

A Review of Agricultural Mechanization Policy in Ethiopia: Drivers and Constraints

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1. Introduction

Ethiopia is the second populous nation in Africa with a land mass of 111.5 million hectares. Only 13.6 million ha is under production mainly under rain-fed system out of 74.5 million ha arable land convenient for agriculture. The agricultural sector is the major contributor to economic growth under the Growth Transformation Plan (GTP), detrimental to achieve food security goals and profound increase in export earnings. Enhancing agricultural productivity remains priority issue to cope with ever-increasing population and resiliency to changing climate. Agricultural production in Ethiopia has shown a steady growth (UNDP, 2011) overtime, however the advancement largely comes from the expansion of farm lands (IFPRI, 2010).

Despite considerable investment close to 13% of the total expenditure compared to SSA, Ethiopian agriculture is characterized by applications of low inputs, low-value and vulnerable to frequent climatic shocks. There are still major gaps between farmers' yield and exploitable yield (Amha *et al.*, 2013) due to limited use of technological packages and inputs (UNDP, 2011). Studies indicated that in many developing countries up to 80% of farm power is provided by human beings (Clarke, 2000; Fonteh, 2010). In Ethiopia, in addition to human muscle, oxen-draft is the dominant source of farm power for land preparation and planting particularly in cereal based systems. In agroforestry systems, hand-hoe is the dominant farm implement and human muscle is used for all farm operations.

Notwithstanding the intensification of agriculture to be targeted in the subsequent development programs, utilization of mechanized power was so limited in the country. Much emphasis has been set towards the inputs of fertilizers and improved seeds. The role of mechanical power in fact is not overlooked at all, rather a deliberate policy direction that could overcome unintended consequences to come. For policy makers in Ethiopia, the displacement of the rural labor force remained the main concern as one of the unfavorable

outcomes from the expansion of mechanization. In relation to this, policy debates prevailed across the world that mechanization and consolidation have often occurred in parallel. This is justified with the efforts undertaken towards large mechanization in the past in SSA, which resulted in consolidation and disappearance of small farms (Mrema et al., 2008). The situation ended up with the displacement of smallholders and hired labor (Binswanger et al., 1995; Brown et al., 2004) as cited in (Baudron *et al.*, 2015).

Contrary to this issue, recent scholarly articles declare that mechanization will not lead to consolidation or displacement of labor. Very diverse patterns of mechanization have taken place in Asia, for example the case of Bangladesh evidences the fact that mechanization can take place without land consolidation (Biggs et al., 2011). Land consolidation could also occur induced by dynamic economic factors, for instance wage-push consolidations. The mechanization model proposed here profoundly takes into account of these concerns. Farmers could access mechanical services through service providers for only the most power-intensive operations (e.g., primary soil tillage, post-harvest operations) likely to be mechanized (Baudron *et al.*, 2015; Kienzle *et al.*, 2013). Therefore, 2WTs are likely to be a complement to, not a substitute for, human labor.

Tillage is the most important operation that requires relatively more energy among other farming activities under the rain-fed agriculture (Lal, 2004). Conservation agriculture though reduced or no tillage contributes to utilization of less power. Reduced manipulation of soil offers an option to utilize 2WT which is low powered, affordable and easy to maintain. Multiple uses of 2WT such as, transport, post-harvest operations and water pumping gave incentive for adoptions and wider acceptance. The experience in Bangladesh evidences that even the poorest households have got access to mechanization services (Alam, 2003). Furthermore, a 2WT is more efficient to work on smaller farms farm sizes lower than 0.1 ha than the conventional 4WTs.

The shift from draught animal power to tractor power gives an incentive to reduce the burden that the crop residue will be retained on the field rather than to be used as feed. Indeed, crop residues represent the main organic input available to SSA farmers (Lal, 2005). Animal manure may be an important source of carbon, but its application to fields distant from the homestead is generally limited (Zingore et al., 2007). Besides, manure is

also important source of fuel in rural areas and is competing need that hampers applications on soils. Environmental policy of Ethiopia states that the burning of dung as fuel instead of using it as a soil conditioner causes a reduction in grain production by 550,000 tons annually. But the biomass could also be used as surface mulch, representing another potential synergy between agricultural mechanization and Conservation agriculture (CA).

Emerging interest towards 2WT has happened very recently in ESA that the import has grown well in several countries. Ethiopia has also started importing 2WTs, with the number of units in use in the country estimated at 4,100 in 2014. The Rural Job Creation schemes will take much of the credit in this regard that unemployed youth were organized to deliver tractor hiring services. Besides, Ethiopia launched climate resilient green economy (CRGE) development path aimed at reducing its emissions. As a result, several abatement strategies are designed within the major contributing sectors: forestry, agriculture and energy. In the agriculture sector, livestock is the major contributor through release of methane. Among other levers, substitution of draught power with mechanical power (both small and large mechanization) is one of the abatement measures to reduce emissions of carbon. In light of this, MOA started to provide training for farmers to introduce 2WT in selected regions.

