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Assessment of Public Agricultural Research Investment Trends and Policy Perspectives in Ethiopia

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Abstract: The study examines financial investment trends in public agricultural research in Ethiopia. The budget data from Ethiopian institute of agricultural research (EIAR) and seven regional agricultural research institutes (RARI's) which is supplemented by national agricultural GDP and inflation data were used for this study. Data were analyzed using descriptive statistics. The study revealed that, agricultural research in Ethiopia is still predominantly funded by the government (77 percent) and total public agricultural research expenditure had increased by 57 percent from birr 0.8 billion in 2015 to birr 1.8 billion in 2020. The total expenditure by EIAR constitutes about 46 and 52 percent of the total agricultural research expenditure in Ethiopia in 2015 and 2020, respectively. Agricultural research intensity ratio dropped below 0.3 percent which is below the investment target of 1 percent or more of agriculture GDP into agricultural research. This intensity gap is related to accelerated growth of AgGDP in Ethiopia, rather than to a slowdown in research investment. To have met this lower target in 2019, Ethiopia would need to have invested birr 6.5 billion or an additional birr 4.93 billion (current prices). Volatility analysis conducted on the agricultural research spending over the period 2015-2020 revealed some degree of volatility in research spending from one year to the other with a volatility coefficient of 0.08 which signifies low volatility. The drastic decline in investment and delay in disbursement were the major challenges confronting the EIAR. Increasing government investment in agricultural and changing the budget calendar, are recommended to address this investment challenge.

Keywords: Public Investment, Agricultural Research, Research Spending, Trend, Policy, Ethiopia

1. Introduction

The global population is expected to reach 8.5 billion by 2030, 9.7 billion by 2050 and 10.4 billion by 2100 [11]. The majorities of the world's poor (75%) live in rural areas and most are involved in agriculture. In the 21st century, agriculture remains fundamental to economic growth, poverty alleviation, and environmental sustainability. In order to feed the growing population of the world, food production will need to increase 60%-70% [1].

To meet the increased food demand of the people, it is must to increase agricultural productivity through investing in public agricultural research and in public extension delivery [8, 12-14]. Science and technology are the most important motivators for a country to improve and strengthen its national economy and global competitiveness. Agricultural research has been shown to be one of the most effective forms of public investment [4, 5, 7]. It is widely agreed that increased productivity, arising from innovation and changes in technology, is the main contributor to economic growth in agriculture. However, the rate of growth in agricultural research and development (R&D) investment has been declining globally while a large number of developing countries have experienced negative growth rates over the past decade [15-17].

The national agricultural investment plans for the period 2010–2015 reveals that a large number of Sub Saharan African countries allocated less than 5 percent of their agricultural budget specifically to research and stagnating investment in Sub-Saharan Africa agricultural research is worrisome [2, 9].

Public investment in agricultural research has resulted in large economic benefits with annual rates of return between 20 and 60 percent [6]. These returns include benefits not only to the farm sector but also to the food industry and consumers in the form of more abundant commodities at lower prices.

In sub-Saharan Africa, seven countries have reached or

exceeded the Maputo target of expenditure on agriculture of 10 percent of the budget [3]. However, in Ethiopia public funding for agriculture has not increased in real terms since the 2008's. In 2020, only about 3.2 percent of federal budget allocated for agriculture (15.3 billion ETB). For the same year investment for research and development were less than 6 percent of the federal agriculture budget (0.9 billion ETB). The existing evidence on the public investment in Ethiopia is not strong and is only limited to a specific areas and mixed in with donor support thus inconclusive, and need to be better understood in different sceneries.

2. Objectives

2.1. General Objective

The overall objective of this research is to identify public agricultural expenditure and investments in Ethiopia from 2015-2020.

2.2. Specific Objectives

1. To obtain a clear understanding of current levels of public investment in agricultural research.
2. To develop a comprehensive understanding of the factors that act as barriers to increased public agricultural research investment.
3. To identify and propose policy measures or initiatives that will assist in increasing the level of public agricultural research investment in Ethiopia.

3. Materials and Methods

3.1. Data

Data from Agricultural Science & Technology Indicator (ASTI), investment datasets from Ethiopian Institute of Agricultural Research (EIAR) and seven Regional Agricultural Research Institutes (RARI's), GDP data, Inflation data, as well as data derived from primary surveys was used to provide a wider context for agricultural R&D investment trends over time. Key informant interview and FGD in eight sampled federal agricultural research centers in Ethiopia were conducted to highlight constraints of agriculture research investment.

