

International Journal of Agriculture Extension and Social Development

Volume 4; Issue 1; Jan-Jun 2021; Page No. 189-194

Received: 01-02-2021
Accepted: 05-03-2021

Indexed Journal
Peer Reviewed Journal

Review on agricultural extension strategies in Ethiopia: Past and present

Guduro Beriso Ware

Department of Rural Development and Agricultural Extension, Jimma University College of Agriculture and Veterinary Medicine, Jimma, Ethiopia

Abstract

Agriculture is the mainstay of the economy, accounting for 38.5% of the gross domestic product (GDP) and 85% of the population's livelihood. An agricultural extension strategy is a practice used to increase the market share for a given product or service and thus keep it in the maturity phase of the marketing product lifecycle rather than going into decline. The overall objective of this paper is to review on Agricultural Extension strategies in Ethiopia: past and present. The paper is based on a review of the literature and analysis of data collected from different part of Ethiopia. The historical and theoretical of extension strategies have been reviewed. During the previous two regimes in Ethiopia (the Imperial and the Derg military regime), a centralized administrative system prevailed, where planning and implementation of agricultural extension and rural development activities followed a top-down path. The various extension strategies have been biased against. Know a day agricultural extension has been emphasized by development experts as crucial in achieving agricultural development, poverty reduction, and food security. By recognizing this, the government of Ethiopia has made great efforts to transform the agricultural sector mainly by strengthening its agricultural extension strategies as part of the general agriculture policy reform. In spite of considerable efforts made to improve the extension strategies of the country in the past, the system is not bringing the desired results. Thus, it is of paramount importance to prepare a full-fledged extension strategy which takes into consideration the growing demand of agricultural development and that also shows the future direction of the extension services.

Keywords: Derg, Ethiopia, imperial, poverty, strategies

Introduction

Ethiopia is the second most populous country in Africa, with an estimated population of about over 1 billion (World Population Review 2016). Agriculture is the mainstay of the economy, accounting for 38.5% of the gross domestic product (GDP) and 85% of the population's livelihood. An extension strategy is a practice used to increase the market share for a given product or service and thus keep it in the maturity phase of the marketing product lifecycle rather than going into decline. Over the last four decades, the country's agricultural extension strategies have changed to keep pace with the economic development and rural transformation goals of the regimes. However, agricultural production and productivity from smallholder farming has been very low and insufficient to feed the growing population in the country, which has been constantly struggling with problems of food and nutrition security (National Plan Commission, 2015).

During the previous two regimes in Ethiopia (the Imperial and the Derg military regime), a centralized administrative system prevailed, where planning and implementation of agricultural extension and rural development activities followed a top-down path. A centralized administrative system prevailed, where planning and implementation of agricultural extension and rural development activities followed a top-down path. The various extension strategies have been biased against. A decentralized federal governance system was introduced and adopted by the current Ethiopian People's Revolutionary Democratic Front (EPRDF) government in the early 1990s. However, in

practice, the governance system has only experienced a quasi-transformation as the planning system, known as the quota system, continues to follow a top-down flow from the center to the region and woredas. Moreover, different categories of farmers are not equally targeted by the extension services. Often, new technologies or practices are introduced for implementation, irrespective of their suitability to the farming system, the socio-economic conditions of the users, or their needs. Naturally, there is a tendency among farmers to resist new technologies or practices, which are recommended as a one-size-fits-all solution (Belle Asante 2010) ^[22].

Considerable efforts have been made by the state to improve agricultural development and reduce poverty through the agricultural extension service. The Ethiopian agricultural extension strategies have witnessed several reforms over the years. However, despite efforts to halt and reverse the problems related to extension services, the centralized top-down route to technology transfer remains the overarching development paradigm (Spielman *et al.* 2010; Elias, A, *et al.* 2016) ^[23, 10]. Thus, although agricultural extension is targeted at ensuring food security, it has never resulted in a breakthrough in the Ethiopian agricultural sector, particularly in the interest of smallholder farmers. The extension system has not realized a truly decentralized management structure in Ethiopia (Elias, A, *et al.* 2016) ^[10]. Further, there is a lack of in-built monitoring and evaluation systems at different levels (Elias, A, *et al.* 2016) ^[10]. Since agricultural extension activities are now being planned and implemented at the regional level, distinctions have been

made in the structure and functions of the system between regions and woredas. While slightly different strategies are adopted and implemented by regions and woredas, most changes to the extension system are often made without a thorough evaluation of the previous system (Kidanemariam G *et al.* 2013) ^[9].