Therefore, the document reviews and portrays pertinent policy issues in the country which are favoring or disfavoring the expansion of mechanization. This is in relation to whether policy exists or not, the way it affected mechanization and the elements that are missing in it. It reveals the trends, current drivers to mechanize and the suggested mechanization model.

2. State Policies and their Implication on Mechanization

State policies in different regimes affected the expansion of agricultural mechanization in Ethiopia in various ways. This is due to their distinct economic set-ups and views on agriculture. Specific policy related to mechanization was missing, nonetheless, the rural development policies and strategies in those periods imposed vital influences. Unlike mechanizations in large-scale farms, the very common scenario is that the focus bestowed

to small-holder mechanization is limited. Three regime specific influencing policies are summarized below.

2.1. The Emperor's time (pre-1974)

During this regime, smallholder farmers have limited use-right on land. Agricultural development strategies were designed during late 1950s and early 1960s with the aim of boosting agricultural production. Development and testing of agricultural technologies using agricultural development units and promotion the technologies using extension systems have been given priority. In line with this, two development units emerged in 1960s. In addition to improved seed and chemical fertilizer, demonstration also included agricultural mechanization. The Minimum Package Program (MPP) mainly targeted to enhance smallholders access to a package of improved technologies.

During the time, the support focused towards medium to large-scale capital intensive private farms mainly producing wheat (Cohen, 1987). The Emperor's regime developed policies that provide large-scale private commercial farms the privileges to import duty-free farm machinery and parts. The incentives also include access to credit and foreign exchange for buying such equipment with government subsidized loans at 7%, and fuel tax waivers (Cohen, 1987). Such a huge support to private farms increased profit margins of mechanized cereal production and a number of land-owners around Chilalo wheat-based system evicted smallholder tenants. However, this didn't last long as the revolution took place in 1974 and large private.

2.2. The Dergue Regime (1974- 1991)

Unjust land allocation within the previous feudal system induced a revolution in 1974. Later on, the Dergue regime has changed the land tenure system with massive land redistribution scheme (Jemma, 2004). During this time, smallholder farmers were entitled to land but most of the development activities are centrally planned under command economy. The government appropriated private farms with all their properties and put them under state farm. More attention was given for mechanizing state owned large farms and support to the emerging smallholder producers' cooperatives (Belete et al., 1991). However, only few producers' cooperatives owned tractors and tractor-pulled farm

implements. Both irrigated and rain-fed state farms have played significant roles in nurturing agricultural mechanization in the country, especially during the second period of “socialist experimentation” (FAO, 2013). The other encouraging step taken in relation to mechanization was the establishment of the Nazareth Tractor Assembling Plant in 1984.

The Rural Resettlement Program which occurred in (1984-1986) resettled some 600,000 people. Resettlement under the socialist regime had multiple objectives. The program was envisaged as a means of encouraging the diffusion of improved technologies in agricultural production. New farm practices and improved technologies were realized as the means to achieve improvements in production and income of the settlers (MacArthur 1972: 148ff). The program may also be associated with large scale operations such as, mechanized plantations, macro-industrial and mining schemes so that the resettled population provides a source of cheap and readily accessible labor.

The Authority designed a 'settlement model': low cost category (i.e., cultivation by animal power), and special category (i.e. mechanized) settlements. However, the settlement program faced lots of challenges, settlers relocation has happened that they abandoned the settlement schemes and returned to their home areas all through the 1980s (Rahmato 1989).

2.3. Current government (since 1991)

In contrast to the previous regime, the current government adhered to relatively free market economy. Besides, the government also retained state ownership of land and smallholders have got no land deeds (Jemma, 2014; Gebreselassie, 2006). The policy declares, ‘Land is a common property for all the peoples in the country. It shall not be subject to sale or to other means of transfer as per Article 4 of the Federal Rural Land Administration Proclamation No. 89/1997. This provision is reaffirming the 1975 Proclamation which for the first time in the country's history, made rural lands under public ownership pursuant to Proclamation No. 31/1975, Public Ownership of Rural Lands’. Afraid of the consequences of eviction of small farmers and the social tensions to happen as a result, the government denied any private land deeds (MoFED, 2003).

The current government though still lacks a clear mechanization policy, has supported the state owned machinery assembling plant and formulated a regulation to establish Agricultural Mechanization Service Enterprise. In 2004, under regulation No. 97/2004, the Council of Ministers issued a regulation for the establishment of Agricultural Mechanization Service Enterprise (AMSE). The Enterprise was established to render mechanization services on rental basis, provide maintenance services on rental basis, sale farm implements and spare parts etc. In 2010, the tractor assembling plant established during the preceding government was transferred to the Metals and Engineering Corporation (METEC). Today METEC assembles and manufactures different agricultural machineries, including 2WT. Within the last three years, it is estimated that METEC has imported around 5000 tractors and 3000 two wheeled tractors, increasing the previous estimate to around 10,000 tractors. So far, more than 1000 of imported 2 WTs have been sold to the regions and Southern region took the biggest share by purchasing 300 walking tractors (CIMMYT, 2014). Currently, both the public and private systems are engaged in the agricultural technology supply system and markets are relatively liberal. The existence of such a policy and strategy gap could be a good indication for the slow expansion and development of agricultural mechanization in the country.