3.2. Method of Data Analysis

The data was analyzed using descriptive statistics. Agricultural research intensity ratio (ARI) which is a measure of total agricultural R&D spending as a percentage of agriculture output (AgGDP) was calculated. International organizations, such as the United Nations, have set minimum agricultural R&D investment targets of at least 1 percent of AgGDP. Volatility coefficient which is a measure of inflow of funding over the period to support agricultural R&D activities was used. To quantify funding volatility, the standard deviation formula to average yearly logarithmic growth of agricultural research spending over time was applied [10]. Accordingly, volatility coefficients ranged as very high (>0.3), high (0.2–0.3), moderate (0.1–0.2), low (<0.1). Percentages, average, maximum and minimum ranges were also used in the study.

4. Result and Discussion

4.1. Agricultural Research Investment Patterns

Results of the study indicated that, agricultural research is still predominantly funded by the government. Government accounted for 77 percent of public agricultural research expenditures in 2020. The total government expenditure for agriculture research has increased from birr 0.8 billion in 2015 to birr 1.8 billion in 2020, growing by 56.5 percent at an average rate of 15.1 percent per annum (Figure 1). However, growth in the national public funding in real terms was comparatively slow because inflation increased from 5.8 percent to 15.8 percent between 2015 and 2020.

Agricultural research investments for EIAR (excluding the RARI's) grew substantially from birr 0.4 billion to birr 0.9 billion during 2015-2020 at an average rate of 16.8 percent per annum. As of 2020, EIAR and the RARIs accounted for 52 and 48 percent, respectively, of the total invested agricultural research budget in the country.

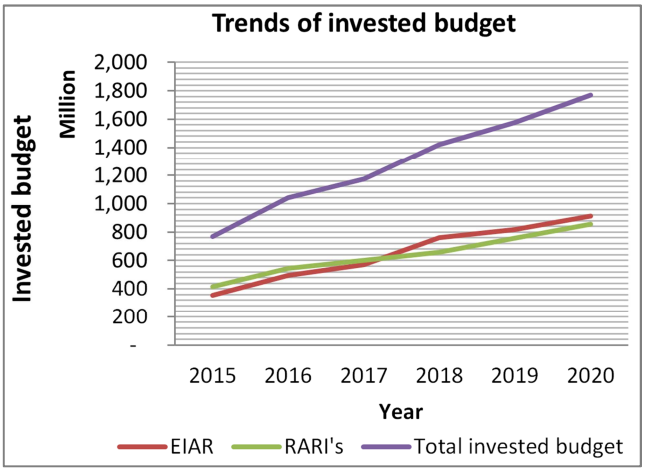

Figure 1. *Trends of invested budget, 2015-2020.*

In Ethiopia, research institutes generate substantial amounts of funding internally by selling goods and services which are primarily outputs of the research activities. However, the proceeds of such sales are channeled back to the national treasury, discouraging the institute from pursuing this revenue stream. Internally generated funds have increased in recent years but still represent a small share (0.9 percent) of total agricultural research funding (2020). Off this generated budget only 22.5 percent of it back to the institute as part of the allocated annual budget.

4.2. Trends in the Agricultural Research Investment Intensity

Agricultural research intensity ratio which is a measure of

total agricultural research spending as a percentage of agriculture output (AgGDP) was calculated (Table 1).

Table 1. *Agricultural research investment intensity trends, 2015-2019.*

Year	EIAR	RARI	Total (Ethiopia)
2015	0.09	0.05	0.14
2016	0.10	0.08	0.18
2017	0.13	0.07	0.20
2018	0.13	0.10	0.23
2019	0.13	0.11	0.24

According to the African Union (AU), more than 1 percent of agricultural GDP should ideally be reinvested in agricultural research. But, between 2015 and 2019, the overall investment ratio dropped below 0.3 percent (Figure 2). This is below the investment target of 1 percent or more of agriculture GDP into agricultural research. Findings revealed that EIAR spent only 0.13 percent of AgGDP on research during 2017-19 with an average of 0.12 from 2015-2019.