The adopted planned extension strategies aims to increase the overall coverage of the extension through technology or best practice up scaling (Leta *et al.*, 2017a) ^[24]. However, much is not known about how the new system operates to realize the government's strategic goals of poverty reduction ensure food security and sustainably manage the natural resources. In addition to the considerable investment in agriculture, nearly all agricultural extension services in Ethiopia is provided by the state. However, the role and interest of the state in the planned extension strategies is not clearly known in research. Specifically, the general roles of the state actors at different levels and their interaction and tradeoffs in addressing common goals are not well known. Additionally, a systematic study has not been carried out either on the role of development agents and model farmers in implementing planned extension strategies and rural development or on the farmer's rationale for adoption or non-adoption of agricultural technologies. Another important gap in the extension strategies is analyzing alternative means to foster knowledge transfer among resource-poor farmers, build their resilience against growing systemic inequalities, and enabling their access and contribution to epistemic resources. Thus, the social learning has not been documented in this context, despite its significance as a coping mechanism to the discriminatory policies of the extension services system and its role in stabilizing the mounting epistemic oppression compounded by the lack of pro-poor strategies. Recognizing the prevailing issues, the government considers improving agricultural production and productivity through expanding and reinforcing agricultural extension is the best resort to reduce poverty, ensure food security and sustainably manage the natural resources (NPC 2015).

Literature review

History of agricultural extension strategies in Ethiopia past and present

Under the imperial regime

Historically, agricultural extension strategies date back to early 1950s; however, the then government hardly focused on agriculture (Paul *et al.* 2014) ^[7]. During the *Imperial* regime (1930 to 1974), Ethiopia passed only three consecutive five-year economic development plans from 1957-62, 1962-7, 1968-73 (Paul Dorosh *et al.* 2010) ^[17]. Despite agriculture accounting for 90% of the country's exports and employment opportunities, the sector did not receive the attention it deserved until the third five-year development plan from 1967 to 1973 (Belay 2003; Paul Dorosh *et al.* 2010) ^[4, 17]. The third five-year plan was thus responsible for bringing Ethiopia's development strategy into focus, with a strong emphasis on increasing agricultural production. However, much of the focus and funding were directed toward large-scale commercial agriculture, with little attention being paid to subsistence (peasant) agriculture which are together makes up the majority of Ethiopian agriculture (Paul Dorosh *et al.* 2010) ^[17].

Moreover, the agricultural economy largely relied on donors fund support, interests, and developmental roadmaps. For instance, the United States Agency for International Development provided a large share of resources to Ethiopian agriculture from 1950s to 1970s (Paul Dorosh *et al.* 2010) ^[17].

The history of integrated rural development efforts in Ethiopia dates to the late 1960s, when numerous extension programs and projects were designed and implemented throughout the country. The Chilalo Agricultural Development Unit, which was launched as part of a broader project known as Comprehensive Package Project in 1967, received financial support from the Swedish government (Spielman *et al.* 2012; Belay 2003) ^[21, 4]. Chilalo Agricultural Development Unit, which latter evolved to the Arsi Rural Development Unit used an integrated approach to agricultural development and served as the blueprint for similar area-based developmental activities such as Wolayita Agricultural Development Unit in 1970 and Ada'a District Development Project (1972). The package involved some applied research initiatives, extension, credit, cooperative development, model farmers, and market intervention (Abate 2007) ^[25].