Despite the big potential of agriculture in Ethiopia, the low level of engineering technology input in agriculture has been one of the main constraints hindering the modernization of the country's agriculture and food production systems (Bishop and Morris, 1992; Mrema and Odigboh, 1993). Investment in mechanization has only taken place on large commercial farms or through government schemes (FAO, 2010). The agricultural GDP per hectare of cultivated land is at about half of Kenya or Morocco. In 2007, the figure was USD 587 per hectare for Ethiopia, USD 1,190 per hectare for Kenya, and USD 1,150 per hectare for Morocco. Addressing this productivity gap would yield substantial benefit for both growth and food security (Bill and Melinda Gates Foundation, 2010).

Agricultural mechanization aims at reducing human drudgery, increasing yields through better timeliness of operations, bringing more land under cultivation etc. Furthermore, it is widely documented that 30 to 40 percent of agricultural produce in Africa is lost because of poor post-harvest handling, storage and processing methods. Past efforts to mechanize

African agriculture have produced mixed results (FAO and UNIDO, 2008) as cited by (Fonteh, 2010).

In the past, misunderstood concepts and inappropriate selection and use of certain mechanization inputs (mainly tractors and heavy machinery) have, in many parts of the world, led to heavy financial losses and lowered agricultural production as well as contributed to environmental degradation. In many developing countries, ambitious politically motivated tractor schemes have often become a burden to the national budget and the farming community rather than being a productive input. This has also been the case in some centrally planned economies, where mechanization was heavily subsidized through the provision of government planned and operated machinery services (Clarke, 2010).

3. Intertwined Policy Issues Influencing Mechanization

It is very indispensable to formulate and implement specific mechanization policy, support to the sector and introduce options for advancing agricultural productivity within the realm of the GTP. This should be pondering on unfavorable social, economic and environmental consequences. It should be in conformity with the development priorities, policies and strategies. Designing a mechanization policy in itself is not an end for achieving the desired impacts. This is because of the fact several entangled incentives and disincentives determine the desired outcome. Those issues are discussed here.

3.1. Agricultural and Rural Development Policy

The strategic document outlining rural development policies and strategies emphasizes rural and agriculture-centered development strategy. The strategies which transform the policy into implementation include the labor intensive strategy, proper utilization of agricultural land, agro-ecological zone based approach etc. (MoFED, 2003). The commercialization of smallholder farming considered to be the major source of agricultural growth (MoFED, 2010)

The Sustainable Development and Poverty Reduction Program (SDPRP) was implemented between 2002/03-2004/05. One of the four pillars of the strategy is the

Agricultural Development-Led Industrialization (ADLI). ADLI was a long-term strategy to achieve faster growth and economic development. Fundamental policy directions that the sector focuses on are scaling up productivity of labor and land is one. Fertilizer, improved seeds, and small farm machineries will be used to enhance production and productivity (MoFED, 2010)

The Plan for Accelerated and Sustained Development to End Poverty (PASDEP) was implemented between 2005/06-2009/10. Agricultural commercialization was one of the eight pillars. The main objectives included: shifting to high-value export crops, focusing on selected high-potential areas, facilitating the commercialization of agriculture, supporting the development of large-scale commercial agriculture where feasible and better linking farmers to global and local markets (MoFED, 2010; ATA, 2014).

Agricultural Growth Program (AGP)

The Government has recently launched a new five-year Growth and Transformation Plan (GTP). The GTP, as a medium term strategic framework for the period (2010/11-2014/15), aims to “ensure food security”, by doubling domestic agricultural production. The provision of improved technology to smallholder farmers and commercialization of small scale farming is the basis of the growth plan. The vision is building an economy which has a modern technology and an industrial sector that plays a leading role in the economy help transform other sectors, particularly agriculture. Ethiopia Extension report IFPRI Ethiopia soil fertilizer IFPRI. These strategies have little but incorporated mechanization as a means for contributing to the sector’s development.

The Labor-intensive Strategy

A basic premise of the strategy is that accelerated and sustained growth can be brought about in Ethiopia through labor-intensive production methods. When we say that we should apply labor-intensive methods, we expect to promote advanced technology and farming methods that are, nevertheless, not labor-displacing in nature. Some agricultural development can be brought about through the extensive use of technology by a few people. This strategy necessarily concentrates on agricultural methods that use land and capital extensively but employ limited manpower (i.e. large-scale farming). On the other hand, it is also possible to promote agricultural development by employing an agricultural

labor force and, using non-substitutable machinery. The other is based on deploying labor-displacing, sophisticated machinery (MoFED, 2003).

