

FINAL DRAFT REPORT

ON

THE STRUCTURE, MAGNITUDE AND TRENDS
OF
CAPITAL FORMATION IN AND FOR AGRICULTURE
IN ETHIOPIA

Submitted
to
Syed Saifullah
Policy and Program Support Division (TCS) of FAO
A study under the framework of project “GCP/GLO/267/JPN

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1. INTRODUCTION

This report is the outcome of the study undertaken in accordance with the Terms of Reference (TOR) of the Policy and Program Support Division (TCS) of FAO under the framework of project “GCP/GLO/267/JPN to study appropriate policy measures to increase investments in agriculture and to stimulate food production. The study's main objective was investigating the structure, magnitude and trends of capital formation in and for agriculture and the factors determining capital formation in and for agriculture. The specific objectives included:

- a) Providing overview of the agricultural development and food security in the past three decades.
- b) Develop analytical framework to examine agricultural capital formation and its impacts on agricultural production and productivity.
- c) Examine stocks, trends and shift in composition of agricultural investments (public and private)
- d) Examine capital formation and its determinants of major private and public investments at aggregate level.
- e) Examine capital formation and its determinants at farm level;
- f) Analyze alternative business models for promoting investment in agriculture and policy recommendations for stimulating sustainable food production in the country.

The report highlights the reviewed literature in relation to Ethiopian agricultural capital formation and briefly discusses the theoretical framework and data collection strategy. The main body of the report is a presentation of the compiled data on: the structure, magnitude and trend of capital formation of the country's agriculture at national and regional levels, in public sector, private business sector and household level. In addition incorporates the outstanding hypotheses of the determinants of capital formation in agriculture.

2. THE LITERATURE ON AGRICULTURAL CAPITAL FORMATION IN ETHIOPIA

The literature in the past ten years on Ethiopian agriculture largely focused on the state of smallholder agriculture and its constraints. The state of agriculture in Ethiopia is depicted as that using backward technology, low productivity and a low output activity that heavily relies on nature where drought and natural calamities frequently render the agricultural populace heavily food insecure. As the experience of degradation of the natural resource base and its impact on rural livelihood has continued, studies aiming at advising policies have generally focused on addressing the problem of low productivity and natural resource degradation. Under this state of affairs the problem of smallholder agriculture in Ethiopia is seen mainly as a natural resource conservation and productivity enhancement issue. The technical solution to do away with low productivity has largely been taken as diffusion of fertilizer and improved seed technologies.

Studies on "Technological Progress in Ethiopian Agriculture" (Mulat et al 2003 ED) are reflections of this general focus where most of the studies are about: adoption and dissemination of agricultural technologies, efficiency and profitability of new technologies, rural finance and input marketing. The technologies and inputs are almost entirely fertilizers, chemicals and improved seeds.

The official Ethiopian government agricultural development strategy seems to have been founded on the premise that the low productivity of the smallholder agriculture is the main problem of the agricultural sector and the envisaged solution as enhancing the productivity with increased use of fertilizers, chemicals and improved seeds or intensifying the small holder agriculture. The strategy has evolved to commercialization of small holder agriculture (EEA 2004/5) with the application of extension services to fast diffuse modern technology across smallholders. Slow adoption pace of

modern inputs(fertilizers, chemicals and seeds) has induced off late a strategy of leasing vast expanse of land to foreign investors who would come with scientific farming techniques and change the food self insufficiency situation. This shift seems to be the acceptance, in practice, of the conceptually neglected need for fixed capital formation in agriculture to increase productivity.

Agriculture remained a pathetically capital starved sector for long while almost all policy oriented literature was confined in the narrow limits of advancing smallholder agriculture with more use of fertilizers and seeds alone. Agricultural researches and the literature has ignored or downplayed the role of capital in land preparation, soil moisture, harvest and post harvest technologies with the general emphasis on labor intensive smallholder agriculture.

A policy dialogue brief under the title "Pathways for Ethiopian Agriculture: Options and Scenarios"(Gebreselassie, S. et al, undated) identifies four possible pathways for Ethiopian agriculture among which policy makers and analysts vacillate: Intensification of smallholder agriculture, Livelihood diversification to secondary sources of income and urbanization, Commercialization of agriculture with accumulation of land or consolidation of small plots into larger commercial farms, 'Depopulation' with voluntary resettlement. While the literature on ways and means of intensifying smallholder agriculture dominates the other options have been less articulated. In connection with this dominance in orientation the structure of capital formation in agriculture and the determinants of capital formation in Ethiopian context have been treated tangentially. Very brief mention is made to capital formation in agriculture in most extensive analyses such as Reports on Ethiopian Economy (EEA, 2004/5, Vol IV) that is particularly dedicated to the review and analysis of state of agriculture in Ethiopia.

The EEA (2004/5) report on the Ethiopian economy entitled "Transformation of the Ethiopian Agriculture: Potentials, Constraints and suggested Intervention Measures" is a very comprehensive analysis albeit with concise allusion of the capital formation aspect of agriculture. It highlights the predominance of century-old farm tools and implements for major activities of land preparation, sowing, harvesting and post harvest crop handling as well as in livestock farming, despite efforts to improve them in research and extension programs. It further acknowledges that this drawback is among the main factors that hinder the rise in agricultural productivity. The report's assessment of the performance of peri-urban and urban agriculture indicates that the urban and peri-urban

agriculture shows more productivity as they are more capital intensive. The report further highlights the state and trend of government capital expenditure on agriculture, natural resources and settlement between 1965 and 2003 and the trend of the share of agriculture in government capital expenditure budget. While the capital expenditure on agriculture and natural resources has slowly increased in absolute terms for most of the period, with a sharp rise at the end of the period, the percentage share has declined after mid seventies. Public expenditure for agricultural research has been rising with a focus mainly on examining the adoption of technologies and highlights that most of them were of little impact on agriculture. Among the agricultural research outputs in Ethiopia in developing, testing and releasing technologies, the report states that research outputs on crop varieties take the highest number while farm implements and soil/water conservation techniques were roughly one tenth in number. Although the report provides important information on capital formation in agriculture it still treats capital formation in agriculture as a side issue in the report not conferring the focus and emphasis it deserves.

Smallholder agriculture, or not, Ethiopian agriculture has to be transformed from the current state of low productivity and high dependence on nature to a state of more productivity and output to ensure national food self sufficiency and individual food security. The success in bringing about substantial changes in productivity of Ethiopian agriculture, be it land or labor productivity, is closely linked to the depth and rate of capital formation in and for agriculture. Success in transforming agriculture hinges on availing adequate capital for agricultural labor and land to work with. Studying the extent of capital formation, the structure of capital formation, and the determinants of agricultural capital formation are relevant research issues on their own right.

The significance of capital formation in and for agriculture to increase output and productivity (as in any industry) has to be emphasized and the particular factors and the mechanisms of inducing and influencing capital formation (investment) in Ethiopian economy have to be investigated. The stagnancy in productivity demands well informed policy intervention. The data pertaining to capital formation in and for agriculture have to be systematically organized and analyzed to inform policy. Existing data on agricultural investment require retrieval and reorganization to directly address capital formation in and for agriculture as a central issue. The issue seems to have suffered tangential treatment as it has, in many cases, been treated as a secondary factor behind other concerns.

3. THE CONCEPTUAL FRAMEWORK

3.1 The concepts of capital and capital formation

In his account of the historical evolution of the concept, Bohem Bawerk(1888) states that capital originally meant "an interest-bearing sum of money" and later in the physiocratic period it meant accumulated goods since all other kind of goods represent money. In classical thinking, since some accumulated goods that are used for immediate consumption do not give off some kind of income, only those goods destined to bring income to their owners were named capital. The definition of capital as a group of 'products that serve towards production' or as groups of 'produced means of production', falls under this conception. The classical definition excludes not only products that serve for immediate satisfaction of wants but also land since it is not a produced item. Still others have defined capital as a source of income that includes every durable foundation of utility having exchange value. Thus this conception incorporates land, furniture, houses even if they are personally used by the owner. The other variations of the definition of capital identified by Bohem Bawerk are, in short, capital as economic good of higher rank , capital as that which lightens the toil of acquisition or productive labor (capital as tools of production only), capital that enables the laborer to await the result of any long lasting work, capital as 'instruments for the exploitation and enslaving of the laborer', capital as available stock of goods (whether for consumption, acquisition, or production) which may be applied to satisfying wants in the future'.

With emphasis on the need for the settlement of the confusion over the definition of capital, as it is difficult for economics to call different things by the same name, Bohem Bawerk(1888) chose what

he considered the most appropriate definition as "A group of products which serve as means to the acquisition of goods".

In current economics literature, we encounter narrower and broader definitions of capital, reflecting the historical conceptual variations and the practical difficulties in holding economic statistics. In contrast to the narrower definition of capital as physical-produced items that are used in the production process and providing income generating service, we have an extended concept of capital with a broader definition that includes stocks of physical-produced items, knowledge and skills (human capital) and stocks of natural and environmental assets (natural capital).

The widely applied literature that provides conceptual and accounting framework on capital and capital formation is the System of National Accounts (SNA) of the United Nations. The SNA is an internationally agreed standard for accounting economic activities based on economic principles and as such provides guidance for national accounts. This evolving standard since 1953, with major updates in 1968, 1993 and 2008, frames the concept of capital in the concept of economic asset, which is a store of value for the owner who holds or uses the entity over a period of time. In this system of accounts the coverage of asset extends only to those assets subject to ownership rights from which economic benefits flow. As such it excludes from the category of asset consumer durables, human capital and natural resources that are not capable of bringing economic benefits to their owners (UNSNA, 2008).

The framework classifies assets into financial assets, which are necessarily and primarily stores of value, and non financial assets, which are produced and non produced assets serving primarily in economic activities but at the same time serving as a store of value. Produced non financial assets are outputs of the production activities while non produced assets are those who came to existence in ways different from production. The produced assets that are the entries of the capital account of the SNA, incorporate fixed assets, inventories and valuables. Human capital is excluded from produced assets category on the grounds that education and skill are acquired through learning, studying and practicing, which are not processes of production. Whenever training is given by an employer to enhance the effectiveness of staff, the costs are treated as intermediate consumption rather than capital. If users of SNA do not get it satisfactory to exclude human capital they can record it in a satellite account.

The capital account is one of the four accounts dedicated to recording changes in the value of non financial assets, whereby the conceptual category capital is given meaning in actual assets entries that exclude financial assets. Financial assets are outside the category of capital. **Capital** means non financial produced and non produced assets. It entirely excludes financial assets.

Produced assets are composed of fixed assets, which are "produced assets that are used repeatedly or continuously in production processes for more than one year", inventories, which are "produced assets that consist of goods and services which came into existence in the current period or in an earlier period and that are held for sale, use in production or other uses at a later date", and valuables, which are " produced goods of considerable value that are not used primarily for purposes of production or consumption but are held as stores of value over time" (UNSNA, 2008)

Non produced assets are the other category within capital that consists of natural resources; contracts, leases, licenses, purchased goodwill, marketing assets and costs associated with transfers of the non produced assets. Natural resources include land, water resources, uncultivated forests, deposits of minerals having economic values. Only those natural resources that do not bring in economic benefits to the users are excluded from this category.

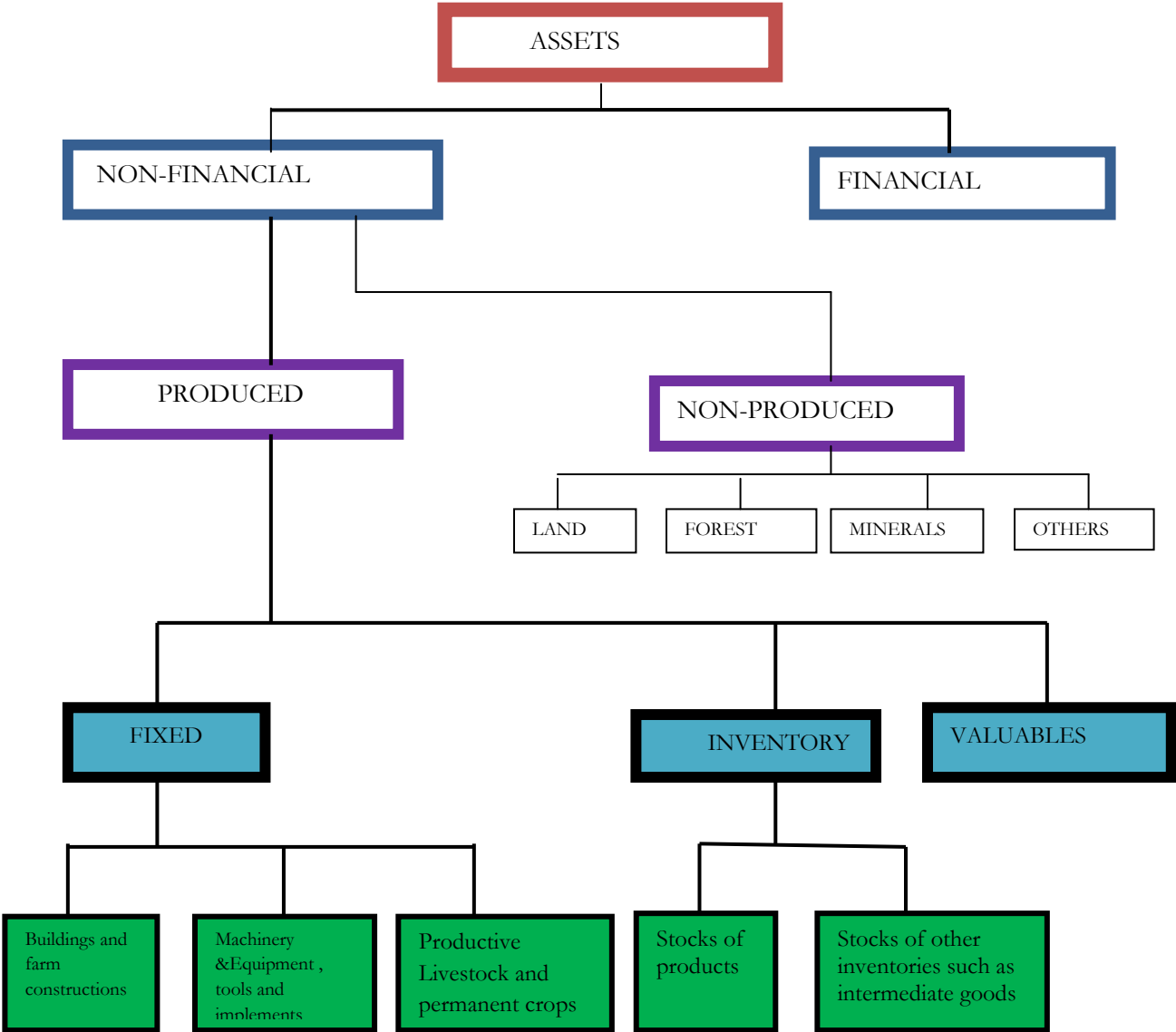
Capital formation is thus the acquisition of produced assets in the form of fixed capital, inventories, valuables and net acquisition of non produced assets. It is largely about changes in produced assets as they are the ones the stock of which can be increased through economic activities. Fixed capital declines during the course of the accounting period as a result of physical deterioration, normal obsolescence or normal accidental damage and this appears as a negative capital formation. The institutional units of analysis of capital formation are those who own the capital, i.e., public, private business and households

Our study basically takes the concept of capital formation of SNA and includes human capital in it with a belief that human capital formation is an important variable in the transformation of traditional agriculture in Ethiopia.

In this study the assets taken in to account for compilation of agricultural capital formation are produced assets created by construction activities for agricultural use, additions on agricultural

machinery & equipment stock and change in agricultural inventories. Additional acquisition of valuables even if the acquisition is by farm households or by farmers, are not included in the compilation as they are not actual investments in agriculture. Acquisitions, loses and costs associated with transfers of non-produced agricultural assets, if available, are not excluded. They are captured where ever possible either as capital formation **in** agriculture or capital formation **for** agriculture.

Fig 1 : The structure of assets and Capital



Source: adaptation from the Indian Final report and concepts in UNSNA2008

3.2 Capital Formation and Productivity

The phenomenon of persistent poverty and food insecurity is partially explained by insufficient food production due mainly to low productivity of agriculture. Low productivity of agriculture signifies low per unit output of factors of production in agriculture. The primary factors of production in agriculture are land and labor. Either low labor productivity or low land productivity or the combined effect of both is accountable for the low productivity of agriculture.

