized machinery at a discounted price and repay over a longer period which could range between 4-12 months conditional on the cost of the machinery. The rate of interest on machinery purchase is 8-20 per cent depending on the duration of the repayment term. Farmers get up to 20 per cent rebate on interest if they settle the loan early. These facilities are presently operational in 27 districts including Bogura, Rajshahi, Rangpur, Jessore, Jhenaidah, Magura, and Chuadanga. In some cases, the machinery is procured directly by iFarmer (assuming the risk of repayment) for the designated farmers, who can pay it back later.

Favorable Terms for Borrowing by Farmers

Considering the financial context of farmers, loans extended for agricultural machinery purchase and other farming purposes are seasonally adjusted and not based on installments. In essence, farmers can borrow at the beginning of a cultivation season and repay the total loan amount after the crops have been harvested and sold in the market at the season's end. Funds borrowed by farmers through iFarmer, especially those from Banks are provided at an interest rate lower than the Micro Finance Institutions (MFI), usually at the rate of 4-6 per cent.

Enhancing the Credibility of Farmers and Integrating them into Formal Banking Channels

The startup helps farmers borrow from banks by generating a Know Your Customer (KYC) of farmers. The company simplifies the documentation process for farmers, such as obtaining local government certificates for the permanent address of the farmer and creating credit scoring. Besides minimizing time and procedural

[4] Grain loss with power threshers is higher compared to harvesting conducted with combine harvesters.
[5] There is a present demand for the technology for onions.

complexities for farmers, it also aids banks in the recollection of loans. Recently, iFarmer teamed with Mutual Trust Bank Limited and United Commercial Bank to digitalize the lending mechanism enabling farmers to open accounts digitally. iFarmer has taken an assertive approach where their field officers obtain data from farmers and transmit it to the bank via mobile app. In Tangail and Mymensingh farmers are already availing loans without any paperwork, at a faster rate and without going to banks.

Precision agriculture is a farm management method based on data and technology used to enhance farm efficiency and productivity, such as through the precise applications of fertilizers and pesticides, raising yields as opposed to orthodox farming methods (United Nations Development Programme, 2021). Mobile phones, drones, satellites, and robotics are a few technologies enabling precision agriculture and possess market opportunities in Bangladesh. Agricultural drones with installed insecticide, fungicide, biofertilizer sprayers, cameras, and sensors are recommended technologies for efficient farming in Bangladesh according to national agriculture experts. Satellite imagery and drones can create high-resolution maps of farms allowing farmers to identify changes in soil fertility, crop growth and pest distribution. Lychee farmers particularly demand such drones[6], enabling them to monitor crop health, detect nutrient deficiencies, reduce damage by pests and bats and expand production. The private sector, at present, is teaming up with universities to obtain foreign grants for piloting drones in farms to promote the technology in Bangladesh. Moreover, agricultural researchers are also collaborating across universities to assess the feasibility of robotics in large farms and have successfully demonstrated its application in informing farmers of soil nutrients, soil temperature and humidity and optimal irrigation time. Harvesting and sorting activities can also be directed with robotics.

The **National Agricultural Mechanization Policy 2020** is a framework formulated with the vision to support the transition in agriculture to a more efficient, profitable sector through greater use of agricultural equipment. The policy prioritizes specialized loans for importers, manufacturers, rental service providers and farmers as well as reasonable rates of income tax rebates on the profits of the agro-machinery manufacturers (Ministry of Agriculture [MoA], 2020). Another core priority is to expand the domestic agricultural machinery manufacturing industry. Moreover, the policy asserts the establishment of "Agricultural Machinery Manufacturers Zone" for mobilizing investments. In tandem, GoB is also investing in improving infrastructure for investments per the policy.

Case Study 2: Hello Tractor - Uber for the Farm

Hello Tractor was established in Africa in 2014 to enable small-sized farmers to benefit from the use of machinery on farms. Using a mobile app, the initiative connects farmers to nearby tractor owners so that the tractor services can be rented by farmers without owing the expensive machinery. Along with increasing agricultural productivity, yield and farmer profitability, the startup also made investing in tractors lucrative since the machinery can be fully utilized and not left inactive. As detailed below, the initiative seeks to address some of the pressing challenges in the agriculture sector common across emerging and developing countries (The Economist, n.d.).

Digitization of Agriculture

The startup uses an Internet of Things-based app to enable farmers acquire tractor services when needed. It collaborated with IBM Research-Africa to improve farmers' access to information on soil conditions and weather crucial for crop productivity, expanding the scope of services. Tractors were equipped with Internet of Things-enabled tracking devices and connected to IBM's Watson Decision Platform for Agriculture facilitating collection and analysis of data on weather forecasts, inputs including sowing times, growth stage, geospatial and satellite information, and latest market prices. The data also helped smallholder farmers to apply for bank loans as banks are guaranteed that farmers' projections are informed by reliable data.

[6] The farmers have expressed the need for drones in lychee farms during the focus group discussion (FGD) in Ishwardi, Pabna.

Better Access to Finance for Local Service Providers

Hello Tractor in collaboration with the Nigerian Federal Ministry of Agriculture and Rural Development and John Deere is implementing a pay-as-you-go (PAYG) financing program that provides easy financing solutions to entrepreneurs seeking to purchase equipment to rent out mechanization services. Under the program, tractors will be leased to new owners and resold to them at a discounted time after a specific period. This program is expected to narrow the demand-supply mismatch by providing 10,000 tractors and bringing 9 million hectares of land under mechanization.

Model for Obtaining Blended Finance

John Deere, the largest agricultural equipment manufacturer in the world, invested in Hello Tractor in 2022. The commercial investment was fast-tracked by the philanthropic fund of USD 4.5 million (consisting of a recoverable grant) provided by Heifer International as seed capital to expand the PAYG program. The investment from John Deere was facilitated by Heifer taking the initial risk, providing capital directly to boost the financing program, and proving that the model would be feasible. Heifer International supports ag-tech businesses to catalyze investment from other investors that consider this sector too risky.

Agricultural machinery has been identified as a priority sector in the government's *Industrial Policy 2022*. This means that machinery will benefit from special incentives, tax exemptions, and reduced rates. Agricultural machinery is also designated as a priority sector in the government's *Export Policy 2021-24*. Increasing financing and access along with creating economic clusters for production are two key strategies under this policy.

Table 2: Facilities and Support for Agricultural Machinery Sector in the Export Policy 2021-24

Section	Policies
5.5.1	Providing project loans at a reduced interest rate on a priority basis
5.5.2	Providing discount on income tax
5.5.3	Providing subsidy or benefit support for electricity, gas, water and other utility services, in line with the WTO's Agreement on Agriculture and Agreement on Subsidies and Counter-veiling measures
5.5.4	Providing export loans with flexible conditions and reduced interest rate
5.5.5	Providing air cargo facilities on a priority basis
5.5.6	Providing tariff refund/bond facilities
5.5.7	Providing facilities for infrastructural development and supportive industry for reducing production cost
5.5.8	Expanding institutional and technical facilities for improvement and control of product quality
5.5.9	To establish compliant industry, import of equipment without tariff
5.5.10	Providing support for production and marketing
5.5.11	Providing support for global market search
5.5.12	Undertaking necessary initiatives for attracting foreign investments

Source: Export Policy 2021-24, 2022

The **National Agricultural Mechanization Policy**, adopted in 2020, can be considered the guiding policy for the agricultural machinery manufacturing industry. A key feature of the policy is its emphasis on facilitating investment and access to finance for manufacturers of agricultural machinery. The policy identifies agricultural mechanization as important in Bangladesh's transition from traditional subsistence agriculture to commercial agriculture. The objectives of the policy include encouraging local agricultural machinery manufacturers to

survive in a competitive market system, expediting the process of enhanced uptake of agricultural mechanization equipment by providing easy and specialized loan facilities, declaring the quality of agricultural machinery and spare parts supplied by the local agricultural machinery manufacturers and importers and to ensure the opportunity to set standards from specialized institutions, strengthening the agricultural machinery services, training, diversified uses and repair maintenance system.

The policy also identifies three pertinent challenges including lack of modern capital equipment and skilled manpower for local production of agricultural machinery and spare parts, absence of quality declaration and determining system of imported and locally produced agricultural machinery, and lack of suitable rural infrastructure for use of modern agricultural machinery. As part of the agricultural mechanization strategy, the policy proposes minimum interest or special interest-free loans for farmers/service providers to facilitate the purchase of agricultural implements used for a short period in a year related to sowing, planting, cutting, drying, storage, and processing. The government will pay interest to the concerned bank as a government subsidy. If implemented properly, this provision can expand the customer base, making the market more lucrative for potential investors. Several other provisions can impact facilitating investment in the sector.

Table 3: Facilities and Support for Agricultural Machinery Sector in the National Agricultural Mechanization Policy 2020

Section	Policies
6.1.4	At present, the 1% duty is levied on the import of various parts / raw materials for the production of various agricultural machinery, such as power tillers, power threshers, power reapers and power seeders along with exemption from all regulatory duties, supplementary duty and value-added tax. However, it does not include transplanters and combine harvesters. In the future, the tariff rate will be further reduced or fixed at a reasonable level for importing raw materials or spare parts for domestic production of all types of agricultural machinery.
6.2.1	The rental use of agricultural machinery is playing a significant role in agricultural mechanization. Farmers are getting the opportunity to use agricultural machinery on a rental basis without investing in the purchase of agricultural machinery privately. To increase agricultural machinery services, the creation of service provider entrepreneurship and motivation programs will be introduced. Training will be provided on maximum use of agricultural machinery, operation, repair, maintenance and business management.
16.0	Agricultural machinery manufacturing industries, machinery repair and maintenance factories hired machinery service providers, farmers group and individual level farmers will be encouraged to raise investments. Income tax rebates on profits earned from the agro-machinery manufacturing industry will be provided at reasonable rates.
17.1	Loan disbursement at a minimum rate will be introduced for agricultural machinery manufacturers under government-specialized loan schemes for the purchase of capital machinery.
17.2	Initiatives will be taken to allocate a certain portion of the total loan of the agricultural sector for the purchase of agricultural machinery under agricultural mechanization activities.