3.2. Land Tenure Policy

The land policy and related causes have led the majority farmers to operate on farms which are too small to make sustainable intensification agriculture. Ethiopian policy makers, however, disagree with this argument evidencing the experience of China where farm size and public ownership of farm land did not hinder agricultural growth. It would be more useful analyzing the differences than the similarities between the two countries. This indicates that it is not the size of farm but its true economic value that matters i.e., farm labor productivity and non-farm employment (Gebreselassie, 2006).

The question that needs to be addressed is whether commercial farming would bring about accelerated and sustained agricultural development where there is shortage of land and high population density. If land could be sold, private investors acquire land in the highlands and it would displace peasant farmers, consolidate their land and use capital-intensive methods. It has already been argued above that, in a country where employment opportunities outside agriculture are limited and where capital is scarce, allowing land to be concentrated in the hands of the few will be detrimental to overall economic growth since capital will be misallocated and labor underemployed. The issue of land fragmentation and consolidation should be seen in this light.

Conversely, the land ownership policy is able to address many of the concerns raised. It is possible to save capital by providing access to land for large-scale commercial farming on the basis of long-term leases in regions where uncultivated land is available. Hence, the most reliable option be to ensure accelerated overall economic development that would allow rapid growth in the non-agricultural sectors and generate employment opportunities for the labor presently held in the agriculture (MoFED, 2003).

Land tenure policy can have an impact on mechanization by influencing the ability of farmers to make efficient use of certain types of agricultural machinery and equipment as well as the ability to use titled land for collateral purposes.

3.3. Environmental Policy and Climate Change

Ethiopia has taken ambitious decision to set its vision to achieve middle-income status by 2025. Ethiopia's ecological system is very fragile and vulnerable to climate change due to stress on natural resources, largely constrain efforts to achieve such a vision. The GTP in its subsection about environment and climate change (subsection 8.9), declares the government's commitment to building a "green economy" economy with zero-net carbon emissions by 2025. In order to build a climate-resilient GE, the plan declares that Ethiopia will pursue both appropriate climate change adaptation and mitigation measures (Wondifraw *et al.*, 2014; EPA, 2012; Adem and Bewket, 2011).

As a Party to the UNFCCC, Ethiopia is obliged by several articles of the convention to address climate change through integration of climate change into its sectoral development policies and plans (Ethiopia CRGE Strategy) (EPA, 2012). Ethiopia's contribution to GHG emissions is very low on a global scale. More than 85% of GHG emissions in Ethiopia come from forestry and agriculture. In addition to agriculture, the energy sector (heating, cooking, and trans-port) contributes to the total GHG emissions with 15%. It is estimated that 95% of the energy consumption is satisfied by bio-mass sources (mainly wood) (Adem and Bewket, 2011; Keller, 2009; Mengistu and Gebremedhin, 2014).

The CRGE strategy focuses on four pillars that will support Ethiopia's developing green economy. It includes improving crop and livestock production practices for higher food security and farmer income while reducing emissions. Livestock generate greenhouse gases mainly in the form of methane emissions. Livestock measures here include intensification and diversifying animal mix, an increased off-take rate, reducing headcount and, better health and marketing facilities. Furthermore, support consumption of lower-emitting sources of protein, e.g., poultry (EPA, 2012; FDRE, 2011) since beef production is far more carbon intensive than the production of other types of meat.

Mechanization of draft power by introduction both small-scale mechanization (techniques and improved tools) and large-scale mechanization (tractors) could substitute draught power results in a net reduction of GHG emissions, thereby lowering the oxen population (EPA, 2012). It is estimated that draught power can be substituted by mechanization by 50% and 60%, respectively. However, these initiatives were moderately feasibility due to

the lower availability of technology, the ability of farmers to afford this technology, and the suitability of the technologies to the land use in Ethiopia (FGRE, 2011).

Soil: the introduction of lower-emitting techniques, such as conservation agriculture (including applying zero or minimum tillage), watershed management, and nutrient and crop management could reduce emissions (EPA, 2012). Soil disturbance tends to hasten decomposition and erosion whereas reduced tillage results in soil carbon gain and reduction of CO₂ emissions. To achieve the latter effect, conservation agriculture will be promoted, including the use of zero and minimum tillage through the application of non-selective herbicides (FDRE, 2011).

3.4. Energy/Power Policy

Under the environmental policy, energy development also received considerable attention. The Agriculture energy supply policy states that the government aims to increase the supply of modern energy sources to the agriculture sector. Agriculture Energy Policy also declares wherever possible, energy demand in the agriculture sector will be met through locally-produced renewable energy resources (The National Energy Policy).

Deployment of renewable and clean power generation for domestic and regional markets is one measure to be opted. The Environmental Policy of the country (1997) fosters use of hydro, geothermal, solar and wind energy so as to minimize emission of greenhouse gases. Recommends biofuel development as important strategy for energy security and climate change mitigation. However, the focus is towards hydro- and bio-energy sources (EPA, 2012; Adem and Bewket, 2011; ATA, 2014). Electricity is a fundamental enabler of modern economic development, from powering cities and fueling industrial activity to pumping water for irrigation purposes in agriculture. Besides the green economy perspective, a critical enabler of industrial and urban growth and a key priority for the growth and transformation program through rural electrification (FDRE, 2011; EPA, 2004).