Agricultural products are outcomes of tamed natural processes that take place on land. Taming of the natural processes is accomplished with human labor. Land has to be worked with labor to generate agricultural output. Land and labor are indispensable primary factors in the absence of which agriculture does not exist. Land, as non produced asset, is fixed in supply. Labor is by its inherent nature variable. Labor force or labor time can change through population expansion or labor supply decisions of workers. Hence agriculture on aggregate level is an industry with a nature of combining fixed land with variable capital. This model of factor combination where land is fixed and labor is variable is a typical depiction of low productivity agriculture where economy-wide land size has a natural limit and agricultural labor force expands under the operation of forces of demographic transition. For the economy as a whole there is little scope to increase the expanse of agricultural land, particularly when concerns for the environment are streamlined with economic activities. Ever increasing population, taking refuge in agriculture, is a fact of life of under developed economies. As such the model of agriculture relevant to our analysis is characterized by fixed land and variable labor dictated by exogenous factors outside agriculture i.e., nature, socioeconomic and political processes of concern for the environment, and demographic factors.

Economic theory had it that a fixed tract of land combined with increased labor would produce increased output at a decreasing rate, as it is bound to face inescapable diminishing returns to labour. Land productivity increases at a decreasing rate as it is worked with more labor. Moreover, land

loses its fertility as soil nutrients get extracted in repeated farming. Hence a model of fixed land with increasing labor and declining fertility loss through time approximates the reality, unless a compensating mechanism is envisaged to have been put in place in the form of land improvement and fertilizing. Underdeveloped agriculture is characterized by low level of use of compensating mechanisms to offset fertility loss. The set of compensating mechanisms is part of a broader concept called land augmenting technology (Todaro 2003), which in other words is the application of a certain form of capital that enhances the productivity of land. That certain form of capital embodies newer methods of doing things (newer technologies).

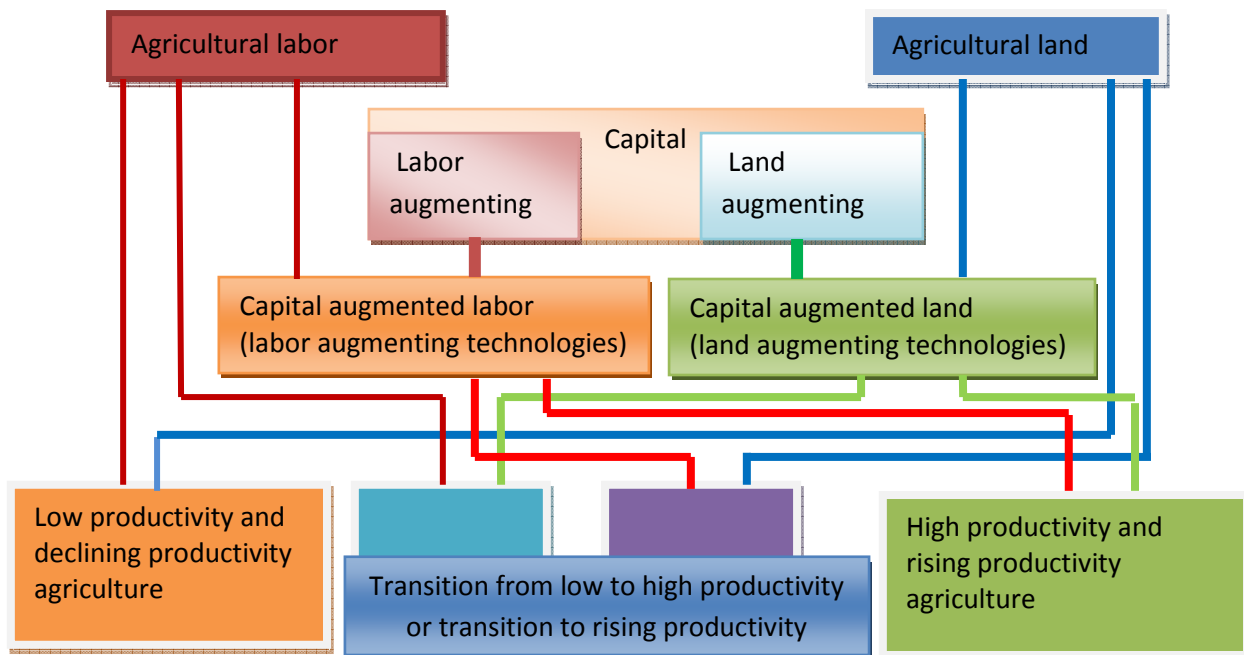
Raw agricultural labor is human exertion of energy to do useful work. The extent of this exertion per worker has natural limits. The natural limit of raw human labor can be exceeded if tools and implements with mechanical advantage are applied. Agricultural labor is not an application of physical force alone. Knowledge and skill guide the application of human physical force, assisted by tools and implements, in working the land and in dealing with natural forces. The tools, implements, skill and knowledge are factors of production known as capital, enhancing the productivity of labor or labor augmenting. The theoretical literature distinguishes between capital and technology as distinctly different factors. The empirical difficulty in separating technology and capital, coupled with the understanding of the ultimate rationale for the use of technology, fused with capital, as that of multiplying labor, makes it unnecessary to expend effort in distinguishing capital and technology. Hence the use of capital fused with a certain method may be conceptualized as labor augmenting capital in the same way that we have land augmenting capital.

In under developed agriculture modern skill, knowledge, tools and implements appear in rudimentary forms. Agricultural labor that suffers from inadequate modern skill, knowledge, tools and implements is low productivity agriculture. Thus, as the work force in agriculture expands and the skill, knowledge, tools and implements remain in rudimentary form, output per worker (agricultural labor productivity) declines as a combined effect of the two factors, i.e, growing number of farm workers and inadequate capital to work with.

The possible combinations of raw labor, land, capital augmented labor and capital augmented land provide a range of productivity possibilities, where the lowest level productivity(traditional agriculture) arises from the combination of raw labor and land while the highest productivity (

modern developed agriculture) is the one that results from the combination of capital augmented labor and capital augmented land(see Fig 2)

Fig 2 : Productivity and Combinations of land and labor with and without capital



In circumstances that prevail in underdeveloped agriculture, where declining fertility of soil is not compensated by investments on land improvement, fertilizers and chemicals, and the expanding labor force is not equipped with modern skill, knowledge, tools and implements, both labor and land productivities are bound to decline. Productivity of labor declines as more households with low labor augmenting capital become dependent on agriculture as their mainstay. Combining increased dose of labor inputs with fixed tract of land would inevitably face diminishing returns to labour. Though diminishing returns alone do not mean declining productivity, soil moisture and fertility loses due to environmental degradation and depletion of nutrients in repeated farming result in decline of productivity. Farm land depreciates and land productivity declines with more exploitation of land and the environment without application of land augmenting capital. Traditional agriculture uses raw human labor combined with traditional wisdom and rudimentary forms of capital where

draught animals, unsophisticated farm implements and tools dominate. Traditional agriculture under population pressure is a case of increasing variable factor (labor) with weak augmentation and declining (rather than fixed) complementary factor (soil or land and other natural assets) without augmentation. Productivity loss is accentuated by both increasing raw labor and declining soil fertility and environmental quality.

Productivity loss from increasing raw labor and declining land fertility and environmental quality can be reversed by introducing modern skill to the farm labor (formation of human capital in agriculture), introducing labor augmenting technologies compatible to the skill level of labor (investment in physical capital in agriculture), and introducing land augmenting technologies and improvement in the quality of natural assets (physical capital formation in and for agriculture). Such inputs will offset the effects of diminishing returns and effects of depreciation of land and natural assets. Hence accelerated capital formation in agriculture is the proximate remedy to reverse the process of declining labor and land productivity.

Agriculture requires increased capital formation from within and without, i.e., investment in and for agriculture. It would be helpful to conceptually differentiate capital formation in agriculture as distinct from capital formation for agriculture. The significance of capital formation in agriculture for growth is evident from the fact that investment on machinery and equipment enables the farm worker to work with increased land and others forms of capital like livestock. The investment in machinery and equipment augments labor and render it more productive by offsetting the effects of diminishing returns. If land and some other inputs are fixed, investment in land augmenting inputs counters the effects of land depreciation and diminishing returns by raising the yield higher. The importance of capital formation for agriculture is realized when investment in service and industrial sectors (such as investment in education, transport, manufacturing facilities for fertilizers and pesticides) enhance productivity of agricultural activities. In a nut shell, this means investment in other sectors of the economy (outside agricultural and allied activities) is to varying extent agricultural investments as well.

3.3 The accounting framework and valuation

The sources of capital formation are saving and capital transfers or simply changes in net worth due to saving and capital transfers. The net worth finding expression in capital formation should in principle be balanced. The components of the actually formed capital are gross capital formation less consumption of fixed capital, changes in inventories, acquisitions less disposal of valuables, and acquisitions less disposals of non-produced assets. The balancing entry between sources and actual formation of capital is net lending/ borrowing. Other changes in the volume of assets could occur as a result of forces unrelated to production such as war, natural disasters and also as a result of revaluation. They may be included if the data allows.

Table 1

Gross fixed capital formation- Consumption of fixed capital	Saving
Changes in inventories	
Acquisitions less disposals of valuables	
Acquisitions less disposals of non-produced assets	
	Capital transfers, receivable (+)
	Capital transfers payable (-)
	<i>Changes in net worth due to saving and capital transfers</i>
Net lending (+) / net borrowing (-)	

The capital account to be used in this study will follow the same format as the in SNA (Tab 1) with adaptation to suit agricultural capital formation. The adaptation necessitates a deliberate exclusion of valuables and restricting fixed capital formation, inventories and acquisition of non produced assets to agricultural assets only.

Gross fixed capital formation in agriculture by type of asset incorporates, buildings other than dwellings, land improvements, machinery and equipment, transport equipment in agricultural use, cultivated biological resources (animal resources yielding repeat products, tree, crop and plant resources yielding repeat products), costs of ownership transfer on non-produced assets (intellectual property products, Research and development).

Changes in inventories include net changes in unconsumed output from agricultural production and changes in inputs.

Measurement of capital formation involves valuation. Changes in stock will have to be multiplied by the respective unit prices or the value of the added capital assets have to be summed together to get the total value of capital formed. There are a number of ways capital is measured: historic cost (acquisition cost) method, current replacement cost method, current sale value, average market value, business value, capitalized value (returns method) value for insurance purposes or for tax purposes, purchasing power parity value. Appropriate valuation method will have to be selected on the basis of the capital asset under valuation. If the capital formed has a market value that will be taken as first choice. Capitalized value and historic cost methods are the next appropriate valuation methods that will be employed.

In addition to compilation of capital formation and stocks of capital by fixed capital, and inventories the structure of capital formation and stock of capital by asset type will further be disaggregated for institutions as the data allows.

4. AGGREGATE LEVEL CAPITAL FORMATION IN AGRICULTURE : METHOD AND RESULTS

In situations where direct national level census or sample survey panel data on capital formation in agriculture do not exist one has to resort to indirect methods of estimation using available data. The study devised three alternative methods to choose one that goes with the available data. Two of the methods collapsed into one while handling the data.

The first proposed alternative method of estimating agricultural capital formation essentially channels capital formation data along institutional lines, i.e., farm household, private businesses, and government. The necessary data required for the method to work were those leading to aggregate household capital formation, bank loan to actually implemented private agricultural businesses, and government capital expenditure in agriculture. While the data on government capital expenditure in agriculture and on household level capital formation in agriculture were available to a certain extent, bank loan for agricultural investment were not available in a useful form. Instead better and direct information on agricultural investment was obtained from licensing investment bureaus on private and foreign agricultural investments in the country for a period of more than seventeen years. The use of investment data from the licensing institution and the non availability of bank data brought this estimation method closer to the second method. Moreover, the nature of data on farm household capital formation led to the use of household saving as a proxy for the investment, the use of which was proposed in the second method.

In applying the second method most of the data on the variables were available, though not in a form directly usable. Data on implemented private investment (both domestic and foreign) that took license from government (Regional as well as Federal), and Public agricultural expenditure are available. Data on agricultural saving was not directly available and hence it had to be estimated from data on agricultural output, agricultural consumption and agricultural tax. Data on agricultural

consumption has limitations in that the household surveys of the Central statistical Agency(CSA) show only how much of the annual crop production is consumed, not including livestock products, and also the number of surveys that relate output with the proportion consumed are two. Estimation of the value of consumption out of crop production output is made, neglecting the livestock aspect, which makes the estimation not the best estimate but as an approximation to the actual from the lower side. Thus the aggregation from this model become one and the same with the first method compared with outcomes of other models.

Table 2 Initially Proposed Estimation methods 1 and 2

Alternative 1
$Agcf = \sum hhki + \sum Blk + \sum Agsub$
<i>where Agcf is agricultural gross capital formation</i>
<i>hhki is household level capital formation</i>
<i>(Blk is bank loan to) private and foreign investment actually implemented for capital formation in agriculture</i>
<i>Agsub is Public capital expenditure in agriculture</i>
Alternative 2
$Agcf = AgSav + AgSub + Capsft + Agfdi$ and $AgSav = AgGDP - AgCon - AgTax$
<i>where Agcf is agricultural gross capital formation,</i>
<i>AgSav is agricultural saving,</i>
<i>Agsub is government capital expenditure in agriculture,</i>
<i>Capsft is capital flowing to agriculture from non agriculture sectors (implemented domestic Private investment in agricultural),</i>
<i>Agfdi is foreign direct investment in agriculture</i>
<i>AgGDP is agricultural GDP</i>
<i>Ag Con is agricultural consumption (estimate of food and non food consumption of the agricultural, population expended from own production as percentage of consumption expenditure)</i>

The method formed from merging the two alternatives used private investment data, public investment data and farm household saving data. The data set obtained from licensing institutions required filtration and cleaning to isolate those actually transformed to implementation and operational status from pre implementation phase projects. The amount of capital of any project in the implementation phase and that in the operation phase is believed to have been spent on formation of fixed assets or inventories. A project under implementation and that just got transformed to operation phase has been hitherto engaged in forming the capital facility for future production. Although the data do not show for which categories of capital (fixed capital or inventories) the expenditure was allocated, the expenditure as a whole can be taken as an aggregated capital formation in agriculture. However it allowed the disaggregation into crop and livestock categories. As such the private business (foreign or domestic) agricultural investments on crop and livestock capital forms were broadly aggregated on regional, multiregional and national level.

The Federal and Regional governments have capital expenditure budget disaggregated in to various categories of which capital expenditure in agriculture is one. Data on public expenditure in agricultural capital formation was obtained from these accounts of national and regional states. Agricultural capital expenditure appears in various forms that demand some analytic effort to verify whether they are capital formation in/for agriculture or not. The guiding principle is asking what the end product of the expenditure in terms of formation of fixed assets, inventories or human capital is. Although human capital formation is not a proper item of capital in the System of National Accounts (SNA) framework, holding a separate account for it is permissible. Hence guided by the role of the stated 'capital expenditure' in the formation of fixed agricultural assets, inventories and agricultural skill and knowledge public investments were assessed for incorporation in "capital formation in or for agriculture". Whenever those public capital expenditures were expenditures directly on projects meant for enhancing agriculture which eventually leave behind fixed assets in the form of infrastructure, inventories and human capital in agriculture, they are taken in general as capital formation in agriculture, the value of which are the expenditures themselves. Here cost of acquisition or the historic costs are assumed as valuation methods of the capital formed. The values

thus obtained could be different from the actual market values as the historic costs or costs of acquisition under government bureaucracy may not be equal to competitive market values. Those expenditures outside the agricultural sector but indirectly enhancing agricultural productivity are reserved in capital formation for agriculture.

Government capital expenditure appears as expenditures of federal government and regional governments. While it is certain that a regional government's expenditure is destined to that regional state, the whereabouts of the expenditure of the federal state cannot be traced from the data. Instead the data is organized following expenditure categories expressed in terms of subsectors in agriculture wherever they may be located. The additional merit of the public expenditure data on agricultural capital formation disaggregated to subsector level is that a time series of more than ten years can be formed out of it.