Source: National Agricultural Mechanization Policy, 2020

The Bangladesh Bank's **Agricultural and Rural Credit Policy and Program** requires all private and foreign banks in Bangladesh to allocate 2.50 per cent of their total loan for agriculture. The policy has a provision for providing loans for agricultural machinery for those who will use it. The loan also applies to users and service providers (Bangladesh Bank, 2022). Bangladesh treats local and foreign investments equally and allows 100 per cent foreign equity (Ministry of Commerce, 1980). Both local and foreign investors receive various incentives in personal income tax, capital gain tax, customs duty and import duty. There are also some general incentives for foreign investors (Annex 1).

Businesses in the agricultural machinery industries that are established between July 1, 2019, and June 30, 2024, are eligible for lower income taxes under Income Tax Act 2023. In Bogura and Jessore, two major hubs of agricultural machinery manufacturing, enterprises are eligible for a ten-year tax exemption. In general, there is

a reduced customs duty on the import of capital machinery (Bangladesh Investment Development Authority, n.d.).

Table 4: General Incentives for Local and Foreign Investors

Tax exemption	• Five-year tax exemption is offered to businesses located in Dhaka Division and Chattogram Division, but excluding the districts of Dhaka, Narayanganj, Gazipur, Chattogram, Rangamati, Bandarban and Khagrachari districts. • Ten-year tax exemption is offered to businesses located in Rajshahi Division, Khulna Division, Sylhet Division and Barishal Division, but excluding areas under the city corporations. Businesses set up in the districts of Rangamati, Bandarban and Khagrachari also enjoy this tax exemption period. • For certain projects under Public Private Partnership (PPP), 100% tax exemption on income and capital gain and 100% tax exemption are offered for 10 years. • 50% of income derived from exports is exempted from tax. • Tax exemption for interest paid on foreign loans.
Incentives for export-oriented industry	• 50% of Income derived from export is exempted from tax • No export duty except on tobacco products • Bonded warehousing facilities for export goods manufacturing • Duty drawback facilities • Export subsidy and cash incentives for specific product exports
Accelerated depreciation	• The accelerated depreciation method for accounting income taxes can be availed for machinery and plants used by an entity that does not enjoy tax exemption.
Exemption on import duties	• Capital machineries are subject to reduced rate from custom duties • Raw materials to be used for producing export goods are exempt from import duties
Tariff refund	• Tariff (if paid) refund on import of raw materials for export
Double taxation prevention	• Bangladesh has Double Taxation Treaties or DTTs with 34 countries.
Ownership	• 100% foreign ownership is allowed
Repatriation of invested capital, dividend	• Full repatriation is allowed for capital invested from foreign sources. Similarly, profits and dividends accruing to foreign investment can be transferred in full. Facilities are provided for the repatriation of invested capital, profits and dividends.

Source: Bangladesh Investment Handbook, BIDA

Since 2010, 71,502 agricultural machineries, including combine harvesters, reapers, clippers, and power tillers, have been distributed through various government support programs. The government has been supporting the growth of the agricultural equipment sector through various support programs, including substantial subsidies. Notably, government support for agricultural equipment was sustained during the COVID-19 pandemic through an incentive package under which the government provided BDT 3,220 crore to around 19 hundred thousand individuals.

To support the purchase of certain agricultural machinery (power tillers, reapers, rice transplanters, and combine harvesters), the government has been providing farmers up to 70 per cent subsidies in the Haor (Backswamp) region and 50 per cent subsidies in other areas. The subsidy program, 'Mechanization of Agriculture Work through Integrated Management', amounts to BDT 30.20 billion and is applicable for 12 machinery categories, including combine harvester, rice transplanter, seeder, bed planter, reaper, maize sheller, potato digger, and dryer. The project's target is to distribute 51,300 units of agro-machinery between 2020-2025 ("Agro-machineries Get Increased Subsidy in Budget FY23", 2022). Under the agricultural mechanization project in 2021, the government distributed 2,300 different agro-machinery, including 1,762 combine harvesters, 379 reapers, and 34 rice transplanters, for BDT 2.8 billion.

The Bangladesh Bank changed its monetary policy in FY2021-22 to lower the 9 per cent cap on agricultural interest rates to 8 per cent and began to offer loans with an interest rate of 4 per cent for crops and the harvest sector. Banks and Non-Banking Financial Institution (NBFIs) were instructed to provide 50 per cent of all SME loans by 2024, which could benefit foundries and workshops as most of these enterprises are classified as cottage, micro, or small businesses (Bangladesh Bank, 2022). However, in the monetary policy of FY2022-23, the interest rate for agricultural credit has been set at 9.13 per cent (Bangladesh Bank, 2023).

In the National Budget FY2023-24, the government has proposed an exemption of advance tax on importing rice transplanters, dryers, sprayer machines, and potato planters. This proposal is a continuation of the government's initiative for increasing equipment use on farms, as previously, the National Budget FY2022-23 expanded the concessional facility by including two new agricultural machinery (combine Harvester-Threshers and other threshing machinery) in the existing SRO for that sector. Most importantly, the National Budget FY2022-23 provided a 10-year tax break to entrepreneurs/startups engaged in agricultural equipment manufacturing.

Upon reviewing existing policies for the agricultural machinery manufacturing sector, it is evident that the support and facilities included in these policies address the sector's supply and demand sides. If implemented properly, these policies can expand the market for agricultural machinery while instituting a holistic support system for investors. The support envisaged at the micro level can translate into greater benefits at the macro level and induce both local and foreign investments.

3. Competitiveness Analysis

The potential expansion of the domestic agricultural equipment manufacturing sector in Bangladesh is subject to competition by dominant market players in the domestic and global markets. This section presents the competitive landscape and the policy of major international players to highlight the best practices.

3.1 Identification of Competitor Countries

The objective of this section is to identify the potential competitor countries for the agricultural equipment sector in Bangladesh to map the dynamics of the domestic and international markets. The competitor countries are identified in three areas—domestic agricultural equipment market, exports, and foreign direct investment (FDI).

The competitors for the domestic market have been identified based on close consultations with the private sector. The countries include China, India, Japan, the United States, and a few European countries such as Germany, Italy, Turkey, and France. While Bangladesh is heavily dependent on imported equipment from China and India, the countries identified are considered competitive owing to their strong market presence, availability of diverse and affordable equipment categories as well as high-quality, advanced technologies.

3.1.1 Exports

While Bangladesh does not have any substantial export of agricultural equipment, the export potential of the sector cannot be denied. The study has undertaken a dual approach in identifying the potential competitors of Bangladesh in the export of agricultural machinery. In this regard, the study considers two scenarios:

i. Competitors in the markets that can be penetrated in the short term.
ii. Competitors in the markets that can be penetrated in the long term.

For the first scenario, the study has identified African and South Asian markets, as there is a popularity of small-scale agricultural machinery among the farms of these regions (Giller et al., 2021; IFAD, n.d.; Bhattarai et al., 2018; Aryal et al., 2021; Dangol, n.d.). As the agricultural equipment manufacturing sector in Bangladesh is already well used to producing such small-scale machinery, it is anticipated that with appropriate conditions and policy support, it would be possible to enter the African and South Asian markets. The competitors in these markets have been identified by analyzing the dominant market players—those whose export share in the top import markets of these regions exceeds 50 per cent.

While China is found to be the sole competitor in South Asia, accounting for 60.85 per cent of the total agricultural equipment import source of the region, the list of competitors for Bangladesh's potential exports to prospective African markets is tabulated below (Table 5).

Table 5: Top Exporters in the Major Import Markets of Africa

Potential African Markets	Major Competitors	Export Value (USD Thousand) in 2022	Share of Total Export to South Africa
South Africa	Germany	99,082	20.84%
	USA	99,006	20.82%
	China	40,317	8.48%
	Brazil	38,136	8.02%
Nigeria	China	164,475	57.22%
	India	66,486	23.13%

Potential African Markets	Major Competitors	Export Value (USD Thousand) in 2022	Share of Total Export to South Africa
Egypt	Italy	12,241	15.15%
	China	11,791	14.59%
	Netherlands	11,437	14.15%
	Türkiye	10,154	12.56%
Potential African Markets	**Major Competitors**	**Export Value (USD Thousand) in 2017**	**Share of Total Export to South Africa**
Algeria	Türkiye	54,571	35.77%
	Italy	23,214	15.21%
	China	16,650	10.91%

Source: Authors' calculation based on data retrieved from ITC Trade Map

In the second scenario, the competitors of Bangladesh, for the export markets that are to be targeted in the long term, have been derived from a four-pronged analytical approach. Using the latest data (for the year 2022) extracted from the ITC Trade Map, firstly, a list of top exporters of agricultural equipment[7] and respective export destinations have been identified (Annex 4). Secondly, across the six continents[8], top importing countries of agricultural equipment, defined as those comprising at least 50 per cent of the region's aggregate imports have been identified. Thirdly, the two lists of major importing countries were matched to find a common set of countries that are considered export destinations for agricultural equipment manufactured in Bangladesh. Fourthly, exporting countries to these destinations have been identified and considered to be the competitors for the exports of Bangladesh (Table 6).

Table 6: Competitors in the Long-term Potential Markets

Long-term potential Markets	Top Competitors	Exported Value in 2021 (USD Thousand)	Market Share
India	World	464,414	100.00%
	China	285,058	61.38%
Türkiye	World	338,801	100.00%
	Poland	101,142	29.85%
	Italy	47,482	14.01%
	China	41,195	12.16%
Germany	World	3,936,088	100.00%
	China	612,609	15.56%
	Italy	363,113	9.23%
	Czech Republic	322,741	8.20%
	USA	318,444	8.09%
	Austria	309,665	7.87%
	France	273,734	6.95%
France	World	3,745,707	100.00%
	Germany	1,130,864	30.19%
	Italy	532,299	14.21%
	China	323,889	8.65%

[7] The study considers top exporters as those who occupy at least 50 per cent of the world exports of agriculture equipment.