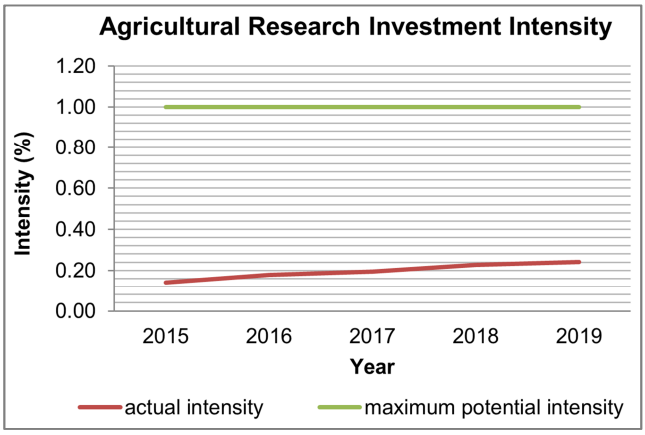

Figure 2. *Trends of research investment intensity, 2015-2019.*

This intensity gap is related to accelerated growth of AgGDP in Ethiopia, rather than to a slowdown in research investment. To meet this lower target in 2019, Ethiopia would need to have invested birr 6.5 billion or an additional birr 4.93 billion (both in current prices) (Figure 3).

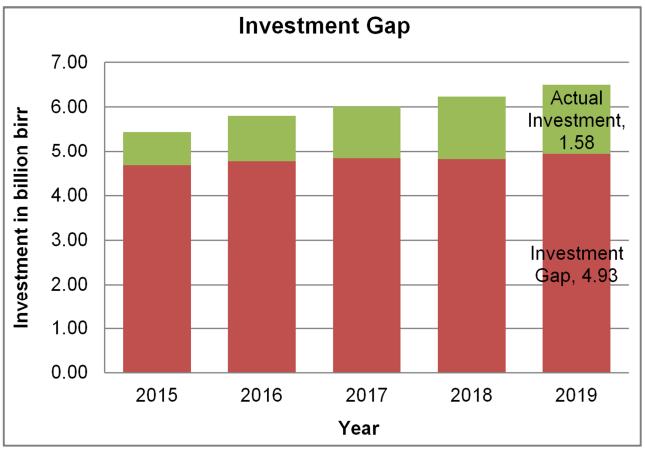

Figure 3. *Investment Gap, 2015-2019.*

4.3. Volatility of Agricultural Research Funding

Volatility analysis conducted on the agricultural research spending over the period 2015-2020 revealed some degree of volatility in research spending from one year to the other with a volatility coefficient of 0.08 which signifies low volatility. In EIAR the volatility coefficient reached 0.1 which signifies moderate volatility. This fluctuating pattern can be attributed to uneven investment over the period to support agricultural research activities.

4.4. Program Funding

The allocation of public expenditures across programs in the institute has been relatively constant (Table 2). As shown in the table, the two major programs which receive the largest share of the budget from the public funding to the institute are crop and livestock research. Natural resource management research receives the third largest share of research fund. The three programs together make up 41.8 percent of the overall expenditures of the institute in 2020. The budget of agricultural biotechnology and plant protection research program were significantly increased in 2020 than 2015. Areas with less funding include agricultural engineering, and agricultural extension.

Table 2. *Functional composition of agricultural expenditure, 2015 and 2020.*

Program	Invested Budget (2015)	Invested Budget (2020)	% change
Crop research	24.3%	19.7%	-4.6%
Livestock research	14.4%	11.5%	-2.9%
Natural resource management research	12.2%	10.6%	-1.6%
Plant protection research	4.9%	5.4%	0.5%
Agricultural biotechnology research	2.8%	5.3%	2.5%
Agricultural mechanization research	1.7%	1.8%	0.1%
Technology multiplication research	8.3%	7.0%	-1.3%
Agricultural extension research	2.3%	3.2%	0.9%
Infrastructure development	4.1%	8.2%	4.1%
Administration	15.5%	17.3%	1.8%
Others	9.5%	10.0%	0.5%
Total	100.0%	100.0%	-

Funding from government decreased with an impressive growth rate of 5.5 percent for applied agricultural research

and 1.3 percent for technology multiplication during 2015-2020, which is a serious concern in view of increasingly capital intensive nature of agricultural R&D such as upgrading laboratories and equipment. However, the overall government expenditure on technology demonstration, infrastructure development (buildings and construction), and administration increased with growth rate of 0.9 percent, 4.1 percent and 1.8 percent, respectively in the same period.