3.5. Credit policy and finance

The financial sector is considered shallow because it is characterized by limited range of services, limited foreign participation in the banking sector and the non-existence of capital markets (Zerihun et al., 2014). Enabling smallholder farmer's access to credit is part of the

policies and strategies where rural credit is expected to improve productivity of farmers. Hence, the policies and strategies provision seek to increase investment in agriculture and accelerate development of rural source of finance that can extend loans and credits to farmers. Cooperatives can serve as intermediaries between formal banks and smallholder farmers. The micro-finance initiative is popular and widely accepted by smallholder farmers since it is transforming the rural economy.

Credit and Finance should be available for all sizes and types of farm operation. Collateral should be facilitated with the condition that the business plan and cash flow projections appear realistic and attainable. A bias towards particular investments will result in distortions in the agricultural economy (Clarke, 2000). With respect to access to financing related to mechanization, currently a number of MFIs offer a basic credit facility for both low and motorized equipment. The loan size given is arbitrary and it is not clear what framework is used to assess this amount. The loan term is also fixed and is not based on the payback period required by the farmers (ATA, 2014).

3.6. Industrial policy

Industrial policy making in Ethiopia has advanced substantially over the last few years. Ethiopia is one of the few African countries that have formulated and implemented a full-fledged industrial policy (IDS) in 2002/03. The outcomes so far appear to be mixed (Gebereyesus, 2013). Transparent procedures with regard to allocation of credits, land, foreign exchange and subsidies of different kinds are needed to create a level playing field for all companies both the public and private. There are critics that the instruments (carrot and stick) are not transparent and the policy makers tend to 'patronize' the private sector instead of encouraging competition & innovation. There is also emerging concern that the public investment expansion is dwarfing the private sector (e.g. credit & foreign exchange availability) (Altenburg, 2010; Gebereyesus, 2013).

Given the limited size of local markets and the need to generate foreign exchange, there is a clear focus on export industries. Export industries benefit from favorable land lease rates, soft loans, tax incentives, subsidies for participation in trade fairs and international missions, and other services (Altenburg, 2010).

3.7. Trade policy

Following the liberalization (1992/93-1994/95), Ethiopia has substantially reduced tariff rates, from maximum import tariff 230 per cent to 80 per cent. Latter streamlined its tariff structure, *Ad valorem* duties range from zero percent to 35 percent, with a weighted average tariff of 16.8 percent (Moges, 2008). Goods imported from COMESA members are granted 10 percent tariff preference. There are no quantitative import restrictions or import quotas. However, the strict foreign exchange control regimes administered by the National Bank of Ethiopia deter imports. Customs administration and administrative entry barriers appear to be the major nontariff barriers (NTB) affecting Ethiopia's trade.

3.8. Import policy

Subsidies and price Support are common in many countries in the world. If countries do decide to use subsidies for farm machinery, then the purpose and time limitations of the subsidies should be clearly stated and understood. Currently, tractors that are imported are exempted from taxes and other duties, When importers miss the six months timeline, a 10% custom duty and 15% VAT are levied on the tractors, increasing the price by a quarter. Spare parts that are imported separately will be taxed at 5% custom duty, 15% VAT and 10% surtax.

Ethiopia's central bank administers a strict foreign currency control regime and the local currency (Birr) is not freely convertible. While larger firms, state-owned enterprises, and enterprises owned by the ruling party do not typically face major problems obtaining foreign exchange, less well connected importers, particularly smaller, new-to-market firms face delays in arranging trade-related payments.

3.9. Investment policy

Ethiopian investment policy gives various incentive packages. Besides, firms investing in marginalized periphery regions (such as Gambela, Benishangul, Somali etc.) are entitled to exemption of an income tax of 30% for three consecutive years after the expiry of the income tax exemption period. Export oriented firms (exporting >60% of their product or service) also receive income tax exemption incentives. The 'Federal Negarit Magazine' No 1.16.2 states that manufacturing of special-purpose (for agriculture, food processing,

mining etc. activities) machinery will give exemption from income tax for 5 years if invests in Addis Ababa and special zone of Oromia or for 6 years if invests in other areas.

3.10 Infrastructure development, Roads

The Government has set out a Road Sector Development Program (RSDP) with the aim of speeding up the improvement and expansion of the road network. In the second phase, RSDP (2002-2007) introduced a new dimension i.e. access to roads in rural villages. This is carried out through the Ethiopian Rural Travel and Transport Sub-Program (ERTTP). By June 2010, the total classified road network had increased to 48,793 km and by the end of GTP period, the road network is expected to reach 136,004 km, increasing to 86.7% in 2014/15 (MoFED, 2010).