[8] Countries included from Asia, Africa, Europe, Oceania, and America (North and South America).

Long-term potential Markets	Top Competitors	Exported Value in 2021 (USD Thousand)	Market Share
Belgium	World	1,762,201	100.00%
	Italy	317,451	18.01%
	USA	316,915	17.98%
	Germany	258,777	14.68%
	France	223,183	12.67%
United Kingdom	World	1,660,533	100.00%
	Germany	404,958	24.39%
	China	254,586	15.33%
	USA	175,432	10.56%
	Netherlands	118,164	7.12%
Poland	World	1,546,794	100.00%
	Germany	456,255	29.50%
	China	189,230	12.23%
	Italy	170,065	10.99%
Australia	World	1,965,542	100.00%
	USA	795,253	40.46%
	Germany	265,882	13.53%
USA	World	7,881,270	100.00%
	Canada	1,835,776	23.29%
	China	1,350,109	17.13%
	Germany	1,041,279	13.21%
Canada	World	3,466,394	100.00%
	USA	2,085,058	60.15%

Source: Authors' calculation based on data retrieved from ITC Trade Map

3.1.2 Foreign Direct Investment

The competitors for foreign direct investment have been identified based on data obtained for the highest recipients of FDI for machinery in general in 2020 as data on FDI inflows for agricultural equipment is unavailable. The competitors for Bangladesh in attracting FDI for agricultural equipment are listed in Table 7.

Table 7: Major Competing Countries for FDI to Agricultural Equipment Sector (FDI Stock from 2016 to 2020, Mil USD)

Partner Country	2016	2017	2018	2019	2020
Singapore	12,850.40	16,561.10	12,073.90	15,218.00	19,703.70
Thailand	7,434.75	8,028.48	7,941.89	9,608.98	9,404.51
Korea, Republic of	5,705.28	5,801.61	7,432.80	6,980.96	7,428.68
Canada	2,028.00	2,388.78	3,384.45	3,784.95	6,759.88
Belgium	5,272.61	6,359.89	5,333.41	5,168.76	5,607.85
Poland	2,189.79	3,170.35	3,288.10	3,551.97	3,693.57
Romania	1,703.22	2,058.24	2,100.16	2,161.53	2,356.03

Source: Authors' compilation based on data retrieved from ITC Trade Map

3.2 Business and Investment Environment of Competitor Countries: Scenario Analysis

This section discusses the policies and incentives of China and India in the context of their significant market dominance and competitiveness presented for the domestic market, exports, and FDI.

China

Enabling policy and incentives helped strengthen the domestic market and exports. The domestic agricultural equipment manufacturing sector in China is supported by policies such as fiscal support, tax incentives, and financing aid. The government runs a subsidy program for agriculture machinery supporting the purchase of 11 categories, 43 sub-categories, and 137 items that are only manufactured in China (The Centre for Sustainable Agricultural Mechanization of the United Nations Economic and Social Commission for Asia and the Pacific [CSAM-ESCAP], 2017). The subsidies applicable for different categories of machinery are capped at specific amounts, as listed in Table 8.

Table 8: Subsidies for Agricultural Equipment Manufactured in China

Agricultural Machinery	Subsidy (Maximum Allocation Per Machine)
General subsidy of agricultural machinery	USD 7,353
Milking machine and dryer	USD 17,650
Large-sized tractor, green fodder harvester, rice soaker and germination controller	USD 22, 060
Large sugarcane harvester	USD 58,820
Large cotton picker	USD 88, 240

Source: CSAM-ESCAP, 2017

Alongside this, the government lays emphasis on the research and development of the agricultural equipment sector. The research is conducted by scientific research organizations and universities, and the R&D and application are done by the manufacturers. The government is aiming to encourage agricultural equipment manufacturers to be primarily responsible for technology research and innovation (Yang & Jiang, 2023).

Dedicated support for foreign investment helped boost both the outward and inward investment for the agricultural equipment sector. The China Development Bank disbursed USD 29.41 billion to support overseas investment, the Export-Import Bank of China provides credit concessions, release of credit limits and extension of loan periods, and the State Administration of Foreign Exchange simplifies the use of foreign exchange funds.

For mobilizing foreign investment, the machinery firms enlisted benefit from exemption of import tariffs and value-added tax and corporate income tax relief to investors from western countries. The policies and beneficiaries are tabulated in Table 9.

Table 9: Policies to Facilitate FDI

Foreign Investment Mobilizing Policy	Enterprises Benefitted
Preferential Corporate Income Tax of 15% (usual rate is 33%)	• Foreign companies in special economic zones • Foreign companies in Pudong New Area • Foreign companies in state economic and technological development zones • Foreign companies in national hi-tech enterprises
Enterprise Income Tax Relief	• Foreign investors in agriculture, forestry and animal husbandry can pay enterprise income tax at 15-10% in the following 10 years after the 5-year tax exemption period ends

Source: CSAM-ESCAP, 2017

India

With strong domestic demand, a growing presence in the global market and enabling policies, India is one of the key players in the global agricultural machinery industry. Incepted around the 1930s, the country's agricultural machinery manufacturing sector has had transformative effects on the country's agriculture. As discussed, in Bangladesh, along with China, India is a key market player.

The market size of agricultural machinery in India stood at USD 12.48 billion in 2022 and is estimated to reach USD 22.60 billion by 2028, growing at a CAGR of 10.4 per cent ("Indian Agricultural Equipment Market: Industry Trends, Share, Size, Growth, Opportunity and Forecast 2023-2028," 2023). The agricultural machinery manufacturing industry of India is marked by both formal and informal sectors. There are around one hundred thousand village-level artisans who mainly produce and service hand tools in villages, two thousand and five hundred small-scale manufacturers, and two hundred and fifty medium-to-large-scale manufacturing units that produce more advanced machinery and provide after-sales service.

Several policy instruments have contributed to alleviating the sector, which can be broadly categorized across three areas (Binswanger & Donovan, 1987): (1) communication and transportation infrastructure, (2) training and R&D, and (3) the regulatory framework. However, it must be noted that due to the federal structure of India, each state has its jurisdiction over policy support for agricultural equipment.

Despite import restrictions, technology transfer facilitation by the government helped build the knowledge base of local manufacturers. Although the Indian government had followed a protectionist trade policy before the liberalization of the 1990s, it had special provisions permitting the import of tractors. Throughout the 1960s, tractors imported from the USSR, Czechoslovakia, Poland, the UK, and Romania entered the Indian market (Patel & Gandhi, 1996). The import of these tractors allowed the Indian local manufacturers to build their technical knowledge and modify the machines to suit local needs. In this way, a technology transfer was facilitated which accelerated the local manufacturing sector (Bhattarai, et. al, 2020).

Subsidies and enhanced access to finance have helped drive domestic demand. The Indian government has been providing subsidies on agricultural machinery to farmers since the 1960s (Singh, 1978). In the 1980s, government subsidies for machinery such as tractors ranged from 25 per cent to 33 per cent of the market price (Binswanger & Donovan, 1987). Currently, India follows a specialized subsidy policy for different machinery and buyer profiles. For example, the maximum subsidy rates are 25 per cent for tractors, 40 per cent for power tillers and all other agricultural machines, 50 per cent for machinery purchased by female farmers and scheduled castes and tribes, and 90 per cent for purchases in the northeastern states (Bhattarai et al., 2020).

The government ordered banks to offer loans of up to 85 per cent for farmers to buy tractors and implements in the 1970s in order to promote mechanization (Singh, 1978; Farrington, 1986). The loans had repayment terms of 7–10 years and had concessionary interest rates of 10–14 per cent. The Indian government also encouraged banks to grant credit to equipment manufacturers at rates between 10–15 per cent (Singh, 1978).

Currently, the Central Bank of India has a Farm Machinery Scheme in place (Box 1). The scheme is designed to provide farmers with long-term loans, with a longer repayment period ranging from 3–10 years, for capital investment in agriculture, such as the purchase of tractors, farm machinery, and construction of farmhouses.

Box 1: Farm Machinery Scheme of the Central Bank of India

Eligibility	Individuals, Partnership firms, companies, FSS, and PACs engaged in agriculture and/or allied activities *For Tractors:* Up to 35 HP New Tractor: 2.5 acres of perennially irrigated land or 5 acres of non-irrigated land Above 35 HP New Tractor: 4 acres of perennially irrigated land or 8 acres of non-irrigated land	
Nature of facility	Term Loan	
Margin	Up to Rs 1.60 lakh: NIL Above Rs 1.60 lakh: 20%	
Security	Primary	- Hypothecation of Tractor & implements. - Hypothecation of crops. - Up to Rs 1.60 lakh – NIL
	Collateral	Above Rs 1.60 lakh – Mortgage/Charge on land (Total value of collateral security should be at least 100% of the loan amount except for combine harvester for which collateral should be 150% of the loan amount).
Insurance	Up to Rs 3 lakh	MCLR[9] + 1.35%
	Above Rs 3 lakh to Rs 10 lakh	MCLR + 2.50%
	Above Rs 10 lakh to Rs 100 lakh	MCLR + 3.00%
	Above Rs 100 lakh	As per the rating of borrowers
Upfront Fee	Up to Rs 3 lakh: NIL Above Rs 3 lakh: 50% of 1.25% (i.e. 0.625%)	
Repayment	Within 5 to 9 years (including a moratorium period of maximum 12 months)	

Source: Central Bank of India

Import liberalization in the 1990s aided in sustaining the growth momentum of the sector. Before the liberalization of import policies in the 1990s, India maintained restrictions on the import of tractor components. Import duty on certain machinery and spare parts was around 40 per cent, with an additional countervailing duty of 10 per cent (Singh et al., 1984). Following the import liberalization policies of the 1990s, the provision of license and permit requirements for importing manufacturing farm machinery or spare parts were lifted. Furthermore, a uniform tax was introduced in place of the import quota. These liberalization policies helped sustain the growth of the sector (Pray & Nagarajan, 2014).