Capital formation at the farm household level is assessed using data from Central Statistical Agency, collected on farm implements, livestock and crop utilization. Survey data on farm implements and livestock are cross sections taken at one particular time without any other repetition of the surveys. It requires imposing certain conditions of capital formation on households and aggregates of farm households to generate time series data. The study attempted to identify realistic conditions or behaviors of individuals and aggregate farm households that indicate possible investment path in livestock and farm implements. Thus it was found necessary to scrutinize the nature of farm implements in terms of their value, life span and rate of their replacement to find some sort of clue to characterize the path of investment and its correlates. The traditional farm implements used by households generally have long life span and have very low value. Households do not generally increase the stock of implements; rather replace them when they depreciate, through wear and tear, in the range of five to ten years period. This nature is indicative of the fact that annual investment in farm implements is not likely to be significantly high to alter the capital formation figure of farm households.

The available one-round (cross section) data on livestock necessitated similar assessment that led to prior conclusion that due to the traditional technology and the carrying capacity of the natural environment the stock of livestock was not increasing and the farm household capital formation

arising from stock change in livestock may be safely neglected. That means the dearth of data in this respect may not be alarming.

Computation of capital formation was done from crop use data through estimating the savings from annual crop output. In connection to estimating farm household saving, production and product utilization data were scrutinized. Regarding product utilization, data from two surveys are available, spanning about six years, which relatively makes it easier to form a time series assisted by some assumptions. The annual savings were computed from the two cross sections on the basis of an assumption of constant rate of change in the intervening six years between the two periods; i.e., the percentage difference in savings between the first round and the second round was equally distributed (interpolated) across the intervening years and extrapolated to the neighboring years, which means a constant annual growth rate was assumed.

The aim of all these efforts is to form a time series of gross capital formation on farm household level compatible with the other institutions. The report begins by describing and discussing capital formation in each institution before analyzing the aggregate capital formation on national level. Part of the mission of the study is compiling the data on capital formation in agriculture.

4.1 PUBLIC CAPITAL FORMATION IN AGRICULTURE

The broad category of public expenditure on agriculture include expenditure on: buildings, furniture, irrigation/ water harvesting infrastructure, rural road, veterinary facility and livestock development, agricultural research, crop and pest control, seed nursery and fruit development, and training. These expenditures are all elements of capital formation in agriculture categorized in agricultural capital expenditure in the government accounts. It was possible to get the data on the expenditure categories both for Regional and Federal governments for eleven years.

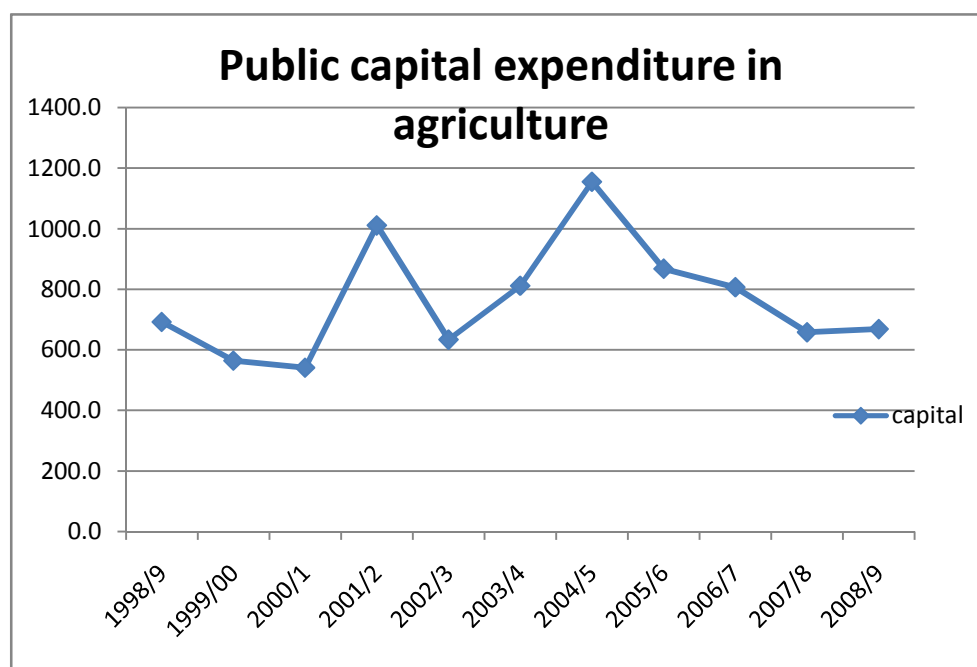
The expenditures in eleven years time are numerically and graphically depicted in Tables (3), (4) and graphs in fig (3) and (4). The figures are presented at constant prices using GDP deflator obtained from the IMF "Report for Selected Countries and Subjects" on Ethiopia in its World Development Outlook.

Table 3 Public Capital formation in agriculture at national level

Public expenditure categories	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
<i>agricultural research</i>	62.6	70.9	138.3	126.3	163.5	132.4	163.2	116.4	117.4	68.1	55.7
<i>buildings of offices ,FTC*, v. clinics**c)</i>	75.8	23.5	20.1	13.7	9.7	95.7	93.6	34.3	40.7	83.3	148.0
<i>crop, pest control</i>	82.5	74.1	49.0	47.7	23.7	8.0	2.6	17.7	2.0	2.3	2.9
<i>fertilizer sector</i>	378.0	284.2	177.1	544.6	22.2	0.0	0.0	0.0	0.0	0.0	0.0
<i>fixed asset(furniture, others)</i>	0.0	3.2	0.0	8.4	6.0	6.2	12.1	4.0	7.6	2.4	1.6
<i>Irrigation/ water harvesting</i>	36.1	63.1	83.0	131.0	93.3	182.5	537.1	517.5	520.8	430.3	406.5
<i>rural road</i>	0.0	0.0	0.0	0.0	11.5	8.9	4.2	0.6	0.0	0.0	0.0
<i>seed nursery/ fruit dev't ,coffee</i>	19.1	18.0	1.6	1.6	0.7	2.0	10.0	26.2	5.1	6.3	3.7
<i>training</i>	3.7	2.4	0.3	104.0	260.2	331.7	257.0	123.4	87.1	46.7	37.5
<i>veterinary , livestock, fish dev't</i>	34.2	24.6	71.5	33.9	42.5	44.3	75.5	27.7	26.1	18.3	12.4
Total	692.0	564.0	540.8	1011.1	633.4	811.7	1155.2	867.9	806.7	657.8	668.3

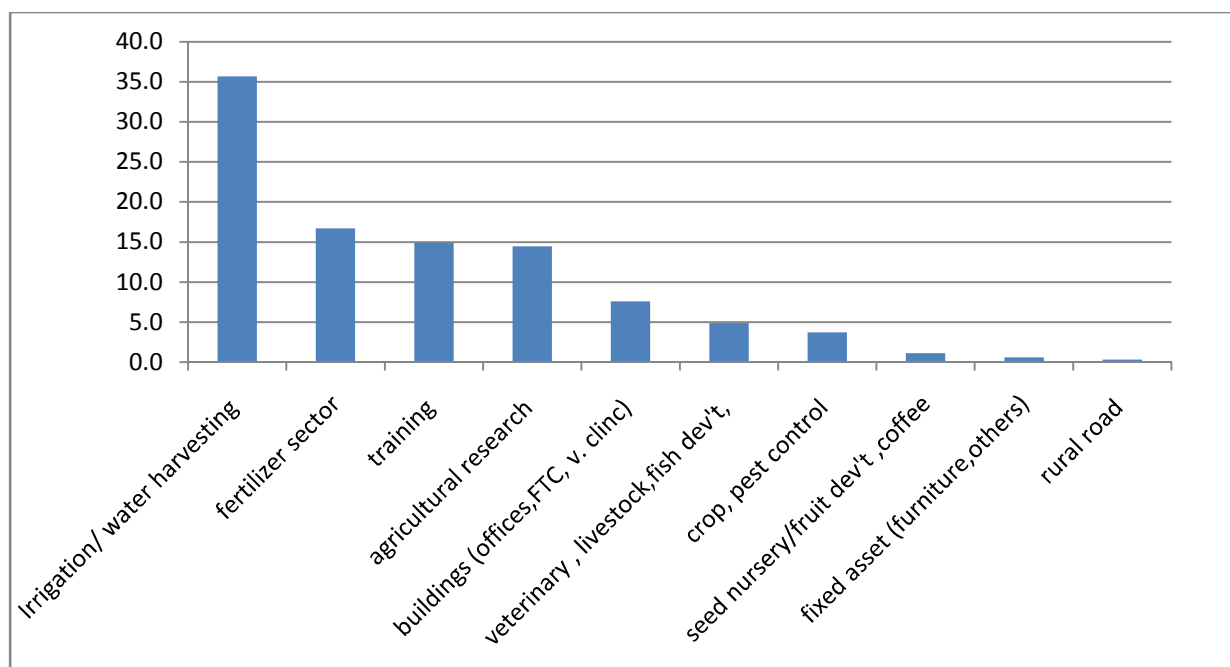
FTC* -Farmers training centers, V.clinic** -veterinary clinics

fig 3



Public capital expenditure in agriculture constitutes 16 % of the total public capital formation in the economy in the past eleven years. Public capital formation in agriculture was distributed unevenly in various sub sectors of agriculture. Ranking the mean expenditures in the past 11 years, for which data is available, indicate that the highest public investment has been taking place in the irrigation and water harvesting category. Fertilizer sector, training and agricultural research were remote followers. Public capital expenditure in agriculture in the past eleven years was growing at trend rate of 6.5 % with marked fluctuation.

Fig 4 Percentage share in total agricultural capital expenditure in eleven years period



In a period of the past eleven years the share of capital formation in irrigation and water harvesting stands as 35.7 percent of the total public agricultural capital formation while that for fertilizer sector, training and agricultural research were 16.7 percent, 14.9 percent and 14.4 percent each respectively. Expenditure on irrigation and water harvesting was growing slowly until 2003 and started to rise sharply in 2004, peaked in 2005 in real terms. This expenditure category represents the

public spending on small scale irrigation study, design, construction projects, integrated irrigation and hydropower projects, integrated irrigation and drainage projects, water pond construction, water pump and generators, well and water harvest projects etc. The growth in expenditure in this category reflects the emphasis on the need to reduce the dependence on rain fed agriculture, which subjects Ethiopian agricultural output to be erratic with changing climate variables.

Fig 5a

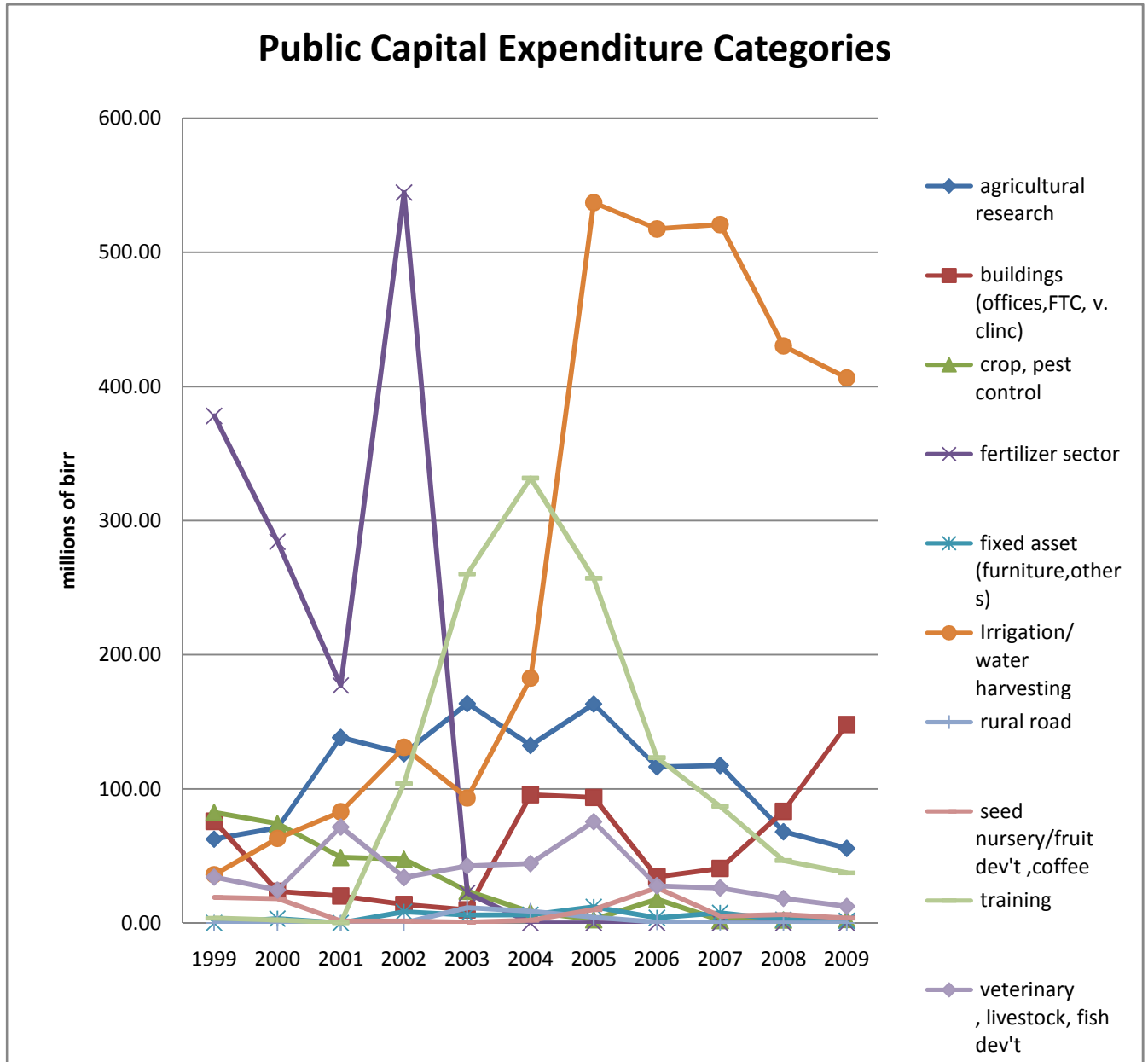
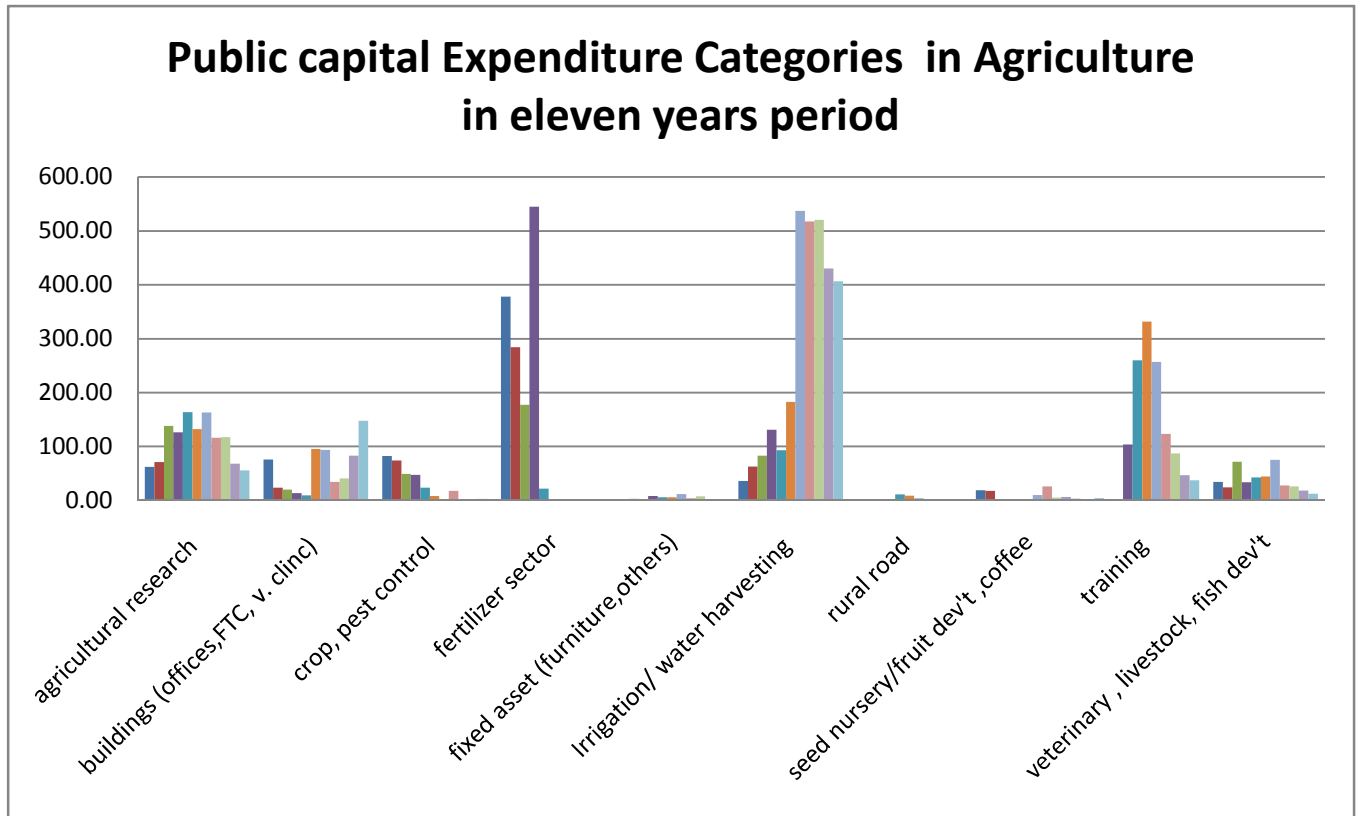


fig5b



Public expenditure on fertilizer sector was significantly high in the first half of the period and nil in the second half of the period invariably. The expenditure was a federal government subsidy to enhance agricultural productivity and seems to have phased out after few years trial.