Under the Derg military regime

The successful outcome of Comprehensive Package Project led to the project being replicated on a relatively large scale, as part of an up scaling lesson in area development and through minimum package programs (MPP I and MPP II). minimum package programs -I was planned and implemented from 1971 to 1974, whereas the implementation of minimum package programs -II extended from 1981 to 1985 because of the revolution and political instability, including the historic land reform process during early Derg military regime (1974 to 1991). MPP-I was expected to reach a large number of farmers; the project aimed at adopting and implementing the substantial experiences of CPP and area development projects (Abate 2007; Abate 2004; Belay 2003) ^[25, 26, 4]. Minimum package programs -I was known for its extraordinary approach and success in agricultural extension. Similarly, the aim of minimum package programs -II was to cover as many districts (woredas) as possible, but it fell short of achieving its goals. Among others, the minimal availability of development agents in the country was a challenge (Belay 2003) ^[4]. MPP-II was funded by the World Bank, the International Fund for Agricultural Development, and, to a limited extent, by the Swedish International Development Cooperation Agency (Belay 2003) ^[4]. Later, from 1986 to 1995, the Peasant Agriculture Development Extension Project, funded by the World Bank, Africa Development Bank, and other donors, was launched in seven of the eight agro-ecologically delimited zones of the country (Abate 2004; Belay 2003) ^[26, 4]. The project aimed at applying the modified training and visit (T&V) extension approach. Agriculture Development Extension Project, which was designed after a critical evaluation of the past extension strategies, was aimed at introducing noticeable changes to peasant agriculture through concerted and coordinated efforts in the areas of agricultural research and extension (Belay, 2003) ^[4]. An innovative extension strategy of Peasant Agriculture Development Extension Project was

designed with different focus areas and objectives such as agriculture, comprehensive rural development, management of natural resources, rehabilitation of degraded land, and irrigation development (Abate 2007; Belay 2003) ^[25, 4]. However, owing to the inflexible and prescriptive economic policies and strategies pursued by the Derg military regime, the multilateral donors withheld their financial assistance. As a result, the comprehensive program was not effectively implemented. The government rejected donors' demands for policy changes such as market liberalization and eventually obstructed the country's access to financial aid from abroad. This had a debilitating effect on the progress of the country's agricultural economy, particularly the agricultural extension services, and eventually led to the fall of the Derg military socialist regime in 1991.

Current situation (FDRE)

The Government of the Federal Democratic Republic of Ethiopia (FDRE) formulated agricultural policy and strategies, the Agriculture Development Led Industrialization, to overcome the agricultural problems and transform the country's economy. Based on implementation of the agricultural policy, growth in agricultural production and productivity has been registered in the economy. Real Growth Domestic Product grew by 10.3% in 2013/14, with 2.3% of this growth from the agricultural sector. As of 2014, 72.7% of employment was generated by the agriculture sector (UNDP, 2015).

Agriculture Development Led Industrialization has served as an umbrella strategy guiding the three most recent five year national plans: the Sustainable Development and Poverty Reduction Program, 2002/03-2004/05; a Plan for Accelerated and Sustained Development to End Poverty, 2005/06-2009/10; and the Growth and Transformation Plan-I (GTP-I), 2010- 2015. In general, Ethiopia's rural development policy and strategies prioritize the transformation of smallholder subsistence agriculture to commercial agriculture through market-orientated production system. Accordingly, the government is investing heavily in agriculture with a focus on public extension services by deploying considerable human and financial resources.

Growth and Transformation Plan-I mainly focused on accelerated growth in agricultural productivity for ensuring food security and supporting the food industry through increasing crop production, enhancing crop productivity by applying good agricultural practices and improving extension services. Moreover, it emphasized on the utilization and agricultural inputs, strengthening agricultural marketing system, enhancing agricultural research and strengthening natural resource conservation. During the period of Growth and Transformation Plan -I, the number of agricultural extension beneficiaries has increased from 5.1 million in 2009/10 to 13.95 million farmers by the end of 2014/15. Although the number of beneficiaries from the agricultural extension system has increased, its effectiveness in terms of better outcome as measured by increased productivity gains needs to be enhanced (National Plan Commission, 2017).

The current Growth and Transformation Plan-II (GTP-II) 2015-2020 builds on the achievements and lessons learnt during the implementation of GTP-I. Though accelerated growth in agricultural productivity continues to be an

important area of focus as food security continues to be a challenge, it is envisaged to shift towards high value crops reinforced by a market system that will benefit farmers (National Plan Commission, 2017).

One of the major objectives of the Agriculture Development Led Industrialization strategy that is reflected in the Growth and Transformation Plans is transforming the agricultural sector to ensure food security and self-sufficiency in food production. Both Growth and Transformation Plans emphasize food security as a national goal. But whereas Growth and Transformation Plan -I focused on traditional crops, Growth and Transformation Plan -II shifts to high value crops, includes market development more specifically, highlights implementation capacities and looks at food and nutrition in a more systematic way (Assefa, 2017) ^[3].