A quick look at the taxes and duties on agricultural machinery is helpful for understanding the general policy regime for the import of agricultural machinery (Box 2).

[9] MCLR, or Marginal Cost of Funds-based Lending Rate, is a benchmark interest rate that is the minimum rate at which banks are allowed to lend. It was implemented by the Reserve Bank of India (RBI) in 2016, essentially replacing the base rate system.

Box 2: Taxes and Duties on Farm Machinery Import-Export in India

For Importers	
Excise duty for finished agricultural equipment	Nil
Excise duty for rotary tillers, rotary slashers, rotary harrow, post hole diggers & balers, hooks, springs, spindles, and hubs	12.36%
Customs duty for finished agricultural equipment	7.5%
Additional duty chargeable for finished agricultural equipment	4%
Goods and Services Tax on tractor and power-operated farm equipment	12%
For Exporters	
Duty drawback on the Free on Board (FOB) value of the exported goods	

Source: Bhattarai, et. al, 2020

Liberalization paved the way for collaboration between foreign and local manufacturers. Even before the liberalization policies of India, there had been the presence of international tractor manufacturers, such as Ford and Escorts, in India (Bhattarai et al., 2020).

Streamlined procedures have facilitated investment in the sector. The Indian government has been successful in making the processes of investment clear, transparent, and online for both local and foreign investors. Investors have easy access to procedural investment and the laws are clearly defined. Streamlining these procedures has helped facilitate investment in the sector (United Nations, 2017).

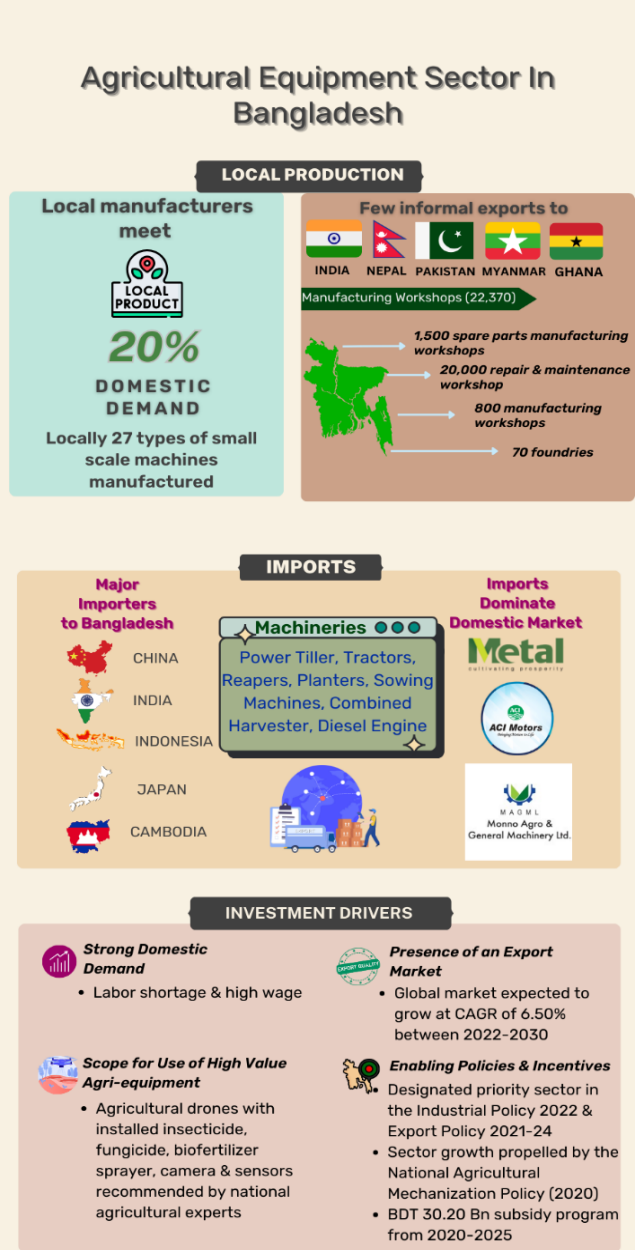
4. Opportunities for Investment

The expansion of the sector will need to be supported through investment mobilization as a number of agricultural activities and sectors such as the non-crop remain to be optimally mechanized. Besides boosting the manufacturing of locally demanded equipment and reducing supply gaps, investors can explore the prospective export markets. There is an emerging export market in South Asia, Southeast Asia, and Africa for equipment manufactured in Bangladesh.

4.1 Growth and Investment Potential of the Agricultural Equipment Sector

The global agricultural equipment market, estimated at USD 150.2 billion in 2021, is estimated to grow at a CAGR (compound annual growth rate) of almost 6.5 per cent between 2022 and 2030 and reach USD 264.7 billion in 2030. By product segment, tractors held the highest market share in 2021. Geographically, the agricultural equipment market in the Asia Pacific region is expected to dominate. The rise in demand for equipment, along with expanding usage and government support, is driving the growth of the market (Zion Market Research, 2023).

As in the global scenario, the agricultural equipment market in Bangladesh, driven by similar factors, is also set to grow. International players dominate the domestic market. Since the sixties, the use of agricultural machinery has gradually gained pace in Bangladesh. In 1988, when import tariffs were significantly reduced for some agricultural equipment, including two-wheeled tractors, a broader mechanization process ensued. This policy change spurred an influx of small engines and machines, mostly from China (Justice & Biggs, 2013; Gisselquist, Nash, & Pray, 2002). By 1994, two-wheeled tractors were completely exempt from import duty. In response to the growing demand for agricultural machinery in the 1990s, local agro-machinery manufacturing workshops emerged. These workshops gradually evolved into small-scale industries (Islam, 2018). The National Agricultural Policy 1999 further boosted this sector by providing tax relief and credit facilities (Hossen, 2019). However, while there has been widespread equipment use in cultivation, irrigation, and thrashing, other areas, such as planting, fertilizer application, and harvesting, remain far behind (Table 10).



The scenario indicates promising opportunities for local manufacturers. As indicated in interviews with industry stakeholders and discussions with the farmers, there is a strong demand for agricultural machinery, particularly those suitable for small and medium-sized lands. There is also great demand for spare parts. Notably, the local manufacturers, including foundries, are concentrated on spare parts and small machines like rice milling machines, sprayer machines, threshers, and vertical pumps (LightCastle Partners, 2023).

Table 10: Extent of Farm Mechanization in Bangladesh

Operation	Methods	Percentage
Land preparation	Tractor (2 WT and 3 WT) (Tractor, Leveler, Plough, Tillage equipment, Harrower)	98%
	Animal/Traditional	2%
Planting	Mechanical (Planting machine, Transplanter, Seeder)	5%
	Manual/Traditional	95%
Weeding	Mechanical (Power weeder, manual weeder)	8%
	Manual	92%
Fertilizer	Mechanical (applicator)	5%
	Manual	95%
Pesticide/Herbicide application	Mechanical	92%
	Manual	8%
Harvesting	Reaper (PTO reaper, Self-propelled reaper, Combine Harvester, Reaper, Tripper, Stripper header)	7%
	Manual (Sickle)	93%
Threshing (rice)	Mechanical	97%
	Manual	3%
Post-harvest	Mechanical (Dryer)	5%
	Manual	95%
Processing	Mechanical (De-husker, Whitener, Separator, Polisher)	98%
	Traditional	2%
Storage	Modern	15%
	Traditional	85%

Source: Adapted from Hossen (2019)

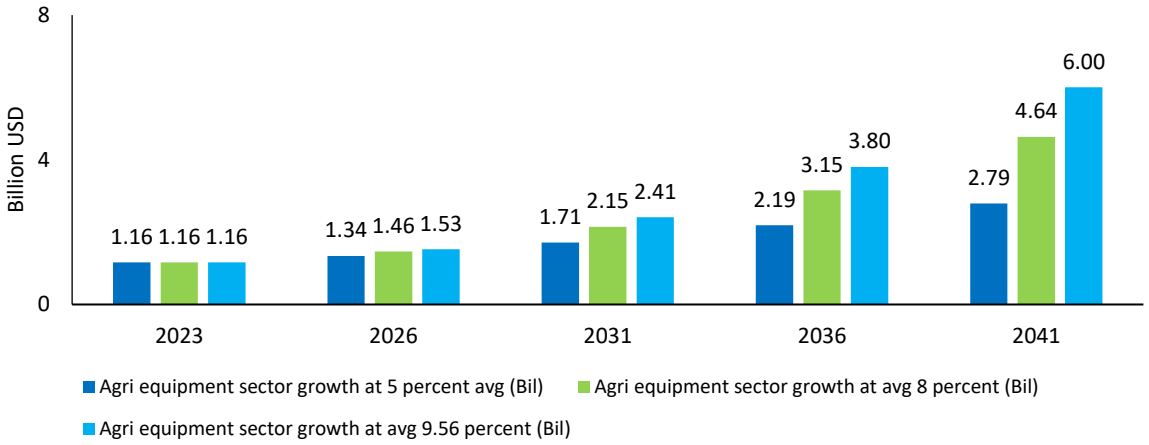
4.2 Scenario Analysis and Projections

In this context, we have considered three scenarios to estimate the growth and investment potential of the sector (Figure 2):

i. The sector will grow at 5 per cent, from 2023 to 2041, and reach approximately USD 2.79 billion in 2041.
ii. The sector will grow at 8 per cent, from 2023 to 2041, and reach approximately USD 4.64 billion in 2041.
iii. The sector will grow at 9.56 per cent (the average growth rate of the manufacturing sector, at constant price), from 2023 to 2041, and reach approximately USD 6 billion in 2041.