Expenditure in training, include public spending on the establishment of facilities for agriculture, technique and vocational programs, human resource development and training for new development agents, water works technical training and capacity building program, and training of farmers' unions. This category reached high levels between 2002 and 2006 peaking in 2004. The level of expenditure in this category shows sharp decline after peaking in 2004.

Public expenditure on agricultural research exhibits low variability throughout the period. The category incorporates expenditures on researches on crop, animal power, forest resource, agricultural extension and technology transfer, agricultural mechanization, food science, forage seed production, crop protection, rural technology, post harvest technology, breeding etc.

The expenditure on building has been rising to create farmer training centers and development agent residences, veterinary clinics, soil laboratories, stores, rural technology and solar energy technology facilities, cattle breeding centers etc. under regional governments. The expenditure by the federal government is undertaken through a rubric of "Rural Capacity Building Project". The expenditure is on the rise of late.

The rest of each of the expenditure categories contributes less than five percent and with no significant trend of rising.

Table 5 Ranking of public expenditure categories by magnitude of annual mean birr in millions and percentage shares

Expenditure category	Mean annual expenditure in eleven years	percentage
Irrigation/ water harvesting	272.83	35.7
fertilizer sector	127.83	16.7
training	113.99	14.9
agricultural research	110.44	14.4
buildings (offices,FTC, v. clinic)	58.05	7.6
veterinary , livestock,fish dev't,	37.37	4.9
crop, pest control	28.41	3.7
seed nursery/fruit dev't ,coffee	8.57	1.1
fixed asset (furniture,others)	4.67	0.6
rural road	2.30	0.3
Total mean in eleven years	764.44	

The federal government spends much larger than regional states in most of the categories of capital formation in agriculture. The overall share of the federal government stood at 81 percent average while the remaining 19 percent was covered by the regional states. The categories where the regional states expend most are rural roads, buildings, furniture and crop protection.

Fig 6 Mean Annual Expenditures and Shares in National level public expenditure in Agriculture

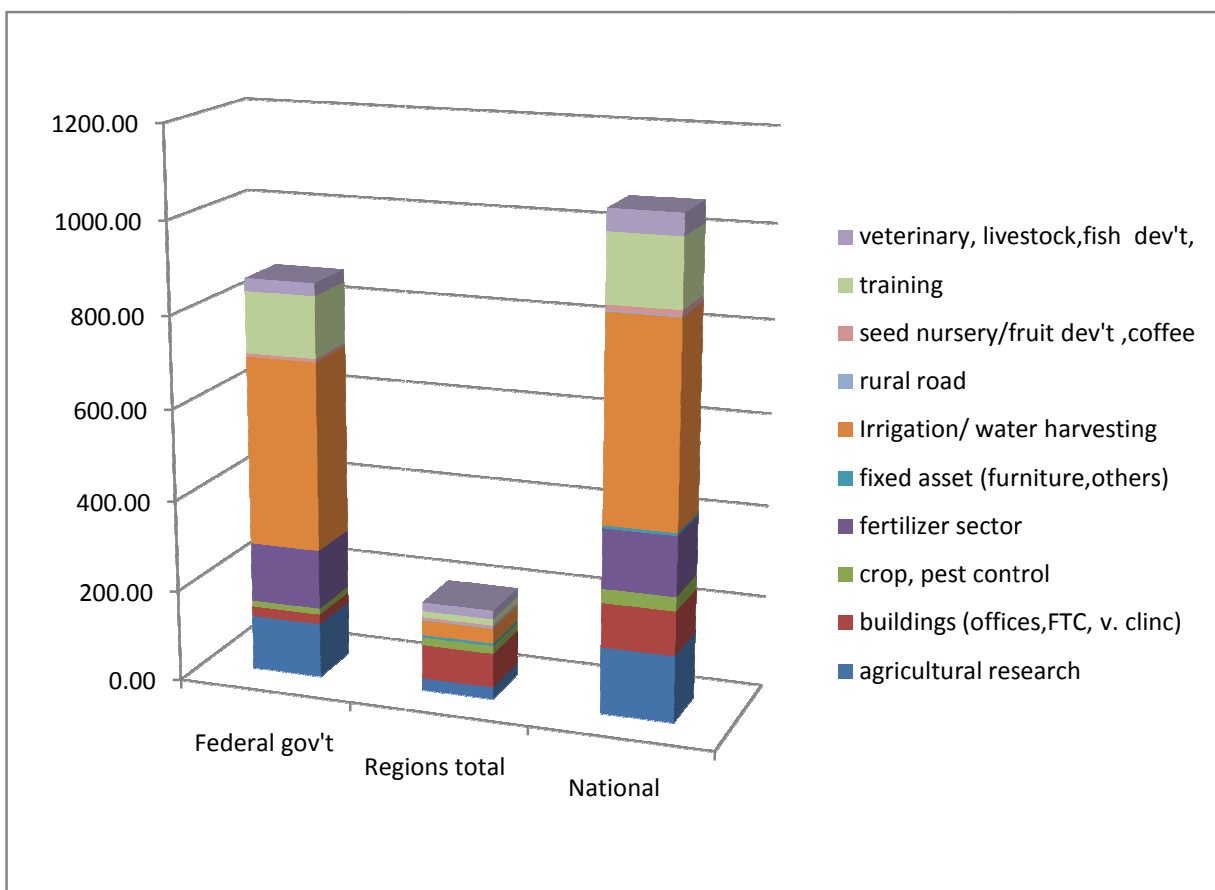


Table 6 Mean Annual Expenditures and Shares in National level public expenditure in Agriculture

Expenditure category	Federal government		Regions total		National
	mean annual	share	mean annual	share	mean annual
agricultural research	91.28	0.83	19.16	0.17	110.44
buildings (offices, FTC, v. clinic)	8.70	0.15	49.35	0.85	58.05
crop, pest control	12.46	0.44	15.95	0.56	28.41
fertilizer sector	127.83	1.00	0.00	0.00	127.83
fixed asset (furniture, others)	0.21	0.04	4.46	0.96	4.67
Irrigation/ water harvesting	246.92	0.91	25.90	0.09	272.83
rural road	0.00	0.00	2.30	1.00	2.30
seed nursery/fruit dev't, coffee	5.74	0.67	2.83	0.33	8.57
training	104.11	0.91	9.88	0.09	113.99
veterinary, livestock, fish dev't,	22.62	0.61	14.74	0.39	37.36
Total Mean annual	619.88	0.81	144.57	0.19	764.45
Share in national agricultural expenditure		0.81		0.19	

4.2 AGRICULTURAL GROSS CAPITAL FORMATION IN PRIVATE BUSINESSES

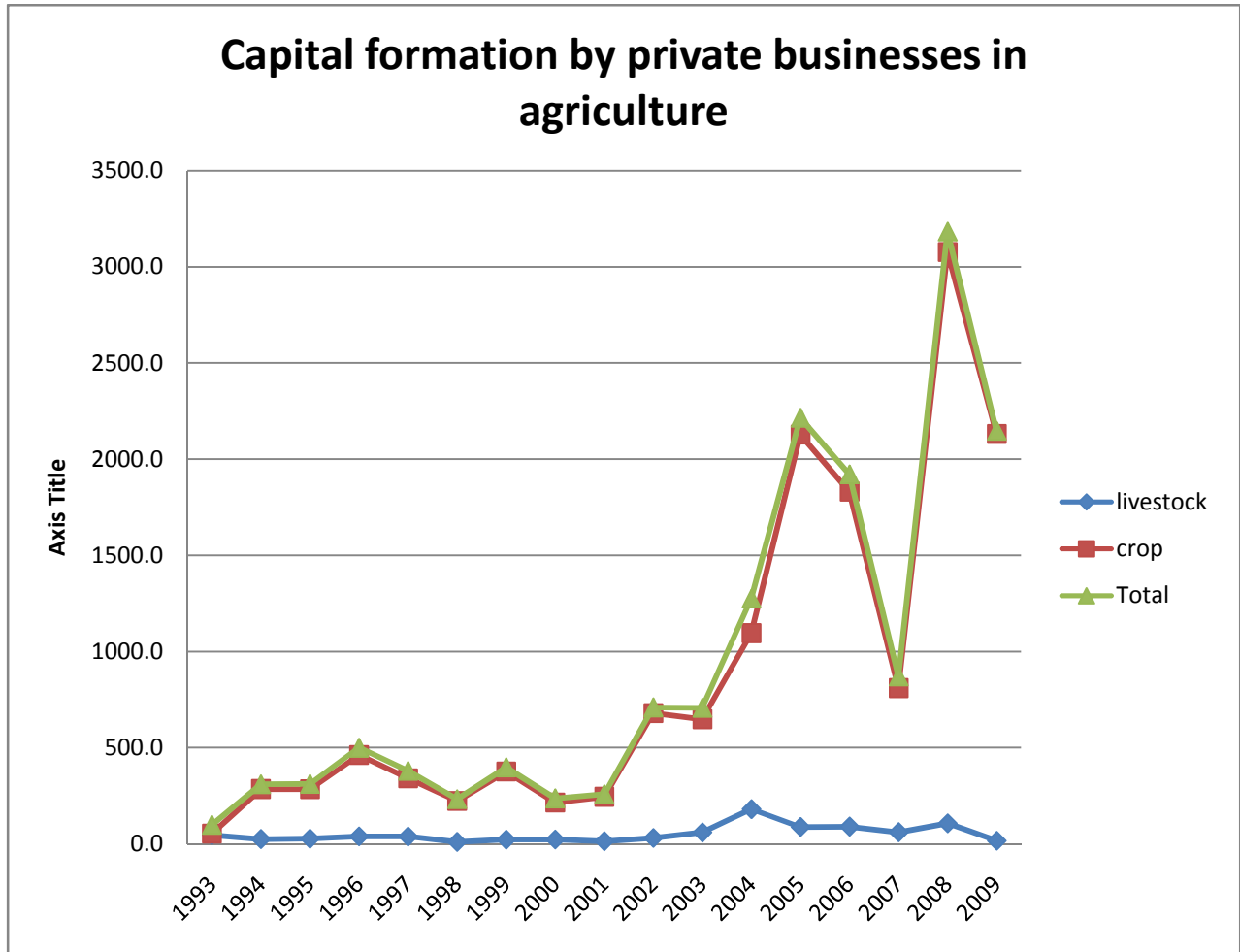
Capital formation in Agriculture by private businesses in a year is captured by summing the total licensed investment that has transformed to implementation phase or gone operational in that year. The broad categories of investment are investments on crop production and on livestock. The assessment of private agricultural capital formation took dimensions not only of crop and livestock, but also dimensions of implementation phase and operational phase, regional and national across a period of 17 years in which data is available.

Table 7 Country level actual private business investment in agriculture in millions of birr

year	livestock		crop		Total
	amount	share	amount	share	
1993	50.62	45.1	61.6	54.9	112.2
1994	26.17	7.5	321.5	92.5	347.7
1995	25.32	8.2	284.6	91.8	309.9
1996	37.28	7.4	463.8	92.6	501.1
1997	36.69	9.7	342.4	90.3	379.1
1998	8.22	3.6	223.1	96.4	231.3
1999	20.11	5.1	372.0	94.9	392.1
2000	19.29	8.8	200.0	91.2	219.3
2001	11.96	4.7	240.2	95.3	252.1
2002	29.37	4.1	693.8	95.9	723.2
2003	51.84	8.1	587.5	91.9	639.4
2004	153.02	14.0	940.0	86.0	1093.0
2005	67.28	3.9	1674.7	96.1	1742.0
2006	62.10	4.6	1300.3	95.4	1362.4
2007	35.52	6.7	491.8	93.3	527.3
2008	48.86	3.3	1437.7	96.7	1486.6
2009	5.42	0.7	809.6	99.3	815.0
mean	40.5	6.2	614.4	93.8	654.9

Capital formation by private businesses in agriculture is heavily skewed towards crop production. 94 percent of the investment is directed towards crop production in the past seventeen years. Investment in livestock and related production is limited to only 6 percent of the total investment in private businesses engaged in agricultural sector.

fig 7



In the first half of the period between 1993 and 2009, private investment in crop production exhibited no growth. A general rise with fluctuations is observed in the second half of the period. Investment is concentrated in two regions, namely Oromia(53%), SNNPR(20%), followed by Amhara(8%), Tigray (4%) and Benishangul (4%). Records indicate that the investment of some

firms is multi regional (8%), which might be in the same regions where concentration exists. The annual mean national investment in crop production in the period was in the order of 614 million Birr (corrected by a GDP deflator of the base year 2000)

fig 8 Regional Distribution of capital formation in Crop production

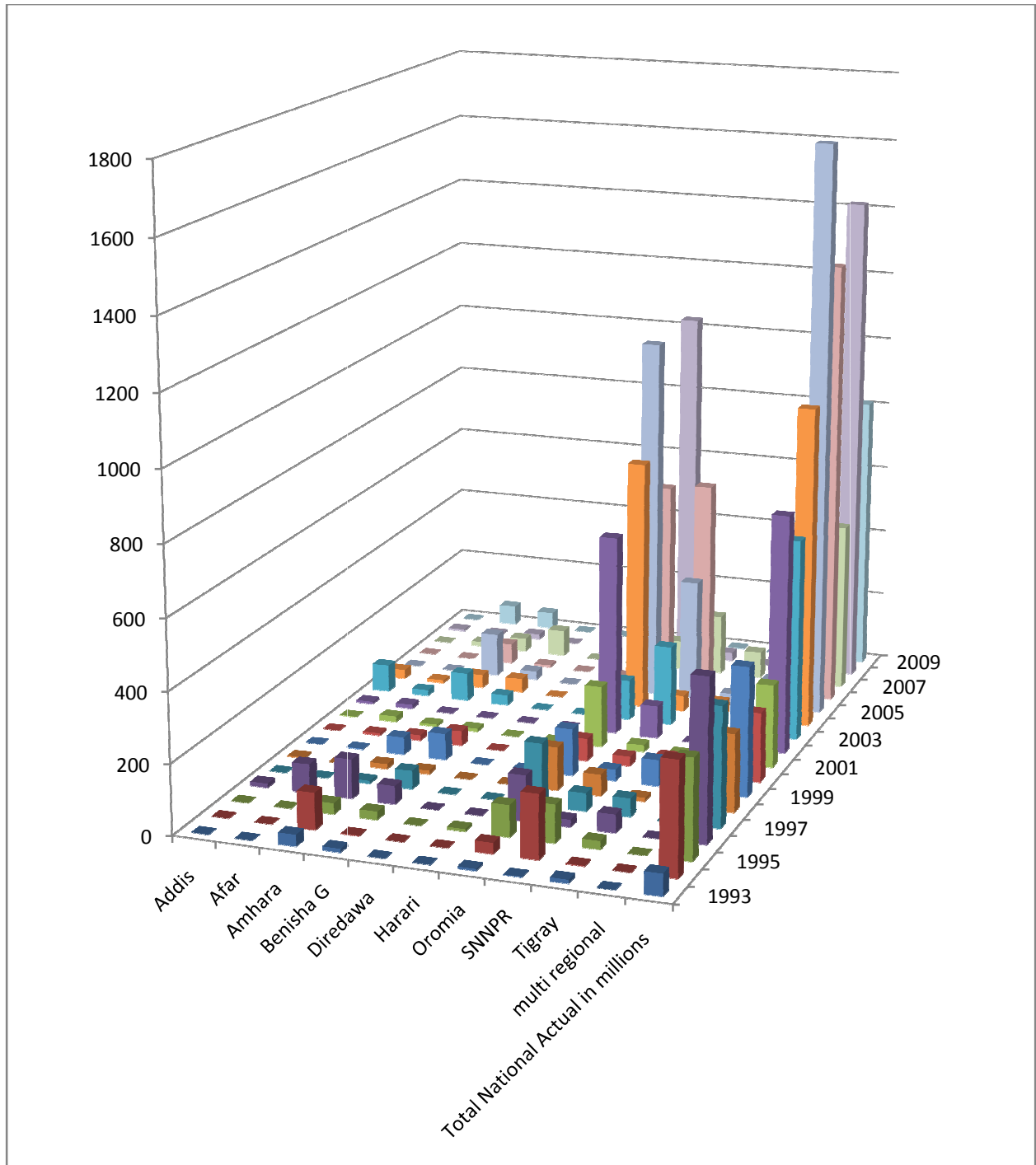


Table 8 Regional distribution of gross capital formation in crop production by private businesses