As laid out in its second Growth and Transformation Plan (GTP-II), the Government of Ethiopia is highly committed to sustainably increasing agricultural production by more than 8% per annum to meet the growing demand for food, industrial raw materials, and foreign currency earnings. In order to respond the growing demand of different stakeholders, there is a need of dynamic and proactive extension system. Rigorous and vibrant extension system is a key policy instrument to enhance agricultural development. Agricultural extension has been emphasized by development experts as crucial in achieving agricultural development, poverty reduction, and food security (Mohammed, *et al.*, 2015) ^[27].

Practices and theories of agricultural extension strategies in Ethiopia: past and present

Within Africa, Ethiopia is probably the country with the greatest state involvement in the agricultural sector (Lefort 2012). In the recent decades, the Ethiopian state has allocated massive resources to its AES. In fact, agriculture has attracted more investments in the current regime than that the earlier two regimes - the imperial regime (1930-1974) and the Derg military regime (1974-1991) (Spielman *et al.* 2012) ^[21]. Today, Ethiopia has the largest number of local agricultural extension workers, known as DAs, which is the highest number in Africa and the fourth largest in the world, after China, India and Indonesia. The state has also invested heavily in agricultural infrastructure such as Agricultural Technical and Vocational Education and Trainings colleges and farmer training centers, among others.

In the early 2000s, 25 Agricultural Technical and Vocational Education and Trainings colleges were set up throughout the country (Davis *et al.* 2010) ^[28], and a total of 62,303 diploma graduates were trained in these colleges up to 2011 (unpublished ATVET report, 2016). Over 10,000 farmer training centers have been constructed in the country over the years (Breen 2014) ^[29].

Specialization and diversification

According to research conducted by Kassa Belay (2003) ^[4] on the case of participatory demonstrations and training extension Agricultural extension in Ethiopia reveals that for decades, agricultural extension in Ethiopia has largely focused on crops, with less attention being paid to livestock. This has also been the case with agricultural research programs.

However research conducted by wuletaw *et al.* (2018) ^[14] on Determinants of crop–livestock diversification in the mixed farming systems: evidence from central highlands of Ethiopia reveals that in fact, crop production contributes to 29% of the Ethiopian Gross Domestic Product (GDP) whereas livestock contributes 12% and planned extension strategies aims to fix this imbalance by focusing on both livestock and the specialization and diversification of crops.

Poverty reduction

Samuel Tadesse *et al.* (2015) ^[11] on study Assessment of Food Security Situation in Ethiopia, In Ethiopia revealed that new knowledge and technologies are considered the main means to address the food security problems. Hence, intensification of crop production is a national priority: a legacy from the past that continues to influence actors' decision-making in the present. Improving production and productivity are the main targets of the agricultural extension system instead of postharvest (product) planning or improving market intervention. This rigid model has been followed for decades, even though; diversification and intensification have been conceptually integrated into the country's short- and long-term developmental plans and strategic directions.

According to (MoFED 2006; MoFED 2002) ^[30, 31] on Plan for Accelerated and Sustained Development to End Poverty stated that over the years, many strategies have been introduced to support the implementation of agricultural extension in the country. Agricultural extension is seen as an important component of the Sustainable Development and Poverty Reduction Program and the Plan for Accelerated and Sustainable Development to End Poverty, which were developed and implemented during 2002-2005 and 2006-2010, respectively. Sustainable Development and Poverty Reduction Program helped farmers enhance their production capacity by providing agricultural extension services and assigning three Development agents to each kebele in the country (Ethiopia Ministry of Finance and Economic Development 2002).

Competent and skilled human resource

The Agricultural Transformation Agency (2017) on Ethiopia's Agricultural Extension Strategy reported that, Development of modernized agriculture and extension system requires competent, energetic and dynamic workforce. In line with this, the role model played in the past and the current ongoing progresses by Higher Learning Institutions and Agricultural Technical and Vocational Education and Trainings in producing skilled human power for the agricultural development is highly recognized. Continued efforts in cultivating and producing competent skilled human power that could respond to the diverse needs of farmers and pro-actively move the agricultural development of the country forward is critically important. Thus, capacity building programs (short and long-term) by the Higher Learning Institutions targeting different actors' vis-à-vis developing competent and dynamic learning institutions are vital to put this strategy into practice sustainably.