The scenarios underscore Bangladesh's major milestones of development goals, as the country is expected to graduate from the list of LDC categories in 2026 and aims to transform itself into a high-income economy by 2041. Thus, accelerating the uptake of agricultural equipment over the next two decades will be crucial. Furthermore, the expansion of the sector will be a key component of the overall structural transformation of the country and will contribute to the diversification of industry and exports.

Figure 1: Market Potential (Bil USD) of the Agricultural Equipment Manufacturing Sector (2023-2041)



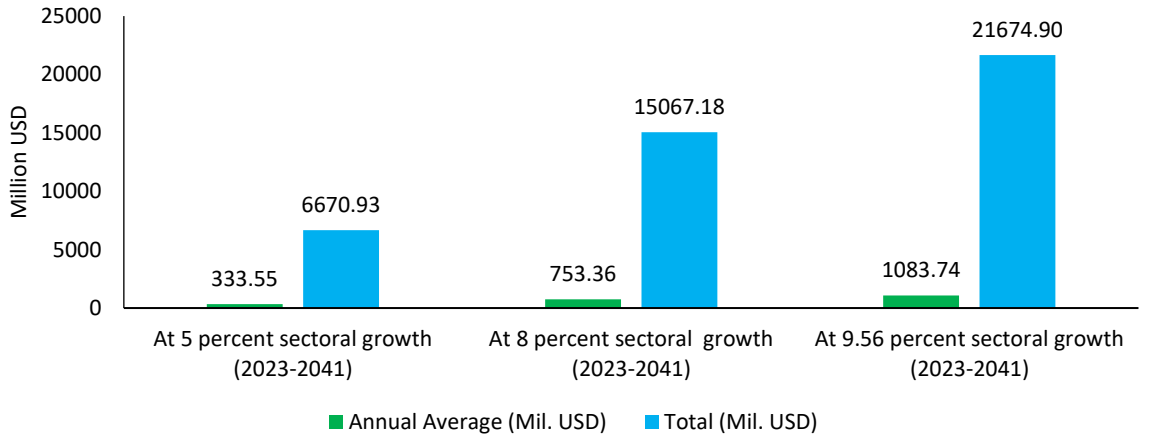
Source: Authors' Estimation

In the foreseeable future, the sector will not only be driven by local demand but also by international demand, as expected by industry stakeholders. While Bangladesh does not currently export any agricultural equipment, given the bright export prospect of the light engineering industry (Kabir, 2021), it is perhaps not farfetched that the export of agricultural equipment will soon be a reality.

Yet, the question remains as to what extent investment will be mobilized in per with the growth of the sector. As we have estimated sectoral growth for three different scenarios, we have also estimated the investment needed to sustain that growth in each scenario. We have employed the sectoral ICOR (Incremental Capital-Output Ratio), estimated for the machinery and motor vehicle sector (General Economics Division (GED), 2019).

Based on the projected sectoral growth rate, between 2023 and 2041, the estimated annual average investment size would be around USD 333.55 million if the growth rate is 5 per cent. During the same period, if the growth rate is 8 per cent, the estimated annual investment size would be around USD 753.36 million; if the growth rate is 9.56 per cent, the estimated annual investment size would be approximately USD 1083.74 million.

Figure 2: Investment Potential (Mil USD) of the Agricultural Equipment Manufacturing Sector (2023-2041)



Source: Authors' Estimation

4.3 Potential Products and Export Destinations for Boosting Domestic and Foreign Investment in the Agricultural Equipment Sector

Based on interviews with key stakeholders and discussions with the farmers, the study has identified some potential products on which investors should focus. There are three categories for such potential products:

1) Demanded in the local market.
2) Demanded in potential foreign markets.
3) Demanded in both local and foreign markets.

Given the predominance of smallholder firms in rural areas, farmers generally prefer small-sized machinery as those are easy to operate. Moreover, bigger machinery costs more for the farmers. Those involved in non-crop farming are highly interested in machinery aiding livestock rearing or fishing. However, those machines are not in supply in the local market.

On the other hand, according to industry stakeholders, a similar trend is observable in the potential export markets of South Asia and Africa. In these markets, too, there is a demand for small and medium-sized machinery and quality spare parts. Based on the local farmers' demand and the experts' opinions on the export markets, it can be inferred that some common product segments are in demand in both the local and foreign markets. For a potential investor, the product-specific demand scenario can be beneficial, as they can cater to local and foreign needs by producing certain products. Based on the aforementioned categories, the study has potential product segments for investment in Table 11.

Table 11: Potential Product Segments for Domestic and Foreign Markets

Machinery	Local Market	Potential Foreign Markets
Small and medium-sized tractors (two-wheelers)	✓	✓
Irrigation Systems	✓	✓
Spare Parts	✓	✓
Weeder	✓	✓
Thrasher	✓	✓
Sprayer	✓	✓
Seeder	✓	✓
Irrigation Pumps/Tubewell pumps	✓	✓
Spare parts of four-wheelers and two-wheelers	✓	✓
Reaper machines	✓	✓
Transplanters	✓	✓
Mini Harvesters	✓	
Power Tillers	✓	
Maize-related Machines	✓	
Potato Transplanters	✓	
Diggers	✓	

Machinery	Local Market	Potential Foreign Markets
Diesel Engines	✓	
Tractor-operated implements	✓	
Rice and Wheat Dryers	✓	
Drip Irrigation	✓	
Vermicompost Machine	✓	
Chiller	✓	
Fruit Harvester	✓	
Rice Sheller	✓	
Feeder production machines	✓	
Corn Sheller		✓
Nut Thrasher		✓
Nut Peeler		✓

Source: Authors' Compilation based on KIIs

4.4 Export Destinations for Agricultural Equipment Manufactured in Bangladesh

The export potential of the agricultural equipment sector of Bangladesh is evinced by the present international demand for small-scale agricultural equipment manufactured by local firms. Limited volumes of small-scale agricultural equipment produced in Bangladesh are currently exported to South Asia, Southeast Asia, and Africa through informal channels. The Indian agricultural equipment market, for instance, offers promising opportunities to manufacturers in Bangladesh. Choppers, threshers, reapers, mustard oil extractors, and irrigation pumps have been exported to Northern India by domestic manufacturers. Although farm mechanization in India is around 40-45 per cent, states in the Northeastern regions have minimal mechanization. Different kinds of equipment have not penetrated Indian agriculture as successfully as tractors, opening markets for small-scale and self-operated equipment as the per-capita land holding of farmers is declining[10] (NABARD, 2018). Also, as India is largely dependent on imports of seeders, planters, and trans planters, domestic firms can improve the quality of the existing production and adapt the equipment to cater to the Indian market.

Similarly, corn shellers, threshers, tube well pumps, weeders and sprayers have been exported to Nepal as the small equipment can be easily transported through hilly regions. Limited use of equipment in the hill tracts due to narrow terraces, rough land and transportation constraints and the adoption of small-scale equipment in these regions can strengthen the market for Bangladesh's agricultural equipment. Small-sized two-wheel tractors, corn shellers and power sprayers are applicable in the hills (Knowledge-based Integrated Sustainable Agriculture in Nepal [KISAN II] Project, 2021). Usage of tillage, threshers and reapers is minimal in the hill tracts, and there is a growing demand for mini tillers (Dangol, n.d.).

In Africa, Ghana is a potential export market where seeder machines, threshers, tube wells, and weeders are presently exported from Bangladesh. The low presence of agricultural equipment on African farms offers opportunities for increasing existing exports. There are fewer than two tractors per 1000 hectares of cropland

[10] BRICS nations, along with Japan and Turkey, are leading the markets for heavy agricultural equipment.

in Africa (Bafana, 2019). Affordable small-sized tractors suitable for the African soil conditions are unavailable. Imports of two-wheel tractors and small four-wheel tractors are low, and government initiatives are in place to raise the promotion of two-wheel tractors, such as in Tanzania. Furthermore, there is demand for reaper machines, small, combine harvesters for wheat in Kenya and Ethiopia, and rice irrigation in the West (Diao et al., 2016).

Although public records of the informal trade are unavailable, the export potential of the equipment sector provides a gateway to diversifying Bangladesh's export basket. Since local firms manufacture to meet domestic demand for agricultural equipment, formalizing the trade would call for investment mobilization in the capacity-building of the firms. Accessing foreign markets will expand investment to obtain economies of scale in production, and enhance the quality of workshops, production processes, and equipment to raise exports (Peluffo, 2016). On the part of the government, boosting the sector's export potential holds vital implications for the careful formulation of investment promotion policies.

5. Challenges for Increasing Private Investment in the Agricultural Equipment Sector

Despite sustained government support and growing demand, the agricultural equipment manufacturing sector is faced with some significant supply-side challenges, which have implications across the whole supply chain, restricting the flow and volume of investment. The major supply-side challenges include a lack of modern capital machinery, inadequate supply of quality raw materials, lack of proper standardization, infrastructural drawbacks, lack of access to finance, and unfavorable tariff policies. Demand-side challenges, on the contrary, are challenges at the user-end that can broadly grouped into sluggish uptake of equipment, constrained affordability, ineffective implementation of credit policy of the central bank and misallocation of public support, minimizing the scope of harnessing the investment potential.

5.1 Supply Side Challenges

Through KIIs with industry stakeholders, government officials, and experts, the major supply-side challenges to the agricultural equipment manufacturing sector are identified as follows:

1. **The scope of institutional support is reduced by high informality.** A great share of the enterprises engaged in manufacturing agricultural equipment is not formally registered. Many enterprises are operating without any official documents. As a result of the lack of formal registration, these enterprises are being deprived of the opportunity to avail of government support or access to formal financial channels. Moreover, these enterprises do not have the option to market their products under their branding, which further reduces their growth potential.