3.11 Output price policy

The shift to a higher growth path of agricultural diversification and commercialization of subsistence agriculture also requires effective marketing system. Modern agricultural marketing system like the marketing practiced through ECX will be made to continue with strength. The market outlook for Ethiopia is also promising despite some challenges. The Ethiopian Grain Trade Enterprise is mandated to purchase grain from farmers and sell into local and (primarily) export markets. Its major role lays towards market stabilization and to encourage farmers to increase their outputs. However, the volumes traded by EGTE are small, their interventions are *ad hoc* without clear and transparent rules, and they have a conflicting mandate between the social role and the need for profitability. EGTE also lacks capacity in handling different grains other than maize.

3.12 Famers' institutions

The rural development policy emphasized the need of promotion and strengthening of cooperatives. It would be no exaggeration that neither meaningful agricultural development nor an efficient agricultural marketing system can materialize in Ethiopia without having a visible breakthrough in the development of cooperatives (MoFED). Cooperatives can buy agricultural machinery, equipment and implements to lease to farmers who individually cannot access these technologies. In addition to providing collection and storage facilities

for agricultural products, they can also set up small agro-processing industries where processed agricultural products with greater value-added may be produced.

Notwithstanding the privileges given to producer organizations, their involvement in purchasing agricultural machineries is very limited. The groups could not go beyond the supply of the seeds and fertilizers. Purchasing farm implements and tractors require large capital and the links with MFIs is also minimal.

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Table 1. Summary of national policies affecting the expansion of agricultural mechanization in Ethiopia

Policy areas affecting agricultural mechanization expansion	Does it exist? Yes/No	Elements encouraging small mechanization	Elements discouraging small mechanization expansion	Missing element(s) in the Policy
Mechanization policy	No	Designed mechanization strategy	Strategy not accompanied by policy	Designing and implementing the policy itself
Agriculture and rural development policy (Labor productivity vs displacement)	Yes	Use of row planters and threshers encouraged for transformation of agriculture and in the new mechanization strategy (without displacing labor)	Introduction of capital-intensive machines in general was less favored	Benefits from increased productivity of labor and land
Agricultural intensification (transformation, etc.)	Yes	GTP's focus on technology multiplication and dissemination	Mechanization has got little attention for intensification, afraid of the unintended consequences	Focus and support for the sector is missing
Livestock Policy (intensification)	Yes	Expansion of livestock fattening and dairy resources development technology. Thus, reducing draught power in agriculture		
Energy Policy (relative to labor market)	Yes	Electricity is considered an essential ingredient of the rural transformation agenda (SS irrigation, commercialization and processing)		
Land policy (ownership, tenure, etc)	Yes	Access to unused land for investment	Hinders land consolidation and affects mechanization negatively	Strategies for the commercialization of SH agriculture is missing

Import policy (taxes, subsidies)	Yes	Gives access to exemption from taxes and duties on imports	Preferential treatment of companies (exchange rate, credit), The incentive is only investors and six months is too short	It is not designed for smallholder farmers or cooperative/unions (mechanism for smallholder mechanization)
Industrial Policy (incentives for local manufacturing, absorbing labor to industrial sector)	Yes	Private sector is considered the engine of the sectors' growth. Policy gives incentives (reduced land leasing rate, attract foreign investment) for manufacturing sector	Incentive for import of spare parts is not there, lack of transparent incentive	Tax incentives for assemblers, implementation and enhancing efficiency of the service
Subsidies on machinery (with view of phasing them out)	No			
Research, extension and development	Yes	Establishment of research in mechanization in different regions	Research and extension has limitation on capacity and manpower	Transferring mechanization technologies simply merged with the supply of seed and fertilizer inputs
Environmental policy (Environment and Climate Change)	Yes	Green Economy a) reduce emissions from livestock, substitute draught power mechanical power b) Soil related abatement measures: Crop residue management and conservation agriculture c) Expansion of renewable energy in rural areas		
Business environment (PPP, etc.)	Yes	Policy to support the private sector exist	Business related to supply of tractors and custom hiring is not based on free	Lack of facilitation, encouragement and efficient involvement of the private

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			competition	
Regulation and enforcement (mobility, quality etc.)	Yes	Presence of organization for certification	Not substantiated with the responsible body	Mechanisms for enforcement and capacity
Infrastructure (national and local roads, electricity, etc.)	Yes	Good access to national roads, efforts to connect rural villages with towns		
Finance, credit and insurance	Yes	Focus for rural finance, Emergence of microfinance institutions (group lending), e.g. METEC and Farmer cooperatives	No access to credits to purchase tractors, land and livestock not used as collaterals, No specific access to insurance	Flexible collateral requirements and mechanisms for access to credit, Insurance for investment in machines
Pricing policy on agricultural commodities	Yes	Ethiopian Grain Trade Enterprise (EGTE) plays stabilization roles, Cooperatives set floor prices		No clear roles of the EGTE, transformation to empowered and regulated farmers institutions, transportation of produce & linkages
Investment policy	Yes	Gives various incentives (exemption from income tax, custom duty, Transfer of duty free imported goods)	Not available for smallholder farmers, farmer cooperatives	

4. Agricultural Mechanization Strategy

Recently, there are attempts in designing a comprehensive agricultural mechanization strategy for all levels of farm size. However, the strategy is ahead of the lacking explicit agricultural mechanization policy in the country. The mechanization to be effective there has to be strong and effective strategy along with proper policy that lay favorable ground for its implements. Up until now there is no agricultural mechanization strategy that governs the proper development of the sector. Recently, Ethiopian Agricultural Transformation Agency (ATA) and Ministry of Agriculture (MoA) are developing Agricultural Mechanization Strategy based on experience of different countries and stakeholder consultations. The draft mechanization strategy is a comprehensive document that puts different agricultural mechanization options for different farm sizes.