Market-oriented and demand driven extension system

Report by the Agricultural Transformation Agency (2017),

on agricultural extension strategy in Ethiopia, stated that to increase farmers' incomes and improve their livelihoods, the extension system needs to provide market-demanded technologies, link producers with buyers, input and credit suppliers, providing market information, and promoting collective marketing.

According to (MoFED 2010) ^[18], on the Growth and Transformation Plan in Ethiopia, The Growth and Transformation Plan is the current state-based development strategy, which in its second phase of implementation (2016-2020). The plan aims to maintain agriculture as the main source of economic growth and as the foundation of the structural transformation towards industrial growth in the long run. In this context, the Growth and Transformation Plan also aims to strengthen the agricultural extension efforts (National Plan Commission, 2015).

Research conducted by Leta *et al.* (2018a) ^[16], the Ethiopian Agricultural Extension System and Its Role as a Development Actor: Cases from Southwestern Ethiopia, in line past and present the production and distribution of improved seeds in Ethiopia is plagued by several challenges: monopoly of the state-owned seed enterprises; low capacities of other commercial seed producers; the biological phases of seed production itself, which leads to shortage of breeder seeds from the research system; poor seed varieties (segregated), which lead to low productivity and are susceptible to diseases and the slow growth of regional seed enterprises.

Other investigation conducted by Gebremedhin *et al.* (2006) ^[12], on Commercialization of Ethiopian reported that, agriculture Extension service from input supplier to knowledge broker and facilitator the future of the extension services in the country relies heavily on the use of these farmer training centers.

Agricultural Development Project (Intr code no. 38, 2015) reported that, the scenario seems to be changing. Unlike in the past, regional seed enterprises, community-based seed producers and commercial farmers have become increasingly involved in seed production throughout the country. In some places, seed-producing farmer groups have begun to produce standardized quality seeds, although, this is still at the initial stage of development. Nevertheless, as the number and diversity of seed producers continues to increase, more competition, more varieties, better quality and lower prices are expected to benefit smallholder farmers.

The key objective of Plan for Accelerated and Sustainable Development to End Poverty was to accelerate the transformation of smallholder agriculture from subsistence to commercial purposes by strengthening extension services through increasing such as technical and vocational trainings (MoFED 2006) ^[30].

Supply of agricultural technologies and inputs

Dercon (2009) ^[8] in his study Impact of Farmers' Training Centers on Household Income: Evidence from Propensity Score Matching in Eastern Ethiopia. In the last decade, state-sponsored strategies and investments in rural development have produced positive impacts on growth and poverty reduction. These achievements have been realized through technology transfer and the reduction of transaction costs, (e.g. through the construction of roads and other

infrastructure in rural areas). However, the operation of the agricultural extension system in Ethiopia is plagued with large-scale ineffectiveness.

Other studies conducted by Kassahun Berhanu and Colin Poulton *et al.* (2014) ^[5], on the Political Economy of Agricultural Extension Policy in Ethiopia, Argue that the root causes of the ineffectiveness are the centralized top-down state control. Berhanu and Poulton (2014) ^[5] link the shortfalls to the trade-offs between the twin objectives of the state extension policy: to improve production and ensuring food security, and to win and maintain the support and loyalty of farming communities.

Other investigation conducted by Leta, Gerba (2018) ^[16] on Ethiopia's Agricultural Extension Strategy, despite many attempts made to create strong linkages between research and extension in the past many years, effective linkage and coordination have been lacking at all levels in the process of technology generation, validation and adoption. Agricultural Development Partners Linkage Advisory Council at the time of its establishment had good motivation and spirit to engage in agricultural development regularly. However, this momentum gradually lost and become inconsistent. As a result, issues which are challenging to agricultural development and are critically affecting the success of extension services such as input supply, human resource development in agriculture, access to financial services, marketing and market infrastructure development, overall directions in agricultural technology generation, dissemination and utilization remain unsolved. Moreover, the platforms lack to have their own regular budget from government to run their activities.