2. **The production capacity of enterprises is constrained by outdated infrastructure and capital machinery.** The infrastructure and capital machinery of the local workshops and foundries are outdated. In many cases, the working space of these enterprises is small. The production technique followed by these workshops/foundries is not modernized yet. For example, many of these enterprises use coal-based furnaces with significant drawbacks. Although recently, many enterprises are moving towards induction technologies. Nevertheless, there is still a lot to be done to update the production capacity of these enterprises.

3. **The domestic backward linkage industry of the agricultural equipment sector is underdeveloped.** The manufacturing of agricultural equipment is highly dependent on substantial intermediate inputs such as spare machinery parts, processed raw materials (cast iron, steel, metal tubes, cab linings, guards, covers, plugs, tubes, seals, gaskets, etc.), etc. The quality of the equipment is contingent upon the quality of these intermediate inputs. As a result, manufacturers are keen to Cupola Furnace source high-quality spare parts and processed materials such as iron and steel, casting, rubber and tire, forging, etc. However, the domestic backward linkage industry is lagging, and the manufacturers identify this as a major constraint to investment. The foundries and workshops operating in the light engineering hubs of the country (e.g., Bogura) have the potential to form the basis of the backward linkage industry. However, these enterprises have their challenges including a shortage of labor, the dominance of cheaper Chinese products in the market, and narrow access to formal channels of finance (Shabuj, 2020).

4. **Limited promotion of local manufacturers:** There are few opportunities for showcasing the work and innovation of local manufacturers, particularly small and medium enterprises. Local small and medium enterprises often struggle to get stalls in business fairs. Moreover, local manufacturers do not get

sufficient exposure due to limited marketing capacity. Another major reason behind the customers' positive perception of foreign brands is the lack of standardization/certification processes. Without proper standardization/certification processes, local brands cannot guarantee the quality of their products.

5. **Constrained operation of local service providers due to anti-competitive practices:** The local service providers (LSP) play a key role in the diffusion of agricultural machinery, but their ability to move beyond their primary area of trade is often very limited due to anti-competitive practices by LSPs of other areas. For an LSP, it is highly important that their machines do not sit idle. Yet, given the duration of the cropping season, and competition from other LSPs offering similar services, they are often forced to remain inactive. In this situation, to sustain their business and profitability, the LSPs are required to go beyond their primary area of business to other localities. However, the LSPs of a locality often form a kind of syndicate and, through collective pressure measures, force restrictions on the entry of LSPs from other localities. Framed through such anti-competitive practices, the supply chain of agricultural machinery service is disrupted. While this adversely affects the end-users in terms of deprivation from competition-determined market prices, such anti-competitive practice also has wider implications for the whole agricultural equipment sector, as the LSPs, being the intermediary demand drivers, may get discouraged in the trade which can harm the overall market potential.

6. **Manufacturers perceive interest rates as high, and small and medium-sized enterprises face significant hurdles in accessing finance:** Across the sector, both large and small enterprises face challenges in accessing finance. While it is comparatively easier for large, established enterprises to secure finance, there are still concerns regarding the interest rate. The industry stakeholders perceive the interest rate of 9 per cent offered by banks to be taxing for the investment. The stakeholders also perceive that the agricultural manufacturers are not given the same priority as other top sectors such as RMG. On the other hand, small and mid-sized manufacturers often are unable to get any loans from the banks. According to a development partner working closely with local manufacturers in Bogura, several enterprises had to liquidate their assets to mobilize finance for investment.

7. **Installment-wise payment solutions extended by big manufacturers are increasingly at risk of customer-end default:** Prominent manufacturers in the sector, acknowledging the complexities of availing finance[11] for the purchase of large agricultural machinery, have instituted a payment solution that is primarily based on installments. Through this modality, the farmers are required to make a down payment initially and pay out the rest of the arrears in periodic installments. Such an arrangement allows the farmers and the LSPs to employ the newly procured machine in the field and/or services and generate revenue which is then used to pay the installments. However, in many cases, the farmers/LSPs fail to pay the installments timely, leading to a cumulation of dues. In this scenario, the farmers/LSPs often fail to pay the dues. After a continued failure in the payment of the installments, the farmers/LSPs are required to forfeit the machinery they purchased. As a result, manufacturers are left with incurred losses and depreciation costs, leaving them in a financially vulnerable position.

8. **High tax and tariff on the import of spare parts of agricultural machinery:** According to industry stakeholders, taxes and tariffs for importing spare parts go up to 50-60 per cent at times, which drives the production cost up significantly. The industry insiders find the taxes and tariffs on imported spare parts detrimental to the development of the sector. Import duties on some selected spare parts of agricultural machinery range from 1-10 per cent (Table 12). The customs duty ranges from 1-10 per cent. A 15 per cent VAT is imposed at the import stage on all but two of these selected items. Additionally, AIT ranging from 2-5 per cent and Advance Tax (AT) of 5 per cent are also applicable. However, there is no supplementary duty on any of the articles. The average total tax incidence (TTI) of these items is 27 per cent. Although the AT is refundable and the importer can adjust advance tax as a decreasing adjustment in that tax period or subsequent 4 (Four) tax periods (Kawsar, 2021), in practice, the importers hardly get

[11] The challenges associated with access to finance has been discussed in detail in section 4.1. Although the government provides a substantial amount of subsidy (70 per cent in haor region, and 50 per cent elsewhere), the price of large equipment like tractors and harvesters still remain well beyond the reach of many farmers and prospective LSPs.

these refunds due to procedural complexities. There has been some discussion among the government regarding the withdrawal or reduction of the AT and AIT for articles used for making industrial products (Government May Cut Import Advance Tax for Industrial Goods Makers, 2020). However, there has been little progress in that regard. It must be noted that not only the local manufacturers, but also the foreign investors are getting discouraged by the provisions of AT and AIT.

9. **Policymakers' hesitancy to adopt drone technologies could limit the market growth precision farming solutions:** Between 2021 and 2030, the global market for agriculture drones is estimated to grow at a CAGR of 22.4 per cent, reaching USD 5.89 billion in 2030 (Allied Market Research, 2021). Farmers, particularly the young ones, are generally interested in adopting drone technology. There is also growing interest in marketing drones in the private sector. Although a "Drone Registration and Aviation Policy 2020" is in place, that discusses the commercial usage of drones, it does not explicitly have any provisions for agriculture drones. Given the security concerns and the related complications with policies, there is some level of hesitancy among policymakers to sanction the permission for importing or locally producing agriculture drones. As policy-level actions for agriculture drones also have implications for other high-precision farming solutions such as AI, Robots, etc., the market potential in this section is so far limited.

Table 12: Tax and Tariff on Selected Spare Parts of Agricultural Machinery

HS Code	Product	Statutory Rate of Customs Duty on Import	CD	SD	VAT	AIT	RD	AT	Total Tax Incidence *
84089010	Diesel Engines with capacity of 3 to 45 HP	1-5%	1%	0%	15%	2%	0%	5%	23.2%
84099990	Parts for Compression-Ignition Internal Combustion Engines	1-5%	5%	0%	15%	5%	0%	5%	31%
84133000	Fuel/Lubricating/Cooling-Medium Pumps for Internal Combustion Engines	10%	10%	0%	15%	5%	0%	5%	37%
84137000	Other Centrifugal Pumps	1%	1%	0%	15%	2%	0%	5%	23.20%
84193400	Other, for agricultural products (non-domestic heating/cooling equipment; non-electric water heaters)	1%	1%	0%	15%	5%	0%	5%	26.20%
84249000	Parts of Machinery and Apparatus Of 8424.10 To 8424.89	1%	1%	0%	15%	5%	0%	5%	26.20%
84329000	Parts of Soil Preparation/Cultivation Machinery...	1%	1%	0%	15%	5%	0%	5%	26.20%
84339000	Parts of Harvesting Machinery	1%	1%	0%	15%	5%	0%	5%	26.20%
84349000	Parts of Milking Machines and Dairy Machinery	1%	1%	0%	15%	5%	0%	5%	26.20%
84369100	Parts of Poultry-Keeping Machinery or Poultry Incubators and Brooders	1%	1%	0%	0%	5%	0%	5%	11.05%
84369900	Parts of Agricultural... Machinery, Nes	1%	1%	0%	0%	5%	0%	5%	11.05%
84379010	Parts for Rice Huller and Wheat Crusher	10%	10%	0%	15%	5%	0%	5%	37%
84835000	Flywheels and Pulleys (Incl. Pulley Blocks)	1%	1%	0%	15%	5%	0%	5%	26.2%
87089300	Clutches and parts thereof	10%	10%	0%	15%	5%	0%	5%	37%

*Source: Bangladesh Customs Tariff 2022-23 (*Does not include Statutory Rate of Customs Duty on Import)*

5.2 Demand Side Challenges

As derived from the Focus Group Discussion (FGD), the major demand-side challenges for the agricultural equipment sector are identified as follows:

1. **Slow infusion of agricultural equipment into farms:** Although small-scale agricultural equipment pieces are manufactured domestically and favored by farmers, those are out-of-reach of farmers owing to cost burdens, government support deficits and the promotion of imported equipment. In some cases, imported equipment is unsuitable for the land texture, soil conditions and the unavailability of repair and maintenance services. Several farmers in Bogura mentioned that they rely on manual planting and harvesting of rice. Notably, this lacks in cost-effectiveness in comparison to mechanical operations.

2. **Limited ownership of agricultural equipment by farmers:** Farmers are inclined towards the ownership of small-sized, affordable, domestic agricultural equipment. Besides, limited financial capacity, training, and knowledge of operating the equipment are hindrances to individual-level adoption.