Lack of comprehensive agricultural mechanization policy and strategy, and institutional capacity remained important challenge for the growth of the sector. As a result, the majority of previous efforts have lacked focus or support across the sector. Additionally, this has also resulted in the relevant institutions to agricultural mechanization being under-capacitated, leaving them underfunded, under-staffed and unable to perform their prescribed mandate. This is throughout the value chain, from research and development through to policy makers that would create effective enabling mechanisms for maintenance and after-sales service provision.

To develop the strategy, relevant lessons and best practices have been drawn from case studies on smallholder mechanization in other countries, such as China and Brazil. Maintaining agriculture as a major source of economic growth is one of the Plan's seven pillars for the GOE. These strategies have little but incorporated mechanization as a means for contributing to the sector's development. GTP II should ensure to capture mechanization as a key pillar for growth and transformation of Ethiopia. With the Climate Resilient Green Economy (CRGE) strategy, replacement of draught power with mechanical power one of the options reducing GHG emissions intensity. It also includes the promotion of conservation agriculture technologies (of no or minimum tillage) and reduction in

draught animal power used; both of which have significant positive environmental advantages.

The strategy wishes to achieve increment of farm power where it is currently at 0.1 kW/ha to 1 kW/ha by 2025, increase income through reduced post-harvest losses, Increase domestic supply of agricultural machinery, increase overall productivity of land, improve the timeliness and effectiveness of work, and decrease drudgery in field operations. Furthermore, promote agricultural mechanizations technologies making up at least 30% of the user population, reducing the use of animal power by 50% so that mitigate emissions and environmental degradation.

The government's primary focus should be creating a strong regulatory environment and providing appropriate incentives to make it attractive for suppliers to meet burgeoning demand for mechanization in Ethiopia. The Government should put in place favorable regulatory incentives (tax reductions and exemptions) to encourage domestic manufacturing, and also incentivize international players to enter the market and form partnerships. Create standards for the manufacturing, testing and certification standards focused on safety and performance.

There is a need to build distribution system machinery in rural areas by integrating into the overall Extension Package. Creation of awareness and accessibility, promote local-level contractor class to render rent services to smallholder farmers is mentioned. Increasing accessibility of financing services for mechanization technologies and services to link up farmers directly to MFIs, and tested manual voucher system is the required intervention. Increasing the breadth and depth of financial product offerings to serve mechanization needs as well as loan products should come with flexible terms and conditions. Specifically, loans related to the purchase of small mechanized technologies and a variety of insurance schemes should be offered. Establishing a "machine distributor" fund that offers flexible credit and collateral terms is essential. Additionally, a revolving foreign currency fund should be formed for use by agents/distributors in the purchase of spare parts to help in ease liquidity constraints.

Establishment of institution of mechanization at the federal and regional level is required. Additionally, policies should be developed that would enable the creation of the proposed institution including issuing a decree for its creation and dedicating expanded funding.

Increasing smallholder farmer production through the adoption of modern agricultural practices and technologies is a fundamental approach for meeting productivity targets. The activities to be undertaken to transform agricultural mechanization include evaluation and promotion of row planters, threshers and harvesters. Scaling up of 'TIRR' technology package (Tef, improved seed, reduced seed rate, and Row planting) has been tested last year.

Row Planters: planting in rows with the appropriate seed rate has shown a significant increase of farmers' yields while at the same time reducing their input costs. However, currently no readily available mechanized planting devices in Ethiopia, particularly for use on tef with its uniquely tiny seeds.

Threshers: post-harvest mechanization is another opportunity with the potential to reduce labor time and costs, while increasing yields by saving 25-30% in post-harvest losses. The intention is to deploy various models in target tef, wheat, and maize cluster woredas.

Harvesters: mechanical harvesters also offer potential increased efficiencies and long-term cost savings for Ethiopia's farmers. Using mechanized harvesters can reduce the amount of days of labor needed to harvest one hectare by 70-80%. Annual report ATA. In the GTP II, introduction and evaluation of power tiller, regular tractor and implements for pre and post-harvest operations is priority and are the activities to be performed.

The ministry of agriculture also intends to establish tractor hiring services in the major four regions (Oromia, Amhara, Tigray and SNNP). Unemployed youth will be organized into groups to provide the services. The business model to be introduced considers options to lease tractors and machineries from dealers or through credits from the government.