	Addis	Afar	Amhara	Benisha G	Diredawa	Harari	Oromia	SNNPR	Tigray	multi regional	Total National Actual in millions
1993	0	0	32.85	10.57	0.00	0.00	6.03	1.58	10.57	0.00	61.61
1994	0	0	104.74	1.77	0.00	0.00	31.26	181.94	1.77	0.00	321.49
1995	0	0	31.46	23.51	0.00	7.36	90.46	108.23	23.51	0.00	284.55
1996	12.12	83.31	112.63	52.26	0.00	0.00	130.16	21.04	52.26	0.00	463.78
1997	0.00	0.00	8.10	52.68	0.00	0.00	177.36	51.58	52.68	0.00	342.41
1998	3.03	0.00	14.08	10.38	0.00	0.00	124.01	61.24	10.38	0.00	223.11
1999	0.00	1.64	50.76	75.78	0.00	0.00	135.19	32.80	75.78	0.00	371.95
2000	0.00	6.15	15.51	42.45	0.00	0.00	65.07	28.37	42.45	0.00	199.99
2001	1.15	16.58	6.75	8.97	0.00	0.00	178.16	19.59	8.97	0.00	240.16
2002	6.26	11.83	0.00	0.00	0.00	0.00	580.96	94.73	0.00	0.00	693.78
2003	79.53	16.87	82.22	29.46	0.00	0.00	117.28	232.72	29.46	0.00	587.53
2004	26.68	8.26	38.96	40.82	0.00	0.00	732.92	45.83	40.82	5.71	940.01
2005	0.00	0.00	126.92	25.37	0.00	0.00	1060.54	353.99	25.37	82.53	1674.71
2006	0.00	0.00	59.07	6.21	0.00	0.00	597.35	612.76	6.21	18.64	1300.25
2007	0.00	13.21	39.31	77.77	0.00	0.00	85.64	176.50	77.77	21.58	491.79
2008	4.67	4.67	15.47	0.00	0.00	0.00	1055.22	24.40	0.00	333.31	1437.74
2009	0.00	57.06	48.19	0.00	0.00	0.00	371.10	1.08	0.00	332.16	809.60
mean	7.85	12.92	46.29	26.94	0.00	0.43	325.81	120.49	26.94	46.70	614.38
share	0.01	0.02	0.08	0.04	0.00	0.00	0.53	0.20	0.04	0.08	1.00

The distribution across regions in livestock investment is more even than private investment in crop production. Concentration is observed in two regions, Tigray(31%) and oromia(27%), followed by Amhara (11 %). The city administration, Addis Ababa and Diredawa host considerable private investment in livestock, about 10% and 6% respectively, indicative of the fact that peri urban agriculture in livestock with modern methods has significant contribution.

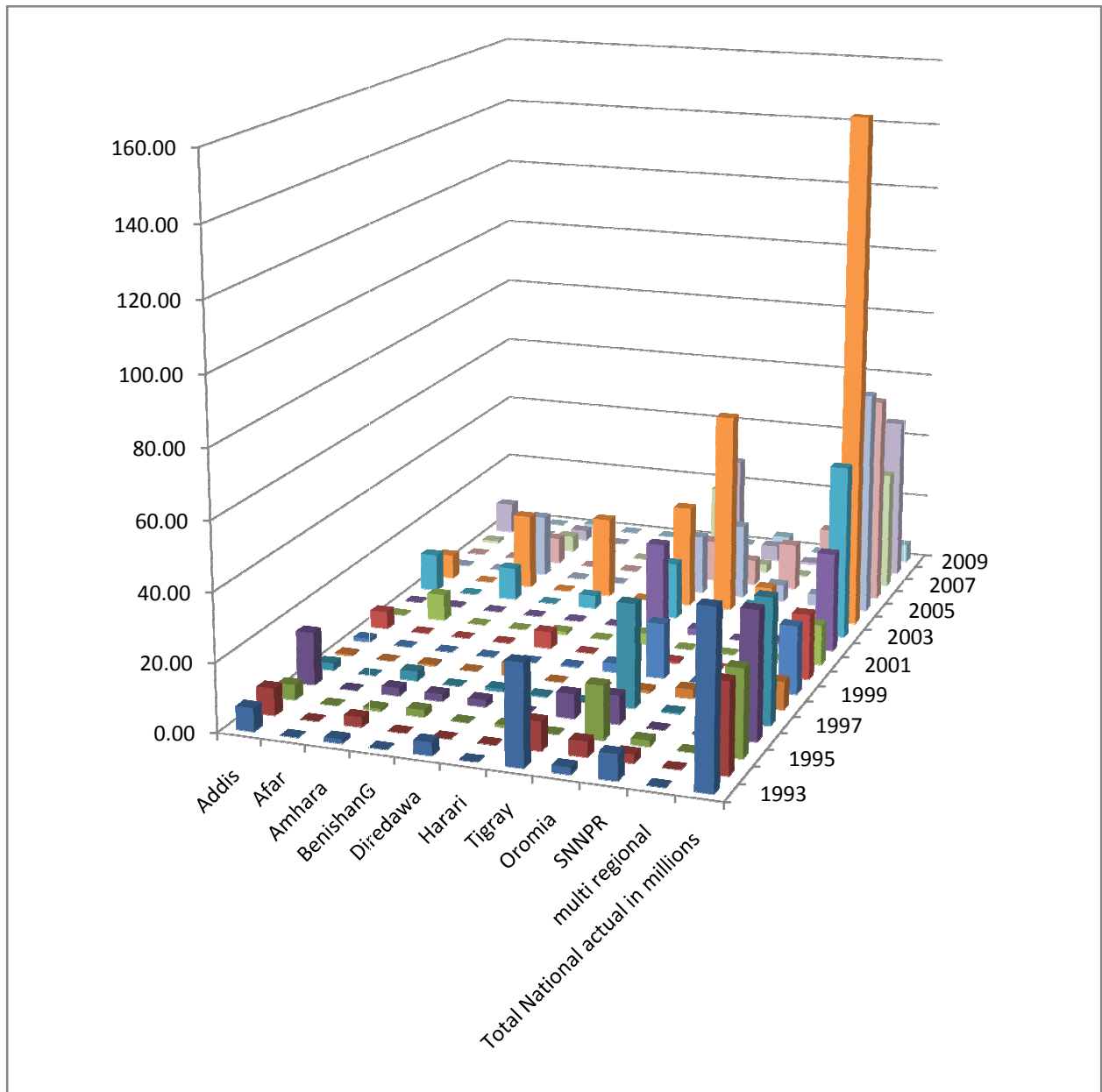
Table 9 Private investment in livestock across regions in millions of Birr

year	Addis	Afar	Amhara	Benishan Gul	Diredawa	Harari	Tigray	Oromia	SNNPR	multi regional	Total National actual in millions
1993	6.77	0.00	1.22	0.00	3.80	0.00	29.34	2.03	7.45	0.00	50.62
1994	7.87	0.00	2.86	0.00	0.00	0.00	8.35	4.48	2.62	0.00	26.17
1995	4.42	0.00	0.72	2.02	0.00	0.78	0.00	15.62	1.76	0.00	25.32
1996	15.50	0.00	2.31	2.10	2.02	0.00	7.04	8.31	0.00	0.00	37.28
1997	2.09	0.00	2.75	0.00	0.81	0.30	0.00	30.40	0.34	0.00	36.69
1998	0.42	0.00	0.45	0.00	3.83	0.00	0.00	0.82	2.70	0.00	8.22
1999	0.95	0.00	0.00	0.00	0.00	0.28	2.72	16.16	0.00	0.00	20.11
2000	5.15	0.00	0.00	0.00	4.93	0.00	3.70	0.57	0.00	4.93	19.29
2001	0.00	7.87	0.00	0.00	0.82	0.00	3.27	0.00	0.00	0.00	11.96
2002	0.00	0.00	0.00	0.00	0.00	0.00	26.69	1.83	0.00	0.85	29.37
2003	11.22	0.00	9.73	0.00	3.89	0.00	16.85	3.60	6.54	0.00	51.84
2004	7.27	0.00	22.57	0.00	24.26	0.00	30.58	60.21	8.12	0.00	153.02
2005	0.00	0.00	18.64	0.00	0.00	0.00	17.70	22.46	5.10	3.38	67.28
2006	0.00	0.00	7.90	0.00	0.00	0.00	12.45	7.69	14.00	20.07	62.10
2007	0.61	1.80	4.77	0.00	0.00	0.00	25.62	2.43	0.30	0.00	35.52
2008	9.35	0.00	3.03	0.00	0.00	0.00	31.23	4.67	0.58	0.00	48.86
2009	0.00	0.00	1.27	0.00	0.00	0.00	0.23	3.91	0.00	0.00	5.42
mean	4.21	0.57	4.60	0.24	2.61	0.08	12.69	10.89	2.91	1.72	40.53
share	0.10	0.01	0.11	0.01	0.06	0.00	0.31	0.27	0.07	0.04	1.00

Investment growth in Livestock production remained largely stagnant throughout the period.

However, the peaks in some years rendered it a 3.3% trend growth.

fig 9 Distribution of Private capital formation in Livestock



4.3 FARM HOUSEHOLD GROSS CAPITAL FORMATION

Capital formation on household level was estimated from the national survey results showing household crop output, percentage consumption from own crop output, on the one hand, and national accounts data of annual agricultural income tax and land use tax. Survey data from the central statistics on production and crop use of farm households are available for two years (2001 and 2009). The use of crop output is reported as a percentage used for consumption, seeds, wage payment in kind, sales and others, out of which consumption takes not less than 60%. Crop output used for seeds and wage payment is a form of capital from own saving used for further production. Sales and others are uses which definitely include payment of income and land use taxes. If the amount used to pay taxes could be deducted from the sales, the remaining unknown amount would be substantially reduced. Hence the aggregate saving from households' crop production may be approximated from the value of crop output, the value of consumed crop output and the value of crop used for the payment of taxes.

National accounts dataset avails the regional agricultural income tax and land use tax. The crop production and use data of CSA for two years is interpolated and extrapolated to get an estimate of the household production and consumption in the years for which data is not available. Once data is generated for the intervening years and in the neighborhood, annual taxes and consumption are deducted from the value of crop output to approximate the farm household saving. This estimate may be considered as the upper limit for two reasons: every saving may not be used for agricultural capital formation and the figure possibly includes household consumption not identified. The estimated saving, when translated to per capita household saving, is about 1000 birr per annum in the last year of the period between 1999 to 2009, which does not seem unrealistic.

The aggregate farm household saving from crops production in turn is taken as the major part of farm household level capital formation, the other being that saved from livestock production. However the dearth of comparable data on livestock could not enable this study to estimate the changes in stock or value. Some studies (Woody Biomas project under the Ministry of agriculture is a case in point) allude to the fact that the limit to livestock population has been reached in many

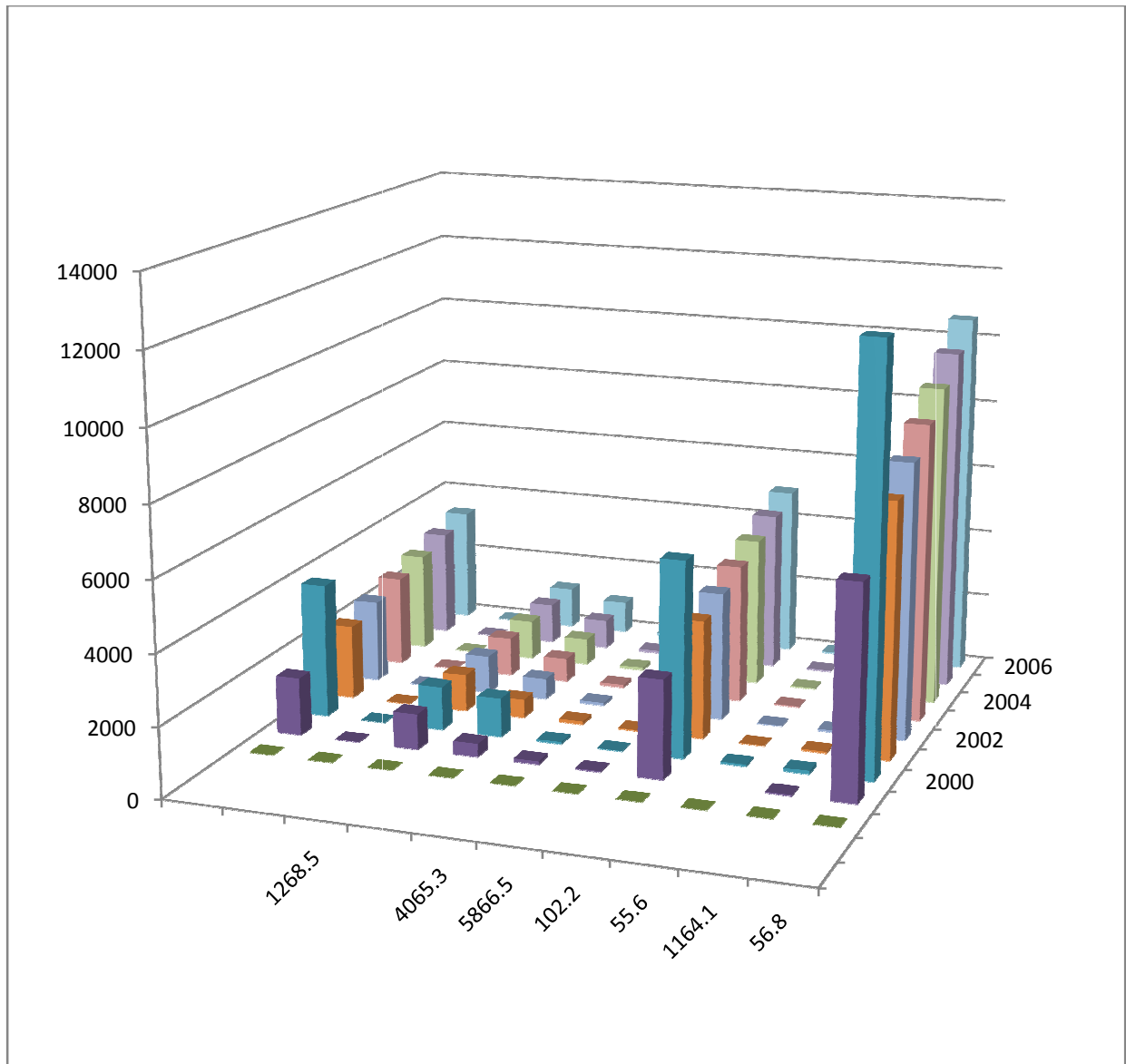
parts of the country as the carrying capacity of the natural environment for traditional herding has been exceeded. This leads to the hypothesis that even if livestock is maintained in farm households, the stock does not expand on aggregate level and hence does not contribute to new capital formation that comes through changes in stock, exceeding the coverage of depreciation. The introduction and prevalence of modern methods of production in livestock has to precede the expansion of stocks. If the possibility for expansion of aggregate level livestock is, as stated, constrained by the natural environment and the level of technology used in the country, there will be only little distance between the estimate and the actual, due to errors arising from changes in value rather than from changes in stock.