3. **Restricted affordability of rented equipment services by farmers:** Although agricultural equipment services rented out by the local service providers have ensured small-sized farmers' access to machinery, the cost of renting services has recently increased due to inflationary pressure. The price charged for harvesting 1 acre of rice rose from BDT 1200 to BDT 2500 within a month due to fluctuations in oil price. On top, the renting services are usually not available to small farmers as harvesting small plots is not profitable for the service providers.

4. **Loans disbursed by NGOs for agricultural equipment are predominantly for clients with long-term credit history and frequent loan uptake.** Small-sized farmers refrain from approaching banks for loans and rely on NGOs as procedures are farmer-friendly and funds are disbursed quickly compared to banks. Loans up to BDT 200,000 are disbursed by NGOs without any request for documents. However, loans of sizeable amounts to invest in large-scale, costly, imported machinery will not be provided by NGOs to relatively new clients. Microfinance is available for small equipment such as power tillers and those manufactured locally whereas the purchase of large equipment such as harvesters, will need to be financed with bank loans.

5. **Inflated cost of borrowing from NGOs due to the absence of direct channeling of funds from Bangladesh Bank to Micro Finance Institutions:** Farmers, irrespective of land size, who have obtained loans from NGOs for the purchase or rent of equipment, irrigation, pesticide and cultivation have been subjected to high interest rates on installments which can rise from an initial rate of 14 per cent to as high as 42 per cent due to compounding rates and low returns on investment. Interest rates rise in the process of channeling funds for the agricultural sector from development partners to Bangladesh Bank, which then transmits the resources to commercial banks for lending to NGOs. Besides, NGOs, except for the ones facing liquidity crisis, are reluctant to acquire the funds from commercial banks as several conditions are enacted on the disbursement. These include interest rates capped at 16-18 per cent[12], complex reporting format and frequent monitoring by the banks, which impose management and human resource costs on the NGOs.

6. **NGO financing options do not help farmers afford different types of farm equipment.** There are concerns over the cost-sharing schemes of NGOs. For example, NGOs finance 20 per cent of the price of a cow milking machine, whereas the subsidy should cover at least 50 per cent of the cost of the machinery. There are no regulations or monitoring of such unscrupulous practices.

7. **Ineffective implementation of agriculture credit policies of Bangladesh Bank:** The Agricultural and Rural Credit Policy and Program for FY2022-2023 of the Bangladesh Bank entails the provision of soft loans to

[12] This is infeasible as average interest rates charged by NGOs is at least 24 per cent.

marginalized, landless farmers and sharecroppers on easy terms as well as crop hypothecation for land no more than five acres. Bangladesh Bank has also initiated a credit guarantee scheme providing marginalized groups with a guarantee at a minimum risk premium. Nevertheless, findings from the FGD suggest that farmers are unaware of such policies and have not benefitted from bank loans. Banks are unwilling to disburse loans without a mortgage and, when approached by farmers, inform them that the allocated funds have already been disbursed. According to experts from the Bangladesh Bank, less than 1 per cent of the total loan has been disbursed for agricultural equipment. One of the impediments is that the central bank cannot ensure whether the loans are utilized for agricultural production or trading purposes[13]. The coordination among the credit policies for agriculture and SMEs is another challenge as marginalized farmers and sharecroppers are targeted under the agriculture credit policy, whereas the SME policy will be relevant for loans to local service providers and for the purchase of agricultural equipment.

8. **Target mismatch in beneficiary selection of government support for agriculture equipment:** *Well-designed government policy support measures often is exploited by local vested interest groups through procedural loopholes. For example, member registrations are not ensured through a participatory approach* in the association or club established by the Department of Agriculture in Bogura. Often, resources are allocated to non-farmers who proceed to sell the obtained machinery in local markets. Moreover, households often remain unable to access financial incentives, even after completing official procedures.

[13] Under the Agricultural & Rural Credit Policy and Program for the FY 2022-2023, loans disbursed must be used for agricultural production. Loans for trading purposes are disbursed to Small and Medium-sized Enterprises (SME).

6. Policy Recommendations

1. **Incentivize Local Workshops for Domestic Production of Agricultural Machinery:**
   Trade policy rationalization is one of the fundamental means to help the development of local agricultural equipment manufacturers. At present, subsidizing the adoption of agricultural equipment and simultaneously taxing the imports of spare parts is conflicting. An effective way of favoring the local equipment manufacturers is to reduce the tariff on imports of spare parts and incentivize domestic assembling of the equipment and forward linkages. Domestic assembling of the equipment in turn will allow for technological transfer and capacity development of local manufacturers.

2. **Establish Display Centers for Showcasing Products of Local Manufacturers at Divisional Levels and Later Expand to District Levels:**
   Promoting local manufacturers is a prerequisite for the expansion of the local industry. However, local manufacturers, due to their constrained capacity, do not have the necessary branding tools that allow them to penetrate the market further and reach a targeted customer base. Display centers, established by the government at the divisional and district levels, can greatly aid manufacturers by facilitating business-to-customer (B2C) interactions. Farmers and Local Service Providers (LSPs) will also be able to compare the quality and prices of different local and foreign machinery.

3. **Expedite the Establishment of the Proposed Special Economic Zone in Bogura:**
   The government has conducted a feasibility study of the economic zone planned to be established in Bogura. The study indicated that the firms concentrated in the zone will be largely from the light engineering sector that manufactures agricultural equipment and spare parts. However, the establishment process is sluggish and presently stagnant in the initial phases of land acquisition processing. Accelerating the process will require the government agencies such as the Bangladesh Economic Zones Authority (BEZA) to identify and address the existing challenges, some of which are related to acquisitions of large land, high prices of private land exceeding the market value, preservation of agricultural land, rehabilitation, and financing.

4. **Establish an Agro-entrepreneurs Foundation to Accelerate the Overall Development of the Agricultural Equipment Manufacturing Sector:**
   A body comprising policymakers and private sector stakeholders is imminent to facilitate government support and investment. This body can be materialized in the form of the "Agro-entrepreneurs Foundation". The government will have to play a key role in establishing and operationalizing this Foundation. The Foundation will be focused on expanding access to finance and training for entrepreneurs engaged in the manufacturing and trade of agricultural equipment. Furthermore, the Foundation will formulate and implement policies for enhancing the business environment for the development of backward and forward linkage industries. As part of its mission, the Foundation may also collaborate with development partners. In this way, the Foundation can act as a channel for communication and exchange between the agro-entrepreneurs and the government.

5. **Establish a Linkage between Research Extension and the Private Sector:**
   The innovative agricultural equipment researched and developed nationally for example by the Bangladesh Agricultural Research Institute (BARI) is not marketed. DAE is primarily responsible to market the new technologies and does so with government subsidies with no involvement of the private sector. A sustainable mechanism for promotion of the nationally developed technologies is to develop a well-integrated approach as to how the technologies will be developed by research institutes, popularized by DAE, and then scaled up by the private sector.

6. **Improve Access to Finance for Actors Across the Value Chain of Agricultural Equipment:**
   Improved access to finance can be ensured by strengthening the bankability of farmers. This can be achieved through institutionalizing self-help groups. India offers a good example which can be replicated by Bangladesh. In India, the National Rural Livelihoods Mission (DAY-NRLM), under the Ministry of Rural

Development, organizes self-help groups for rural poor women. The groups have a three-tier structure composed of the village-level groups followed by the "secondary village organization" and "tertiary cluster level federations" (Raj, 2022). The institutional arrangement of the group facilitates democratic processes and transparent decision-making and even allows members to apply for bank loans.

7. **Mandate a Revision of the Documentation Process for Farmers at Commercial Banks:**
   Impact tech companies work collaboratively with commercial banks to enable farmers to provide a unique set of documents for obtaining bank loans. This documentation process should be integrated into the banks' policies so that repeated negotiations can be avoided, and farmers can be informed of the required documents when they approach banks for agricultural loans.

8. **Strengthen the Agricultural Insurance System to Enhance Farmer's Protection:**
   The new Insurance Regulatory Sandbox[14] policy of The Insurance Development and Regulatory Authority (IDRA) is an opportunity to address the difficulties related to the risk and damage measurement in agriculture which prevents farmers from being protected by insurance in unforeseen soil and climatic conditions. At present, agricultural damage is generally measured by weather index and yield-based procedures and farmers are not compensated for losses occurring beyond conventional or pre-determined conditions.

9. **Explore Blended Finance Tools to Ensure Sustainable Financing Schemes Across both the Demand and Supply Sides:**
   The United Nations (UN) defines blended finance as the combination of concessional public finance with non-concessional private finance and expertise from the public and private sectors (UN, 2015). According to OECD/WEF (2018), blended finance is "the strategic use of development finance and philanthropic funds to mobilize private capital flows to emerging and frontier markets". The government has a central role in operationalizing the blended finance mechanism. Also, extensive involvement of the private sector and development partners will be required. Soft loans can be provided to farmers, LSPs, and manufacturers through a blended finance mechanism. A key advantage of the blended finance model is the distribution of risks across the stakeholders, which can incentivize banks and non-bank financial institutions to design and market schemes for demand and supply side actors.

10. **Evaluate the Long-term Sustainability of the Subsidy Program for Agricultural Equipment with a Focus on Efficiency:**
    The BDT 3000 crore farm mechanization project that subsidizes farmer's purchase of agricultural equipment should undertake an evaluation of the mechanisms which will sustain the adoption and use of agricultural equipment beyond the project period. The evaluation should be conducted considering the existing business case for equipment i.e., the types of equipment appropriate for the land sizes and useful for farmers as well as issues related to collective ownership and operation of the equipment. Although the subsidy is essential to expand demand for equipment by improving the purchasing capacity of farmers, the evaluation should examine the efficiency of the program as there are reported incidences of machinery underutilization and farmers' unaffordability of the costly imported equipment. Some plausible means of efficiency gains include the engagement of the private sector and incentivizing the development of custom hiring services to support farmers with their equipment requirements, providing direct cash transfers to farmers or soft financing options enabling farmers to procure the appropriate equipment[15]. This will divert the focus of government policy from raising supply and import push, lower the cost burden on the government, and improve the efficiency of resource allocation, ownership, accountability of farmers, and functioning of the market.