5. SWOT Analysis

<u>Constraints</u>	<u>Opportunities</u>
<ul style="list-style-type: none"> ▪ Lack of mechanization policy and strategy ▪ Lack of effective demand creation ▪ Farmers are not sufficiently aware of the technology opportunities ▪ Topography and soil type ▪ Lack of maintenance and repair services ▪ Insufficient skill throughout sector ▪ High import taxes, tariffs and higher prices ▪ Poor access to credit 	<ul style="list-style-type: none"> ▪ Focus towards row planters, threshers and harvesters ▪ Green economy strategy ▪ Lack of strong competition in the market ▪ Low level of mechanization ▪ High potential for tractor sales and earning revenue ▪ Lack of strong competition in the market ▪ Available of large unused arable land
Strength	Weakness
<ul style="list-style-type: none"> ▪ Mechanization considered at directorate level in MOA ▪ Mechanization strategy developed recently ▪ Availability of developed and tested technologies of implements ▪ Given focus by many actors ▪ Lessons from METEC and way forward 	<ul style="list-style-type: none"> ▪ Shortage of trained manpower ▪ Lack of institutional linkage, Scattered efforts ▪ Few sellers ▪ Little focus of extension ▪ Subsidized supply of 2WT by single company (METEC)

References *(Yet not complete)*

- Adem A., and Bewket W. 2011. Climate Change Country Assessment Report for Ethiopia.
Submitted to Forum for Environment
- Altenburg T. 2010. Industrial Policy in Ethiopia. Discussion Paper / Deutsches Institut für
Entwicklungspolitik
- Amha W., David Peck D., Berhane G., Aseffa Y., and Kidanu B. 2013. Diagnostic study of
providing micro-insurance services to low income households in Ethiopia: an input to
a national micro-insurance strategy, ESSP II-EDRI Report.
- ATA (Agricultural Transformation Agency). 2014. Ethiopian National Agricultural
Mechanization Strategy. Vision, Systemic Challenges and Strategic Interventions.
- Bill and Melinda Gates Foundation. 2010. Accelerating Ethiopian Agriculture Development
for Growth, Food Security, and Equity
- Clarke L.J. 2000. Strategies for agricultural mechanization development, the roles of the
private sector and the government. Rome, Italy
- CIMMYT (International Wheat and Maize Improvement Center). 2014. Market analysis for small
mechanization in Ethiopia. Farm mechanization and conservation agriculture for sustainable
intensification.
- Energy Policy of the Transitional Government of Ethiopia
- EPA (Environmental Protection Authority). 2004. The 3rd national report on the implementation
of the UNCCD/NAP in Ethiopia
- EPA (Environmental Protection Authority). 2012. National Report of Ethiopia, the United
Nations Conference on Sustainable Development (Rio+20). Federal Democratic
Republic of Ethiopia, Addis Ababa
- FAO and UNIDO. 2008. Agricultural mechanization in Africa ... Time for action: planning
investment for enhanced agricultural productivity. Report of an expert group meeting
jointly held by FAO and UNIDO in Vienna on 29–30 November 2007. Rome, FAO.

- FDRE (Federal democratic Republic of Ethiopia. 2011. Ethiopian Climate Resilient Green Economy Strategy (CRGE). Green Economy strategy.
- Fonteh M.F. 2010. Agricultural mechanization in Mali and Ghana: strategies, experiences and lessons for sustained impacts. Food and agriculture organization of the United Nations. Agriculture and food engineering working document.
- Gebreselassie S., 2006. Land, Land Policy and Smallholder Agriculture in Ethiopia: Options and Scenarios. Working Paper 008, Future Agricultures
- IFPRI (International Food Policy Research Institute). 2010. Fertilizer and Soil Fertility Potential in Ethiopia: Constraints and opportunities for enhancing the system.
- Jemma H., 2004. The politics of land tenure in Ethiopian History: experience from the south, paper for XI World congress of rural sociology, Trondheim, Norway
- Keller M. 2009. Climate Risks and Development Projects. Assessment Report for a Community-Level Project in Guduru, Oromiya, Ethiopia. Bread for all
- Kienzle J., Ashburner J.E., Sims B.G. 2013. Mechanization for Rural Development: A review of patterns and progress from around the world. Integrated Crop Management Vol. 20
- Mengistu T. and Gebremedhin A. 2014. Ethiopian NAMA on Forestry/agroforestry presentation, Copenhagen
- MoFED (Ministry of Finance and Economic Development). 2003. Rural development Policy and Strategies. Addis Ababa
- MoFED (Ministry of Finance and Economic Development).2010. Growth and Transformation Plan (GTP). Addis Ababa.
- Moges K. 2008. Ethiopia's Trade Relation with the EAC and Sudan. EEA (Ethiopian Economic Association)
- Rahmato D. 1989. Resettlement in Ethiopia: The Tragedy of Population Relocation in the 1980s. Office of the National Committee for Central Planning (ONCCP). Conference Proceedings.