Table 10 Farm household aggregate capital formation from crop production

	Amhara	DireDawa	Tigray	SNNP	BSGumuz	Harari	Oromiya	Gambella	Somale	National
1999	1659.1	9.2	1018.0	379.8	93.2	28.1	2818.4		29.6	6035.37
2000	3856.7	1.7	1247.2	1117.9	59.9	12.1	5620.3	50.6	95.0	12061.5
2001	2138.9	7.5	1066.0	529.8	85.7	24.7	3412.1	7.4	44.1	7316.25
2002	2374.8	6.7	1091.6	603.1	81.7	22.8	3708.0	13.6	51.4	7953.79
2003	2615.7	5.8	1119.4	686.5	77.6	21.0	4019.2	19.7	58.7	8623.66
2004	2845.6	4.9	1144.4	768.4	73.6	19.2	4326.0	25.9	65.9	9273.85
2005	3088.3	4.2	1170.3	850.8	69.6	17.4	4633.7	32.1	73.2	9939.48
2006	3333.3	3.3	1196.6	934.4	66.2	15.6	4940.9	38.2	80.3	10608.8
2007	3579.7	2.3	1222.7	1017.0	62.6	13.8	5252.4	44.4	87.7	11282.6
2008	3824.5	1.7	1249.5	1099.2	58.8	12.0	5568.0	50.6	94.5	11958.8
2009	4065.3	0.8	1268.5	1164.1	55.6	10.2	5866.5	56.8	102.2	12590
mean	3034.7	4.4	1163.1	831.9	71.3	17.9	4560.5	33.9	71.2	9785.8
share	0.310	0.000	0.119	0.085	0.007	0.002	0.466	0.003	0.007	1.000

Note: Data for Addis Ababa and Afar are missing

Fig10 Regional saving from crop output by farm household



The regions that exhibit larger farm household level savings from crop output are Oromia (46.6%), Amhara (31%), Tigray(11.9%) and SNNP(8.5%). These regions are the major grain production areas in northern, central and southern highlands. The fact that these regions are the major sources of agricultural saving, on aggregate, suggests that they are better in their surplus grain production than the other agricultural regions.

This fact at the same time hides the extent of prevailing poverty in these regions. In the poverty assessment of 1995/6, by the Ministry of Finance and Economic Development, three of these

regions (Tigray, Amhara and SNNP) were the three poorest regions in terms of head count indices, with Head Count Indices of 57.9%, 56.7%, and 56.5% respectively. The 1999/00 and 2004/5 rounds show improvement in their relative position.

The 2004/5 round of poverty assessment statistic clearly shows they are in general better in their poverty status than those agricultural regions which are not mainly grain producers but less than those mainly urban regions, namely Addis Ababa, Harari and Diredawa. Overall the poverty figures, with the exception for Tigray, lend credibility to the claim that these regions are major sources of agricultural saving as they produce surplus over aggregate grain consumption.

Table 11

Poverty profile of regions : head count indices				
	1995/6	1999/00	2004/5	Changes in poverty between 1995/6 and 2004/5
Tigray	0.579	0.616	0.51	-0.069
Afar	0.518	0.68	0.429	-0.089
Amhara	0.567	0.429	0.404	-0.163
Oromia	0.347	0.404	0.372	0.025
Somale	0.346	0.441	0.452	0.106
Benishangul	0.476	0.558	0.458	-0.018
SNNP	0.565	0.517	0.382	-0.183
Harari	0.133	0.149	0.206	0.073
Addis Ababa	0.404	0.271	0.299	-0.105
Diredawa	0.366	0.332	0.398	0.032
Total	0.475	0.454	0.393	-0.082

source MOFED 2008

4.4 AGGREGATE CAPITAL FORMATION IN AGRICULTURE

The aggregate figures (ref table 12) indicate that agricultural capital formation mainly takes place within farm households. Modern businesses and government are supposed to be agents of dissemination of modern methods and facilities. The contribution of these institutions altogether in agricultural investment, however, is about 14 %. Farm household capital formation is that arising from smallholder farmers which is highly dispersed and unable to perform bulky investments that are necessary to enhance agricultural productivity. The low density capital formation will have retarded effect on the increasing productivity unless some mechanism is devised for small holder savers to bring together their hard earned saving into fruitful capital use. The aggregate magnitude of saving however is potentially promising.

Table 12 Total capital formation obtained using estimation method 1

year	private business investment	public investment	farm household	National Aggregate
1999	392.06	692.019	6035.37	7119.44
2000	219.29	564.035	12061.46	12844.78
2001	252.12	540.791	7316.25	8109.16
2002	723.16	1011.067	7953.79	9688.01
2003	639.37	633.397	8623.66	9896.42
2004	1093.03	811.681	9273.85	11178.56
2005	1742.00	1155.207	9939.48	12836.68
2006	1362.36	867.913	10608.75	12839.02
2007	527.31	806.689	11282.60	12616.61
2008	1486.60	657.795	11958.82	14103.22
2009	815.03	668.296	12590.00	14073.32
mean	841.12	764.44	9785.82	11391.38
Percentage share	7.38	6.71	85.91	

4.5 COMPARISON WITH FAO DATA SET ON AGRICULTURAL CAPITAL IN ETHIOPIA

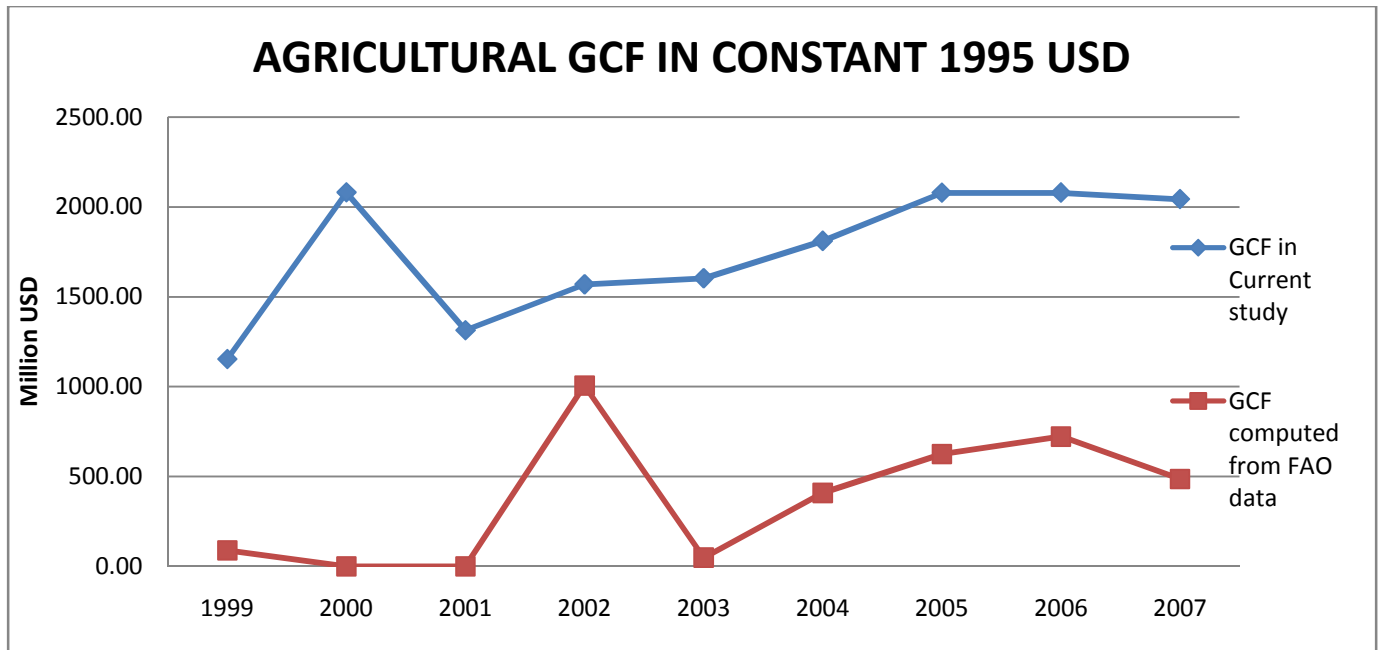
The data obtained from FAO on Ethiopian agricultural capital stock shows the value of capital stock in 1995 US dollars rather than the value of gross capital formation. Computation of the changes in stock value between consecutive years yields end-of-year gross capital formation. These changes are used for comparison with the respective figures in the current study. Using same base year and with the conversion of values to same units of currency at the prevailing exchange rate in the base year, the levels and trends may be compared to see to what extent results from different studies differ or converge.

Table 13

year	GCF in current study in Constant 1995USD	GCF inconstant 1995 USD from FAO data	Percentage of GCF from FAO data to GCF in current study
1999	1153.49	88.63	7.7
2000	2081.10	0.00	0.0
2001	1313.84	0.00	0.0
2002	1569.65	1005.94	64.1
2003	1603.41	48.51	3.0
2004	1811.14	408.83	22.6
2005	2079.79	624.90	30.0
2006	2080.17	722.24	34.7
2007	2044.14	485.68	23.8
Mean	1748.5	376.1	20.7

The comparison of the data for the last nine years, where there is comparable data, indicates that there is a marked difference in levels while there seems to be similarity in trend. There is also a clear difference in the entries of forms of capital. The forms of capital on aggregate level included in the FAO data are machinery and equipment, land, livestock and structure. The gross capital formation derived from FAO data and tabulated above are positive changes in these items.

Fig 11



5. CAPITAL FORMATION FOR AGRICULTURE

All capital formation outside agriculture and allied activities (forestry and fishing) are scrutinized for the extent to which the sectors serve agriculture as compared to the service they provide to the rest of the economy. That portion of capital formation for agriculture is calculated sector by sector taking the appropriate proportion devoted to advance agricultural activities. Some products of the industrial sector are meant only for use in agriculture. Fertilizer and herbicide are such industrial products. Services of electricity and roads located in the rural areas are utilized by agriculture. Warehouses in urban areas used for storages of products are to some extent meant for agriculture. Capital formation in these and other sectors outside agriculture are partly all wholly capital formation for agriculture.

The scrutiny follows public as well as private domains. The main public sectors that have significant linkage with agriculture in Ethiopia and hence the capital formation of which are partly capital formation for agriculture are, environmental protection sector, productive safety nets programs, meteorological service, rural water supply, rural electrification, Transport and communication, road construction, education and health sectors in the public domain, manufacturing, construction, trade in the private domain.

5.1 Public gross capital formation for agriculture

Capital expenditure on Environmental protection is in a large proportion capital formation for agriculture as it is the agricultural sector that benefits largely from the investment. Tourism and other non agricultural sectors also benefit. Public expenditure under the title of food security is directed to public works in rural areas that are believed to assist agriculture. Meteorological services are meant to provide weather information to all users including agriculture. Rural water supply to some extent is used for livestock and small irrigation. Rural electrification could be used to a limited extent in pumping and other agricultural uses. Communication facilities such as land line and mobile telephones serve agriculture in non negligible extent. Since investments in these sectors serve agriculture to some extent a certain proportion of the capital formation in these sectors is investment for agriculture. The proportions considered in this study are tentative figures based on largely informed guesses that need refinement. The proportion of road construction that serves agriculture may be approximated from the proportion of marketed agricultural output, which is about 30% of agricultural output that is about 40 % of GDP. Hence 12% of public capital

expenditure on road construction is apportioned to agriculture. Educational public capital expenditure also is partially meant for agriculture in a proportion derived from agricultural contribution to value added , which is 40%, and the proportion of literacy removed from agricultural labor force, assumed to be in the range of 30%, making the share 12% . The proportion of public health capital expenditure that goes to agriculture is estimated from the proportion of agricultural GDP (40%) and the participation rate of the labor force (80%), which results in 32%.

Table 14 Apportioning rate of public agricultural formation for agriculture

sectors of public capital expenditure	%proportions of capital formation in agriculture
Environment protection	0.90
Food security (productive safety net)	0.90
Meteorological services	0.85
Rural water supply	0.10
Rural electrification	0.10
Transport & communication	0.05
Road construction	0.12
Education	0.12
Health	0.32

Table 15: Sectoral gross capital formation for agriculture in the public sector(*adjusted by GDP deflator*)

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Environment protection	105.46	65.09	34.81	39.35	57.85	90.72	39.40	34.90	28.57	27.02	30.33
Food security	9.02	7.17	9.19	0.00	126.24	825.72	1530.58	1971.31	1809.80	1636.20	2099.73
Meteorological services	2.28	5.22	7.63	10.83	6.39	12.88	3.65	6.34	4.91	1.82	4.42
Rural water supply	9.44	3.45	4.06	5.32	5.35	6.13	8.60	10.85	13.38	18.70	10.08
Rural electrification	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	33.91	29.21	23.84
Transport & communication	14.51	11.58	16.74	20.54	9.15	4.96	5.54	60.56	11.25	9.37	12.05
Road construction	122.17	121.11	160.56	212.78	221.74	236.10	230.64	234.82	300.43	368.55	463.05
Education	52.54	33.75	70.97	97.37	139.31	188.09	153.27	209.51	604.74	465.50	500.91
Health	56.82	52.56	74.26	96.41	95.21	108.34	267.72	186.96	0.00	0.00	0.00
Total	375.78	320.88	384.46	472.25	729.20	1715.73	2845.15	3823.92	4619.83	5470.25	8273.65