Agricultural Transformation Agency (2017) reported that "Path dependencies are the legacies from the past influencing and new technologies such as improved seeds and associated packages. Even then, participation is limited to only those farmers who are afforded the access.

Conclusion and policy implication

The ramifications of agricultural extension strategies in Ethiopia are viewed from several angles. First, it has played an important role in augmenting smallholder production due to improved access to inputs, credits, and training and plays a great role in improving in food security in Ethiopia. Over the last four decades, the country's agricultural extension strategies have changed to keep pace with the economic development and rural transformation goals of the regimes. A centralized administrative system prevailed, where planning and implementation of agricultural extension and rural development activities followed a top-down path. The various extension strategies have been biased against. A decentralized federal governance system was introduced and adopted by the current Ethiopian People's Revolutionary Democratic Front (EPRDF) government in the early 1990s. However, in practice, the governance system has only experienced a quasi-transformation as the planning system, known as the quota system, continues to follow a top-down flow from the center to the region and woredas. Moreover, different categories of farmers are not equally targeted by the extension services. The adopted planned extension strategies aim to increase the overall coverage of the extension through technology or best practice up scaling. However, much is not known about how the new system

operates to realize the government's strategic goals of poverty reduction ensure food security and sustainably manage the natural resources. By recognizing this, the government of Ethiopia has made great efforts to transform the agricultural sector mainly by strengthening its extension strategies as part of the general agriculture policy reform. In spite of considerable efforts made to improve the extension strategies of the country in the past, the system is not bringing the desired results. Thus, it is of paramount importance to prepare a full-fledged extension strategy which takes into consideration the growing demand of agricultural development and that also shows the future direction of the extension services.

References

1. Abel Guy J, *et al.* Meeting the Sustainable Development Goals leads to lower world population growth. *Proceedings of the National Academy of Sciences.* (2016);113(50): 14294-14299.
2. Assche K. van, and Anna-Katharina Hornidge. *Rural development: knowledge and expertise in governance.* Wageningen Press; c2015.
3. Assefa Yibeltal, *et al.* Successes and challenges of the millennium development goals in Ethiopia: lessons for the sustainable development goals. *BMJ global health.* 2017;2(2):e000318.
4. Belay K. Agricultural extension in Ethiopia: the case of participatory demonstration and training extension system. *Journal of social development in Africa.* 2003;18(1):49-84.
5. Berhanu Kassahun, Colin Poulton. The political economy of agricultural extension policy in Ethiopia: economic growth and political control. *Development Policy Review* 2014;32(s2):s197-s213.
6. Coates A, Kung A, Mounts E, Hesla J, Bankowski B, Barbieri E, *et al.*, Optimal euploid embryo transfer strategy, fresh versus frozen, after preimplantation genetic screening with next generation sequencing: a randomized controlled trial. *Fertility and sterility.* 2017;107(3):723-730.
7. Collier Paul, Stefan Dercon. African agriculture in 50 years: smallholders in a rapidly changing world?. *World development.* 2014;63:92-101.
8. Dercon S, Hill RV, Zeitin A. In Search of a Strategy: rethinking agriculture-led growth in Ethiopia. *Synthesis Paper prepared as part of a study on Agriculture and Growth in Ethiopia, University of Oxford, UK; c2009*
9. Egziabher Kidanemariam G, Erik Mathijs, Jozef A Deckers, Kindeya Gebrehiwot, Hans Bauer, Miet Maertens. The economic impact of a new rural extension approach in northern Ethiopia. No. 1067-2016-86816. 2013.
10. Elias A, Nohmi M, Yasunobu K, Ishida A. Farmers' satisfaction with agricultural extension service and its influencing factors: a case study in North West Ethiopia. *Journal of Agricultural Science and Technology.* 2016 Jan 10;18(1):39-53.
11. Endalew Birara, Mequanent Muche, Samuel Tadesse. Assessment of food security situation in Ethiopia: A Review. *Asian Journal of Agricultural Research.* 2015;9(2):55-68.
12. Gebremedhin B, Hoekstra D, Tegegne A. [Berhanu