[14] The policy aims to lower the regulatory barriers for organizations involved in innovation such as new concepts, products and services and matches its development with changes in the insurance technology.
[15] Agriculture Mechanization Through Integrated Management Project of the DAE largely focuses on increasing the use of combine harvesters, tractors, reapers, transplanters etc.

11. **Formulate a High-level Committee to Make Policies Conducive to Precision Agriculture:**
Although the private sector and agricultural researchers have been advising policymakers to devise a flexible policy for the use of drones in agriculture, progress has been negligible. Leveraging the benefits of agricultural technologies like drones will require precise policies, for example, a Standard Operating Procedure (SOP), for drone use in agriculture, such as in spraying pesticides and nutrients to soil and crops. The policy could consist of legal provisions, restrictions on areas and distances, flying permission, safety insurance, drone application and registration procedures and other clauses relevant in the context of Bangladesh.

12. **Rationalize the AIT and Streamline Refunding to Encourage Investors:**
For both domestic and foreign investors, the AIT poses an impediment to expanding their business. It can be argued that the AIT acts as a constraint on importing raw materials and spare parts. It is, therefore, crucial for the government to rationalize the AIT. Moreover, the official procedure for refunding the AIT needs to be streamlined, as investors often face challenges in getting refunds. This policy measure can benefit the agricultural equipment sector and other manufacturing sectors.

13. **Create an Agriculture Wing in the National Board of Revenue (NBR) to Ensure Tax Benefits:**
The wing set up in the NBR will work closely with the Ministry of Agriculture and Khamarbari. If certificates can be issued by Khamarbari or the Ministry stating that the imported equipment or spare parts are solely used for agricultural purposes or the manufacture of agriculture equipment respectively, the sector will be able to avail tax concession.[16]

14. **Develop an Extensive Open Data Facility with Accurate and Up-to-date Data:**
There is an acute lack of publicly available data and information on the agricultural equipment sector of Bangladesh. Information asymmetry acts as an obstacle to new market entrants. Firstly, the Bangladesh Bureau of Statistics (BBS) does not record sectors' data at 4 level HS code—which is where the agricultural equipment sector is designated. To facilitate investment, it is necessary to make data and information on the sector publicly available so that investors can understand the market dynamics. Thus, the government needs to establish a dedicated, well-maintained database that will extensively cover relevant data on enterprises, investments, market size, growth, customers, etc. Secondly, a central database is essential for the farmer's loan uptake from NGOs or MFIs, which will help assess the creditworthiness of farmers to apply for bank loans. Thirdly, data on soil nutrients and yield levels should be gathered at the disaggregated level and made publicly accessible so that farmers can be advised on fertilizer use and production of crop varieties.

15. **Extend the Policy Support Enjoyed by RMG to the Agricultural Equipment Sector:**
The success story of Bangladesh's RMG industry offers crucial lessons in policy support that can be utilized for the development of the agricultural equipment sector. The RMG industry, as an export-oriented industry, has historically enjoyed benefits like the export performance benefit (the 1970s to 1992), bonded warehouse facilities, duty drawbacks, duty-free import of machinery, back-to-back letters of credit, cash subsidy, interest rate, subsidy, tax holiday, income tax rebate, retention of earnings in foreign currency, export credit guarantee scheme, and special facilities for export processing zones (Razzaque & Raihan, 2007). On paper, similar facilities are available for other export-oriented industries as well. However, although designated as "Priority Sectors", many export-oriented industries are not able to reap the benefits of these incentives (Raihan, 2020). Considering the interplay of this policy regime, it is essential that the government extend similar support to the agricultural equipment sector.

[16] Taxes are higher in case the equipment or spare parts have multiple uses.

Case Study 3: Investment Promotion Agencies (IPA) Facilitating Investment in Sustainable Agriculture – Country Experience

Brazilian Trade and Investment Promotion Agency

The ScaleUp program, in collaboration with Israel Trade and Investment, the Japan External Trade Organization and Enterprise Singapore established 15 international tech companies in Brazil with business service and financing opportunities. These include agritech startup companies catering to enhancing agriculture production through easy spotting of plagues and diseases and climate-smart agriculture with innovative technology.

Egypt's General Authority for Investment and Free Zones

Aligned with the 2030 vision for sustainable development of Egypt to achieve food security and adapt to climate change with smart agriculture, the country's IPA facilitated a joint venture between sugar industry investors in Egypt and the United Arab Emirates (UAE). The venture comprises a training academy for local farmers to efficiently maximize yields to increase Egypt's self-sufficiency in sugar production and create 50,000 jobs.

Lesotho National Development Corporation

The IPA launched a trading platform for local farmers which is a one-stop marketing and product management facility. This seeks to augment farmer's access to markets and finance so that they can shift from subsistence to commercial farming. The program has already encouraged greater investment from smallholder farmers in local agricultural production (United Nations Conference on Trade and Development [UNCTAD], 2022).

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Annex

Annex 1: General Supporting Policies for Foreign Investment

- The Foreign Private Investment (Promotion & Protection) Act 1980 protects foreign investment from nationalization and expropriation;
- Equal treatment of both local and foreign investment;
- There are no restrictions on issuing of work permits for foreign nationals and employees related to projects;
- Provision of transfer of shares held by foreign shareholders to local investors;
- Royalty, franchise, technical know-how and technical assistance fees can be remitted;
- Repatriation of invested capital, profit and dividend: Full repatriation is allowed for capital invested from foreign sources. Similarly, profits and dividend accruing to foreign investment can be transferred in full. Facilities are provided for repatriation of invested capital, profits and dividends.
- 100 per cent FDI, Joint Ventures, Partnerships, PPPs, non-equity mode (technology transfer, licensing franchising, contracting etc.), and Foreign Lending are allowed;
- 100 per cent FDI or Joint Venture FDIs are allowed to participate in the primary and secondary stock markets;
- Foreign Investors are allowed to have access to local banks for working capital requirements;
- Intellectual Property Right is protected by law.
- Bilateral and multilateral investment agreements ensure the protection of investment.

Source: Bangladesh Investment Development Authority, 2023

Annex 2: Stakeholders Consulted for Key Informant Interviews

Stakeholders	Number of Organizations Consulted
Government Ministry and Agency	4
Private Sector	4
Development Organization	4
Research Organization/University	3
Non-Governmental Organization	1
Impact Tech Companies	1
Total	**17**

Annex 3: Stakeholders Consulted for Focus Group Discussion

Stakeholders per Location	Number of Participants
Bogura (29 May 2023)	
Poultry Farming	4
Crops and Vegetable Cultivation	17
Dairy Farming	7
Total	**28**

Stakeholders per Location	Number of Participants
Ishwardi (30 May 2023)	
Poultry Farming	1
Crops and Vegetable Cultivation	11
Dairy Farming	1
Fruit Cultivation	1
Floriculture	2
Fish Farming	1
Total	**17**

Annex 4: Top Exporters of Agricultural Equipment and Export Destinations

Top 10 Global Exporters	Top Market Destinations (Export Share above 50%)	Exported Value in 2022 (USD Thousand)	Share of Total Export by Top Exporter
Germany	World	8,304,237	100%
	France	1,113,220	13.41%
	USA	991,253	11.94%
	Russian Federation	534,941	6.44%
	Poland	446,597	5.38%
	United Kingdom	397,507	4.79%
	Austria	367,973	4.43%
	Hungary	298,445	3.59%
	Netherlands	287,990	3.47%
USA	World	6,736,489	100.00%
	Canada	2,624,417	38.96%
	Australia	810,282	12.03%
China	World	6,418,764	100.00%
	USA	1,504,053	23.43%
	Germany	424,869	6.62%
	India	294,630	4.59%
	France	252,335	3.93%
	Australia	218,581	3.41%
	Canada	208,917	3.25%
	Thailand	196,064	3.05%
	United Kingdom	187,007	2.91%
Italy	World	3,810,263	100.00%
	USA	631,540	16.57%
	France	511,049	13.41%
	Germany	431,154	11.32%
	Austria	160,524	4.21%

Top 10 Global Exporters	Top Market Destinations (Export Share above 50%)	Exported Value in 2022 (USD Thousand)	Share of Total Export by Top Exporter
	Poland	129,146	3.39%
	Spain	125,215	3.29%
Netherlands	World	2,901,347	100.00%
	Germany	515,184	17.76%
	USA	291,726	10.05%
	France	270,390	9.32%
	Belgium	260,889	8.99%
	United Kingdom	188,222	6.49%
Canada	World	2,518,053	100.00%
	USA	1,954,425	77.62%
	Australia	207,796	8.25%
	Lithuania	52,665	2.09%
Belgium	World	2,474,088	100.00%
	France	431,576	17.44%
	Germany	319,049	12.90%
	USA	284,643	11.50%
	Austria	174,058	7.04%
	Netherlands	154,052	6.23%
France	World	2,186,004	100.00%
	Germany	450,643	20.61%
	Belgium	191,875	8.78%
	Italy	150,248	6.87%
	Poland	144,174	6.60%
	USA	127,570	5.84%
	Spain	123,495	5.65%
Poland	World	1,704,217	100.00%
	Germany	310,729	18.23%
	France	130,246	7.64%
	Russian Federation	122,767	7.20%
	Türkiye	90,562	5.31%
	Belgium	83,288	4.89%
	Ukraine	82,256	4.83%
	Czech Republic	59,258	3.48%
Austria	World	1,186,560	100.00%
	Germany	311,529	26.25%
	France	222,322	18.74%
	Czech Republic	104,086	8.77%

Source: Authors' calculations based on data retrieved from ITC Trade Map

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