Fig 12

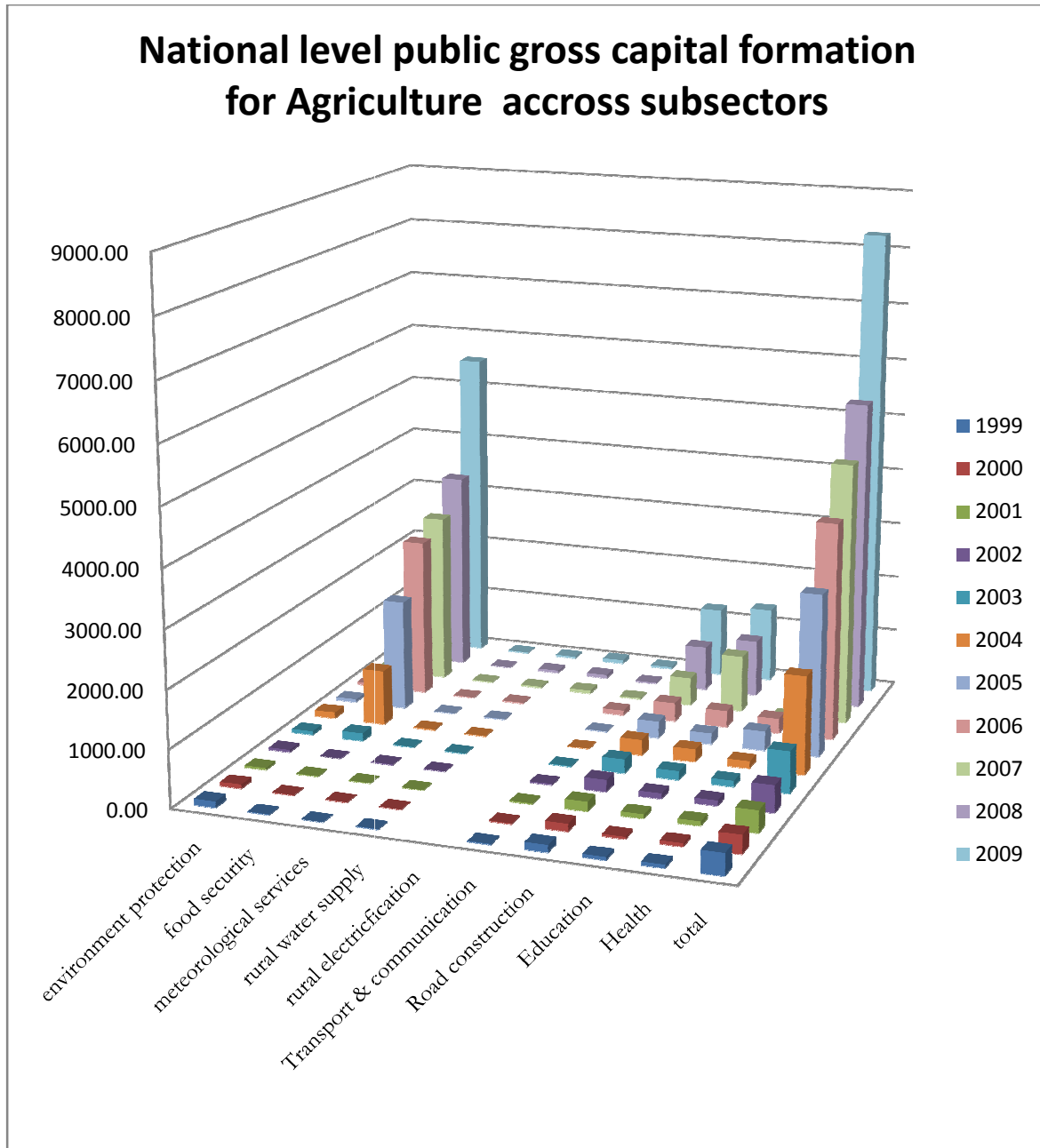
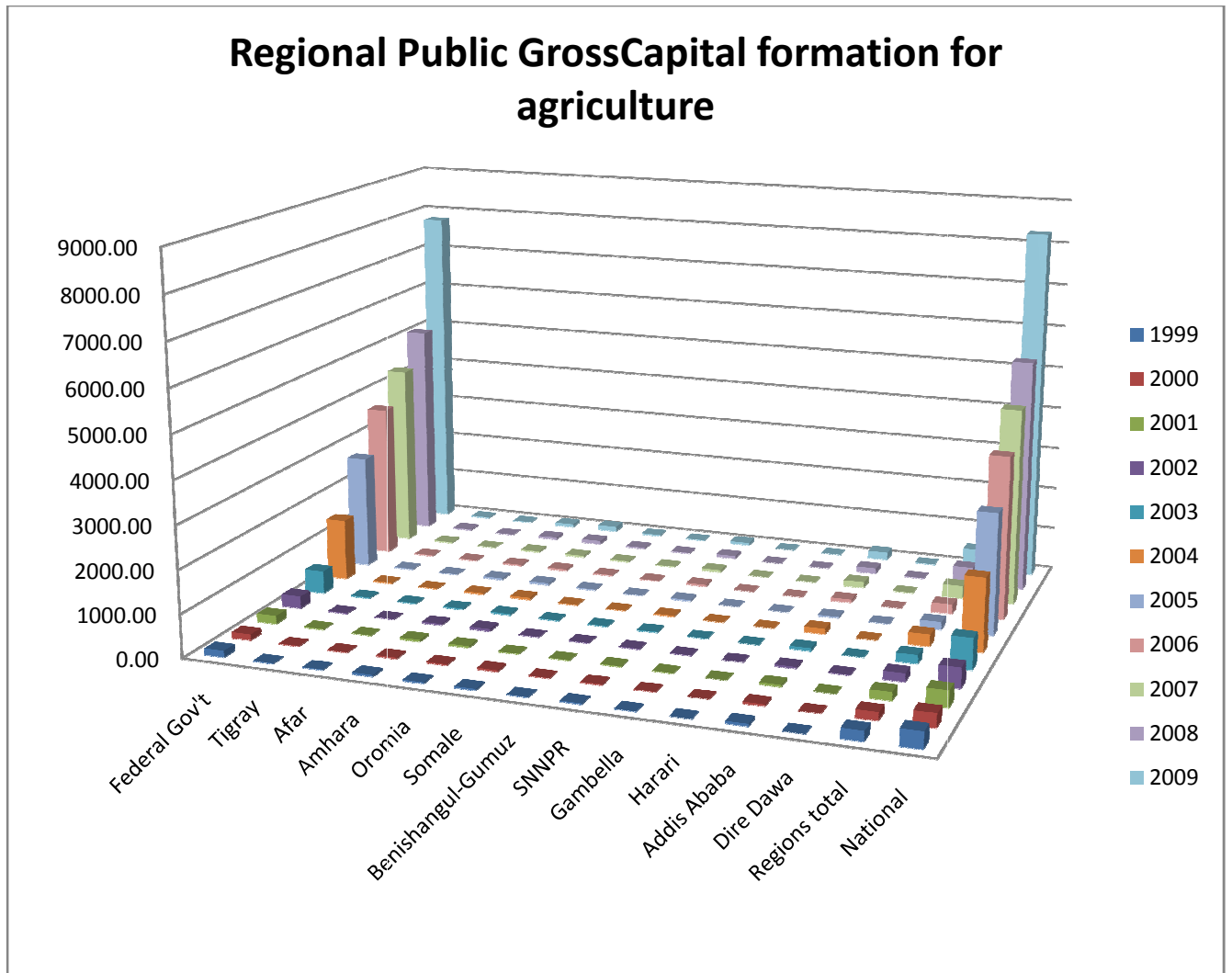


Table 16 Regional capital formation for agriculture in the public sector (current prices)

	<i>Federal Gov't</i>	<i>Tigray</i>	<i>Afar</i>	<i>Amba ra</i>	<i>Oromia</i>	<i>Somale</i>	<i>Benish angul-Gumu ጅ</i>	<i>SNN PR</i>	<i>Gam bella</i>	<i>Har ari</i>	<i>Addis Ababa</i>	<i>Dire Dawa</i>	<i>Regions total</i>	<i>National</i>
1999	150.08	11.32	14.62	43.61	29.68	33.84	8.09	23.33	5.80	1.04	53.50	0.87	225.70	375.78
2000	133.51	13.03	10.52	29.26	22.58	33.74	8.61	20.43	5.68	0.65	41.05	1.83	187.37	320.88
2001	191.21	16.72	4.75	41.56	43.11	11.24	7.06	15.07	7.13	0.99	44.72	0.89	193.25	384.46
2002	281.70	13.05	7.24	33.34	51.77	6.56	8.65	13.17	6.03	1.93	39.17	9.64	190.55	472.25
2003	531.59	21.41	12.72	24.81	29.41	10.77	8.90	18.22	4.85	1.64	62.63	2.26	197.61	729.20
2004	1440.58	20.51	7.77	28.99	47.37	8.41	5.97	23.02	3.36	1.52	126.44	1.81	275.16	1715.73
2005	2662.09	13.27	6.77	36.69	41.73	18.77	4.61	26.65	1.13	1.46	28.40	3.56	183.06	2845.15
2006	3603.71	15.77	8.47	25.35	33.36	16.62	7.26	36.43	1.65	2.16	72.40	0.74	220.21	3823.92
2007	4315.13	17.23	3.60	27.29	34.82	19.10	12.40	46.43	1.36	1.90	135.99	4.60	304.71	4619.83
2008	5077.50	24.70	4.47	46.73	80.50	25.14	13.54	59.43	0.58	1.74	125.43	10.48	392.74	5470.25
2009	7781.62	17.90	10.18	66.34	120.23	24.56	8.19	58.38	0.30	2.37	177.48	6.10	492.04	8273.65

Fig 13



5.2 Private gross capital formation for agriculture

Manufacturing: The subsectors of manufacturing that may have capital formation for agriculture are the metal products, chemicals and electrical machinery manufacturing sub sectors, which likely produce, tools implements, machinery and equipment, fertilizers, pesticides, insecticides and herbicides.

Capital formation meant for manufacturing of fertilizers, herbicides, agricultural tools, implements, equipment and machinery, is capital formation entirely for agriculture by the manufacturing sector. Pesticides and insecticides are partially meant for agriculture and partially for household use.

Machinery and equipment producing firms may not exclusively produce for agriculture. The proportion of capital formation for agriculture may be estimated from the proportion of the output used for agricultural production. Producers' information on technical grade and value of pesticides and marketing data on the one hand and CSA's survey data on the other may be used with regard to pesticides and insecticides. The proportion of the value of output of machinery and equipment for agricultural use may be estimated for the respective data on firms' value of production at selected base year prices. However the institutional units of capital formation for agriculture were found difficult to identify from CSA's annual survey of large and medium scale manufacturing firms. This difficulty coupled with the limited number of firms producing agricultural inputs has led to the decision to ignore it without significant loss of information on capital formation for agriculture.

Construction sector

Acquisition of goods used in the construction industry constitutes capital formation in construction. A certain percentage of the construction service using these goods is provided to the agricultural sector. Therefore some proportion of the value of the acquisitioned goods used in construction should be taken as capital formation in agriculture. The proportion could be estimated from the ratio of values of agricultural constructions to total constructions. Agricultural constructions include farm warehouses, irrigation facilities, rural roads, rural electrification, land improvement constructions etc. However the non availability of disaggregated data on the values of agricultural construction precluded such apportioning.

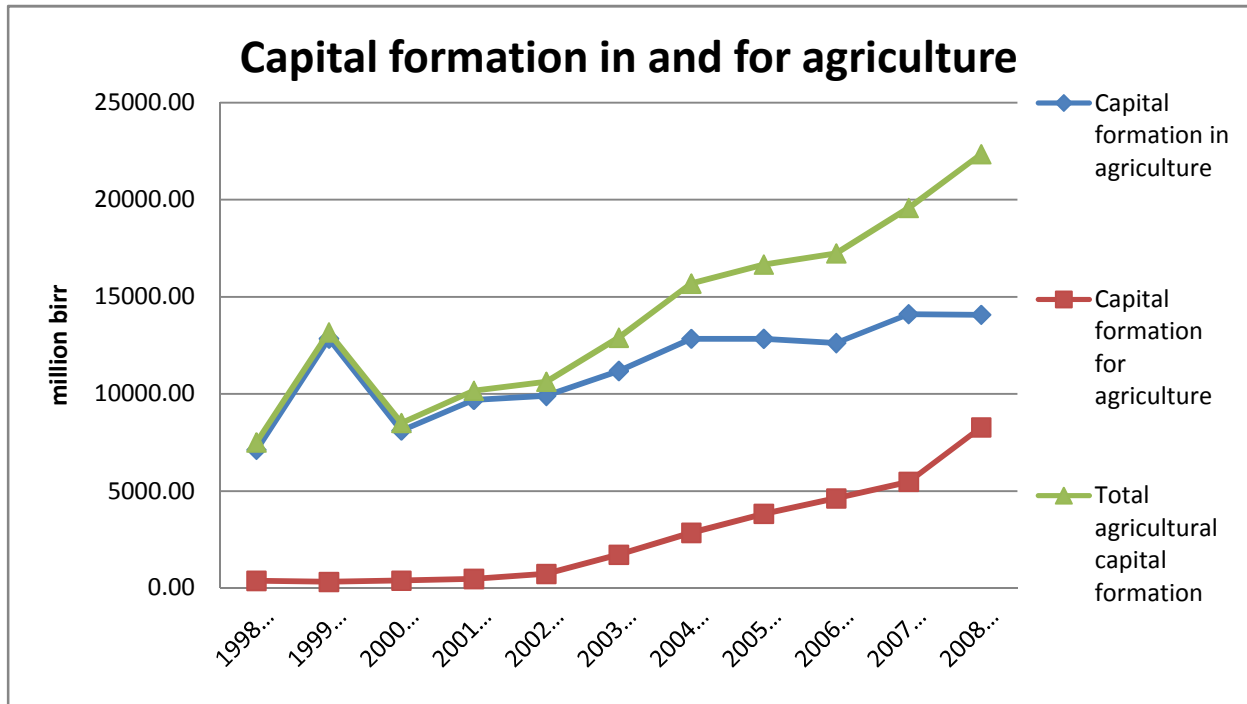
6. GROSS CAPITAL FORMATION IN AND FOR AGRICULTURE

Capital formation in agriculture constitutes 81percent while capital formation for agriculture takes a 19percent share. Both capital formations in and for agriculture show a rising trend. in the period between 1999 and 2009.

Table 17

year	Capital formation in agriculture	Capital formation for agriculture	Total agricultural capital formation
1999	7119.44	375.78	7495.22
2000	12844.78	320.88	13165.66
2001	8109.16	384.46	8493.62
2002	9688.01	472.25	10160.26
2003	9896.42	729.20	10625.62
2004	11178.56	1715.73	12894.29
2005	12836.68	2845.15	15681.83
2006	12839.02	3823.92	16662.94
2007	12616.61	4619.83	17236.44
2008	14103.22	5470.25	19573.47
2009	14073.32	8273.65	22346.97
Mean	11391.38	2639.19	14030.57
% share	81	19	

fig 14



7. DETERMINANTS OF CAPITAL FORMATION

The institutional units that undertake capital formation in agriculture are households, private businesses and public institutions. Private capital formation comprises additions on farm machinery and equipment, building construction, irrigation facilities, land improvement, livestock while public capital formation in agriculture is generally building infrastructure necessary for agriculture to facilitate private investment and to create an enabling environment. Private sector capital formation includes those undertaken by private corporate business (domestic as well as foreign), unincorporated business, cooperatives and households. Public capital formation incorporates those undertaken by communities, NGO's in behalf of communities, regional and federal government undertakings meant to enhance agricultural infrastructure. Capital formation under the various institutional units is driven by different forces. The heterogeneity of institutions and the heterogeneity of factors affecting the respective magnitude and pace of capital formation may necessitate looking into determinants of capital formation separately for each institution. Factors at work on household capital formation might not be entirely same as those working on private corporate businesses, although there could be commonality to a large extent. Moreover drivers of private and public capital formation are different while the two groups of capital formation interact as determinant of one another, which means simultaneous causation.

7.1 Public capital formation in agriculture

Agricultural growth requires technological research and rural infrastructure which are public goods in nature. Provision of such public goods rests on the public sector as the private sector will not involve itself since it cannot capture the gains from such investments. In Ahluwalia and Rangarajan (1986) as cited in Dhawan and Yadav (1997), total public investment of the economy as a whole is an endogenous variable which depends on savings in the public sector and market borrowings by the public sector. In view of the structure of expenditure in the Ethiopian budget, public capital formation in agriculture at time t is expected to be determined by factors such as public debt, total capital budget availed in the economy, revenue receipts from agriculture at the previous time ($t-1$), agricultural gross domestic product at time $t-1$, public capital formation in agriculture in the previous period ($t-1$), the political orientation(political regime dummy).

Capital budget in the economy serve as sources of funding for public capital formation in agriculture. The higher the capital budget of the government the higher the funds available for capital formation in agriculture.

Public debt (PD)

The role of public debt may be seen from two aspects; public borrowing may serve as the other source of public investment in agriculture or public debt could be a deterrent to capital formation as debt serving could divert resources away from investment.

Revenue receipts from agriculture (RA)

Agricultural tax and land use tax revenue are the nearest public resources available for agricultural public investment. The higher the revenues the higher will be the likelihood of enhanced investment in agriculture.

Agricultural gross domestic product at time t-1($GDPA_{t-1}$)

Agricultural GDP is associated with the public capital formation in agriculture as the higher the agricultural GDP is likely to influence public expenditure on agriculture.

Public capital formation in agriculture in the previous period (t-1)($PACF_{t-1}$)

Investments in the previous period by public institutions in agriculture influence public capital formation in the current period dictated by the need to continue already started activities or by dictates of new needs engendered by historical achievements.