- Gebremedhin; Azage Tegegne]. ILRI, Nairobi (Kenya). Improving Productivity and Market Success of Ethiopian Farmers Project (IPMS). Commercialization of Ethiopian agriculture: extension service from input supplier to knowledge broker and facilitator. IPMS Working Paper 1. Nairobi (Kenya): ILRI; c2006.
13. Kassa Belay, Dawit Alemu. Agricultural research and extension linkages: Challenges and intervention options. *Ethiopian Journal of Agricultural Sciences*. 2016;27(1):55-76.
 14. Kassa Fentaye, Wubshet Wuletaw. Assessment of the problems associated with artificial insemination practices in Essera Woreda, Dawuro zone, Southern Ethiopia. *International Journal of Livestock Production*. 2018;9(2):24-28.
 15. Lefort Craig T, *et al.* Distinct roles for talin-1 and kindlin-3 in LFA-1 extension and affinity regulation. *Blood*. 2012;119(18):4275-4282.
 16. Leta Gerba, *et al.* Nikinake: the mobilization of labour and skill development in rural Ethiopia. *Natural Resources Forum*. John Wiley & Sons, Ltd (10.1111), 2018;42(2).
 17. Mellor John W, Paul Dorosh. Agriculture and the economic transformation of Ethiopia; c2010.
 18. MoFED FDRE. Growth and Transformation Plan 2010;15:11-2014, 2010.
 19. Saif NMA. How does marketing strategy influence firm performance? Implementation of marketing strategy for firm success. *International Journal of Innovation and Economic Development*. 2015;1(3):7-15.
 20. Sebaaly Fadia, *et al.* Design and implementation of space vector modulation-based sliding mode control for grid-connected 3L-NPC inverter. *IEEE Transactions on Industrial Electronics*. 2016;63(12):7854-7863.
 21. Spielman David J, Dawit Kelemwork, Dawit Alemu. Seed, fertilizer, and agricultural extension in Ethiopia. *Food and agriculture in Ethiopia: Progress and policy challenges*; c2012. p. 84-122.
 22. Tarsitani BA, Tarsitani S. Integrating local knowledge in Ethiopian archives: music and manuscripts in the collection of Abdulahi Ali Sherif. *African study monographs*. Supplementary issue. 2010;41:5-18.
 23. Spielman DJ, Byerlee D, Alemu D, Kelemework D. Policies to promote cereal intensification in Ethiopia: The search for appropriate public and private roles. *Food policy*. 2010 Jun 1;35(3):185-94.
 24. Leta OT, El-Kadi AI, Dulai H. Implications of climate change on water budgets and reservoir water harvesting of Nuuanu area watersheds, Oahu, Hawaii. *Journal of Water Resources Planning and Management*. 2017 Nov 1;143(11):05017013.
 25. Abate AF, Nappi M, Riccio D, Sabatino G. 2D and 3D face recognition: A survey. *Pattern recognition letters*. 2007 Oct 15;28(14):1885-906.
 26. Abate J, Valkó PP. Multi-precision Laplace transform inversion. *International Journal for Numerical Methods in Engineering*. 2004 Jun 7;60(5):979-93.
 27. Mohammed A, Sheikh TL, Gidado S, Pogensee G, Nguku P, Olayinka A, *et al.* An evaluation of psychological distress and social support of survivors and contacts of Ebola virus disease infection and their relatives in Lagos, Nigeria: a cross sectional study-2014. *BMC Public Health*. 2015 Dec;15(1):1-8.
 28. Davis ME, Zuckerman JE, Choi CH, Seligson D, Tolcher A, Alabi CA, *et al.* Evidence of RNAi in humans from systemically administered siRNA via targeted nanoparticles. *Nature*. 2010 Apr;464(7291):1067-70.
 29. Mattick RP, Breen C, Kimber J, Davoli M. Buprenorphine maintenance versus placebo or methadone maintenance for opioid dependence. *Cochrane database of systematic reviews*, 2014 (2).
 30. MoFED (Ministry of Finance and Economic Development). Ethiopia: Building on Progress, A Plan for Accelerated and Sustained Development to End Poverty (PASDEP) 2005/06-2009/10, September, 2006, Addis Ababa: Ethiopia; c2006.
 31. MoFED FD. Ethiopia: sustainable development and poverty reduction program. Addis Ababa, Ethiopia. 2002.