4.5. Agricultural Research Expenditure by Cost Category

The expenditure for EIAR by cost category follows similar pattern to that of the total agricultural research expenditure. On average, the cost of personnel service accounted for 49.5 percent of the total agricultural research expenditure, while goods and service cost, travelling & official entertainment service cost, construction investment, fixed assets investment, maintenance & repair cost, training cost, contracted service cost and other payments (contributions and subsidies) accounted for 17.8 percent, 8.8 percent, 5.8 percent, 5.1 percent, 4.8 percent, 4.7 percent, 3.4 percent and 0.1 percent, respectively.

The study showed a drastic decline in goods and services from 21.1 percent in 2015 to 14.6 percent in 2020, fixed assets investments from 5.1 percent to 2.1 percent and travelling & official entertainment service from 11.3 percent to 7.7 percent in the same period. Because of a drastic decline in fixed assets investment there is limited research infrastructural development. In contrary, there was a drastic growth in personnel service and construction investment from 45.9 percent in 2009 to 55.7 percent in 2020 and from 4.3 percent to 8.3 percent respectively (Figure 4). One of the reasons for growth in personnel cost is the increasing need for farm labor and the labor intensive nature of the research activities.

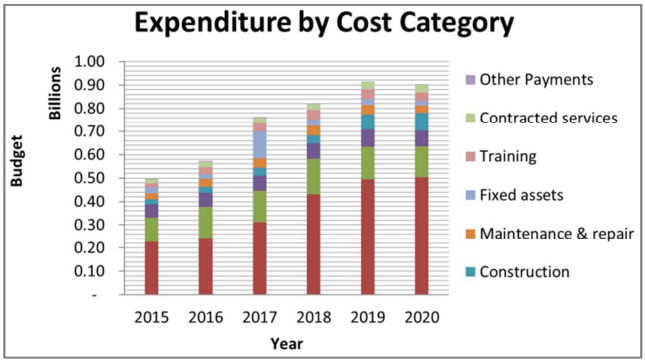

Figure 4. *Agricultural Research Expenditure by Cost Category, 2015-2020.*

5. Major Challenges

5.1. Under Investment

Research takes a long time to affect production (time between the research stage of a new technology and the point at which that technology is adopted and begins to affect productivity). Public research undertaken today will begin to noticeably influence agricultural research productivity in the future. The time lag between investment in research and its observable impact on productivity makes the benefits of investment difficult to measure in the short-term. This long research lags has slowed the long-term benefits generated by agricultural research in the mind of decision makers. This results in substantial reduction of the agricultural research investment by the government officials.

5.2. Delay in Disbursement of Approved Budget

Delays in the release of budget funds were partly due to delays in revenue accruals to the government treasury, to nonfunctioning bureaucracy at the level of the Ministry of Finance and partly due to political instability.

Ethiopian Fiscal Year (EFY) begins from July 8-July 7. There is typically a two-month time lag between budget approvals and the first disbursement of funds, which is a key period for many agricultural operations because it is the rainy season. The funding gap complicates operations and has a significant effect on the implementation of activities and the efficient management of expenditures in the year.

5.3. Too Many Account Codes

In the government accounting system, the coding system starts from budgeting. The account codes shall be used for the detailed budget purpose. Expenditure codes shall be assigned to each item in the budget based on the chart of account and that code must be used in keeping the accounting records to ensure comparison of budget with actual spending. These codes were not established under major categories and obliged to allocate the budget for more than 40 cost categories. These makes the budget utilization and reporting more complicated.

5.4. Reduced Capital Budget

There is drastic decline in capital investment in the institute as compared to the increasing number of new research centers and huge capital investment need for the renovation of research infrastructure in old research centers. Consequently, development, maintenance, rehabilitation and operation of infrastructure such as laboratories, offices and equipment for research and development have become a major challenge confronting the institutes.

6. Conclusions and Recommendations

The investment decisions that governments make today will affect agricultural productivity for decades to come. The government support to agricultural research has stagnated or declined in Ethiopia when measured in inflation adjusted terms. As a result, agricultural research investment was too low to support future needs. In Ethiopia, the trend in expenditure (investment) showed a non-difference between the approved and disbursed budget. However, time of disbursement fallen behind earlier scheduled plan. Therefore, government needs to address underinvestment in agricultural research, ensure timely disbursement of approved budgets

and revise the existing budget calendar.

Conflicts of Interest

The authors declare no competing interests.

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