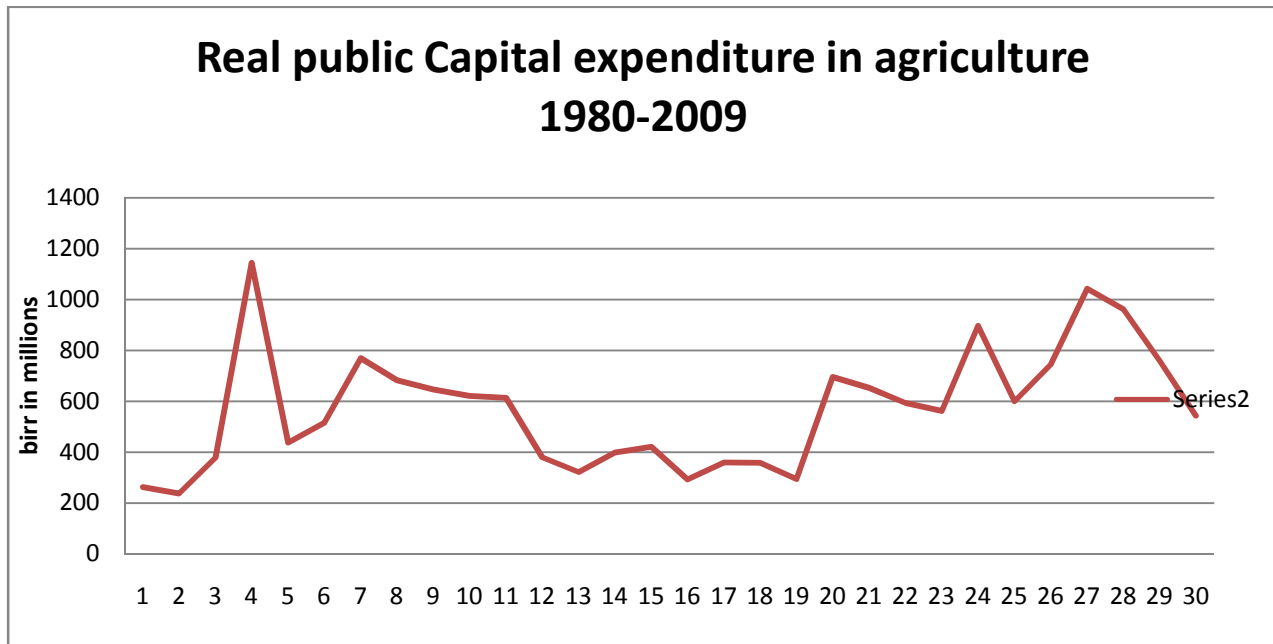
Econometric model of the determinants of the level of public investment was planned to be specified for estimation using panel data analysis (Fixed Effects model) with regional data compiled from regional records on capital formation. The effort, however, was thwarted by inadequate data of determinants on regional level. Hence a time series data on national level that was available for the past 30 years was used in the regression. The right hand variables actually tested were government deficit, one year lagged agricultural revenue, one year lagged agricultural GDP, one year lagged agricultural public investment, capital budget, time in years, regime dummy. The regression results indicate that the coefficients of most of the regressors are insignificant except the time trend and regime dummy. The regime dummy indicates that real average public investment in agriculture has

been less under the current regime while the overall trend is positive. The trend in the past 29 years is better shown by a graph below. As shown in the graph year 12 is the change over to the new regime. There was a general decline in the past 7 years, including the 11th year and later a general rise from low beginnings from the 12th year onwards. The data seem to tell that the driver of public capital expenditure in agriculture is political decisions rather than economic factors prevailing in the country.

Tab 17 Real public expenditure on agriculture

year	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
agricap	263.2	237.8	378.6	1144.3	438.1	515.3	769.6	683.5	645.8	620.8	614.0	379.4	321.7	398.3	421.7
year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
agricap	292.9	359.9	358.6	294.1	695.5	653.0	593.6	561.8	897.2	599.7	744.2	1042.2	962.0	758.2	542.7

fig 14



7.2 Determinants of Capital formation by households and Private businesses

Most of the drivers of capital formation of private businesses and household are believed to be same as economic actors generally make decision towards maximizing economic gains under the constraints they face. The analysis of determinants of capital formation *in* agriculture by private businesses ideally requires data on farm land size , the prospect of high net income, the prospect of capital gains, output in earlier period, the environment the business finds itself in terms of the prevalent business conduct and uncertainty , ease of entry from other walks of life, credit / loan availability and interest, land cost, the ease for acquisition and transferring of assets, price of and demand for products, the state of complementary public investment, rainfall and quality of the natural environment, rural labor availability, changes in factor prices, changes in complementarities of capital assets. Most of these factors are quantitative in nature while some of them are qualitative. The qualitative aspects are necessary as the quantitative ones to fully capture and understand the investment environment and the overall economic situation that constrains, induces or stimulates the moves of economic actors. The decision to invest by households, as economic gain motivated actors, like that of private businesses, is a function of similar factors.

In the absence of survey data particularly designed to investigate factors affecting private capital formation, this study relies on the researcher's understanding of the state of things to hypothesize the most relevant determinants of agricultural capital formation in Ethiopian context. The prominent determinants are hypothesized as farm land size, farm land use right, credit / loan availability, ease of acquisition of land, and uncertainty. The verbal explanations and arguments supporting the main hypotheses are presented along with other less important factors as follows.

FRONT LINE DETERMINANT FACTORS

Farm land size (FLS)

Agriculture being land using industry, the extent of farm holding is an important precondition for land as well as labor augmenting capital formation particularly those forms of capital which are fixed and scale dependent. Small land holdings are not worth investing on as they do not utilize the capacity of the investment. This means small land holdings make it unnecessary or discourage scale dependent fixed capital formation and hence the smaller the holding the lesser would be the capital formation in agriculture. Small holders with farmland size of a hectare or so per household cannot be expected to invest on labor augmenting capital and technologies as their primary problem is not

shortage of labor. They tend to invest on land augmenting capital and technologies if they get the means. However, the small land size they hold and the small output thereof does not, in many cases, allow investment on land augmentation either. Small farm land size obviates labor augmenting technologies/capital and weakens the ability of reinvestment on land augmenting technologies/capital from own surplus output. In light of this the smallness of farm land sizes stands as the most constraining factor for agriculture in Ethiopia, where farm households holding is fragmented in the range of not more than one hectare on the average. The fact that much of the farm land in the country is in the hands of small holders suggests that there is limited scope to advance agriculture under existing arrangement. The direct implication of this is that greater farm land holding per household is a precondition for meaningful household investment in either land or labor augmenting capital / technologies.

Farm land use right (FLUR)

Prospective investors in agriculture who have the resource and who aspire to work with existing small holders or who have the capacity to substitute smallholders by larger scale operation that allows fixed capital formation face a restrictive land use right. Fixed capital formation requires secured ownership or use-right for extended period. The prospect of using the fixed investment up to the end of its life time is a necessary condition for deciding to invest. Absence of such security dissuades the investment decision as the individual would opt for better areas of investment that allow extended period of reaping the returns on investment than agriculture. The existing system of land use-right perpetuates small holder agriculture with little prospect of substitution by or cooperation with capable investors that require extended land holding and secure use-right directed to a transition to larger scale operation with more and more fixed capital formation. The institutional set up does not make land as legally accepted means for borrowing and as a means of further accumulation of capital. The direct implication of this fact is that without institutional changes that discourage fragmentation and encourage consolidation, capital formation doesn't seem to change for the better.

Credit / Loan availability (CL)

Farm households or business persons that have the determination to be engaged in agriculture, having the necessary knowledge and information in conducting the business, may lack in sufficient financial resources that are required to purchase the capital equipment and inputs. They need credit

or loan. The higher the probability of getting loans the higher will be the number of investors or the higher the magnitude of investment in agriculture. Coupled with small holder nature of agriculture, the unfavorable land use-right and institutional set up credit remains a big constraint for capital formation in agriculture.

Ease of acquisition of land (EAQL)

Land as an essential factor for agriculture, even if own fund, loan or any other non land resource that enables acquisition of land exists, difficulty in acquiring land in terms of time and other transaction costs could be a serious constraint that retards capital formation in agriculture. Time taking, bureaucratic and doubtful procedures lead not only to heavy transaction costs but also erode confidence and discourage investment.

Uncertainty (Un)

Like any investment, capital formation in agriculture depends on the investment climate. If the degree of uncertainty in prices, government policies and macroeconomic stability predominates, the pace of capital formation gets retarded. Land related regional and federal government policies seem to be not consistent and sufficiently favorable for private investment, particularly for domestic investors.

OTHER DETERMINANT FACTORS

Prospect of higher net income (NI)

Private businesses, big or small, are driven by the profit motive. If costs are high and farm product prices are low the prospect of getting real net income is low and hence investing in agricultural capital is not rewarding. Expected high prices of farm products induce investment in agriculture as the prospect of increased net income is high. Capital formation in agriculture at time t can be conceived as varying with real price ratios of farm products to farm inputs (P_p/P_i) observed at $t-k$ where k is lags 1,2, 3or simply the terms of trade of agricultural products and industrial inputs to agriculture.

Farm Output in earlier period (QAG)

Capital formation in agriculture comes partly from savings from output in the earlier period. The higher the output of a farm, the higher would be the prospect to save. Savings would constitute one of the sources of capital formation in agriculture itself, though they could also be allocated for other priorities. Capital formation in agriculture in time t could thus be conceived as a function of output in earlier period $t-k$, where k denotes lag periods in years.

Prospect of capital gains (CG)

Capital goods are stores of value in addition to their use in generation of income or as factors of production. The availability of markets for already invested capital on land and the prospect of gaining out of those sales provides confidence in investing as fixed capital.

Ease of entry from other walks of life (EOE)

Investment resources in agriculture originate from within and from without agriculture. If agricultural savings and other contributions from agriculture are sources of investment from within, savings from other sectors find their way to agricultural capital formation if there exists ease of entry to agricultural business. The easier the entry to agricultural business the higher will be the capital formation in agriculture due to capital flows from without.

Interest (I)

Interest on loan influences the decision of the investor to invest in agriculture. Higher interest rates, at least theoretically, necessitate investment in projects that have higher rates of return only. The higher the interest on loan the lesser will be the capital formation in agriculture.

Ease to transfer assets (ETA)

Before individuals commit their resources in agricultural capital formation they are likely to weigh the possibility of transferring the assets to others if adverse circumstances happen. At times investors may face situations that force them to leave agricultural investment for good and if the investment is simply to be a sunk cost it would be a loss. If initial evaluation of the situation from the point of smooth exit possibility by transferring the assets is not favorable investors may decline from investment in the first place.

Growing Demand for products (DP)

Demand for agricultural products initiate derived demand for factors of production, i.e., labor, land and capital. Growing demand for agricultural outputs leads to derived demand for capital in agriculture. Growing demand for agricultural products originates from growing population, growing income, government consumption and government investment.

The state of existing complementary public investment (CPI)

Private investors' decision to invest depends on the state of complementary public investment already in place. Public investments on rural roads, rural electrification, extension services, public water control and irrigation schemes, etc encourage private investment in agriculture. The level of public expenditure in agriculture is a variable that influences private capital formation in agriculture.

Public subsidy (PS)

The presence or the absence of public subsidy to agriculture affects private costs and benefits as a result of which capital formation in agriculture is influenced in turn.

Rainfall and quality of the natural environment (RNE)

As a natural resource based industry, agricultural investment is influenced by the quality of natural resources and environmental services. Deteriorating natural environment on the one hand seems to discourage investment in agriculture as costs of agriculture become heavy, while on the other hand agricultural capital formation will be necessitated by the short supply of natural services to compensate the meager natural endowment. Which influence dominates has to be empirically tested.

Rural labor availability (RLA)

The use of land augmenting capital in agriculture necessitates the use of more labor. Private capital formation in agriculture is subject to the availability of wage labor. Wage labor is particularly crucial in the peak sowing and harvesting seasons. The inadequate availability of agricultural labor discourages particularly land augmenting capital formation in agriculture. The non availability of adequate labor manifests itself by high and growing wages. The inadequacy of availability of labor or the higher agricultural wages, the lower will be the capital formation in agriculture.

Changes in complementarities of capital assets (CCCA)

The other factor that necessitates capital formation in agriculture is change in complementarities of capital assets in agriculture. Investment in land augmenting capital, say the use of fertilizers, improved seeds and chemicals necessitates the use of irrigation technology and mechanized equipment to cope up with increased demand for water and labor.

A survey of private businesses is necessary to gather the respective data on these variables for an appropriate analysis. The survey has to incorporate firms, individuals and households already engaged in farming, and firms and individual business people who are not in agricultural business.

8. POLICY IMPLICATIONS

The findings of this study indicate that the annual per holder gross capital formation is low, which is in the order of 1000 birr. Considering the predominance and backwardness of the small holder agriculture, the stock of capital per agricultural household is extremely low by any standards. As such the prominent capital related characteristics and accompanying problems of agriculture in Ethiopia are:

- low farm level capital use such as: low fertilizers and chemicals, farm machinery and equipment transport and storage facilities
- low infrastructures such as irrigation systems , rural roads, crop clinics, Soil analysis, veterinary services, agri- consultancy services, Credit and finance services

This state of agriculture requires the reconsideration and formulation of policies towards promoting capital formation through: consolidation of land and through coordinating the cooperation of business and smallholder.

The use of low fertilizers and chemicals, the absence of modern farm machinery and equipment, low transport and storage facilities that affect post harvest activities are manifestations of low level capital availability in small holder agriculture, which are outcomes of underlying fundamental factors.

The main factor smallholders possess, which is of paramount importance in agricultural investment nexus, is the land under their possession. The farm land is the real asset for farmers that can be used to open up opportunities or to grab opportunities when they appear. Individuals with capital are likely to be attracted to agriculture as increase in population and demand for food push relative food prices up. Derived demand for farm land will also rise thereby opening the opportunities for smallholders who possess land. Innovating the institutional setting that determine the relationship of the smallholders with those who have the capital to invest on the land may have to be revisited if investment is to sustainably proceed with a solid foundation of private incentive. Introducing a regulatory environment that allows private capital to migrate to agriculture to work with smallholders from within the country requires: provisions for consolidating land from a group of smallholders in the neighborhood so that scale economies are achieved, risk insurance coverage and legal protection. Private investors may go with larger flow of fertilizers, farm machinery, equipment and new technologies to the small holder if the rights to work with a group of smallholders and sharing the gains from such arrangement are legally acknowledged and protected. Studies decomposing the relative contributions of factors and inputs to output, and further in value creation, should guide the legal framework that stipulates the apportioning of benefits. Institutional innovations, with a focus to farm land use and benefit apportioning, are relatively low cost interventions on the part of stakeholders (government, nongovernmental institutions, and development assistance groups) to direct private interest towards effecting sustained investment in small holder agriculture from within the country. This seems to be one important area for consideration as it overcomes problems associated with land fragmentation and at the same time benefiting the smallholder.

Infrastructural facilities such as irrigation systems, crop clinics, soil analysis laboratories, veterinary services, agri- consultancy services, and credit and finance services would likely be attractive businesses if there exists an institutional setting with a credible promise of creating a vibrant agricultural sector. These infrastructural facilities will flourish if smallholder agriculture is giving way to more consolidated and larger scale farming infused with investment, and demand for these services becomes a reality. The prior existence of these infrastructural facilities is also an important condition to engender vibrant agriculture. The driver of sustained existence of such facilities is private interest, which requires conducive environment to hatch. The conducive environment is the provision the institutional arrangement and the regulatory framework permits. Legal and financial

guarantees from transgression and losses on the one hand and coordinating with complementary investments are important undertakings to be initiated by government and other stakeholders. Providing information and coordinating complementary investments with the necessary guarantee may serve a crucial role to realizing viable agriculture that enjoys economies of scale that may not be realized otherwise. To this effect, prior path breaking technical feasibility studies could be made for demonstration purposes on commercial irrigation facilities, crop clinics, soil laboratories, and create initial incentives to private investors to venture. Such incentives would be initial subsidy until the scale of operation allows them to stand on their feet afterwards.

The attraction of capital from outside agriculture to the small holder agriculture was the policy focus of the above discussion. Facilitating and enhancing reinvestment from own capital is the other direction of policy focus. Capital formation from own production is closely associated with agricultural revenue of households. Securing agricultural revenue in turn is negatively affected by volatile prices unfavorable to farmers, effects of long value chains between farmers and consumers where farmers are not the major beneficiaries, low information on market prices, qualities and quantities, lack of farmers long term market partnership with traders, low level of forward markets and assured prices. The removal or reduction of these problems mainly requires the provision of accurate and timely information to all. Access roads and communication facilities are the concomitant requisites with information. The success in attracting investors in input provision as well as for the supply of infrastructural facilities will take care of many of the market related constraints such as formation of forward markets and the prevalence of competitive prices for the farming community. For example the operation of financial intermediaries will avail credit and insurance for large number of agricultural traders.

9. BUSINESS MODELS AND INSTRUMENTS OF POLICY INTERVENTION

The challenges posed to agriculture in Ethiopia are fragmented farms with low farm level capital, weak infrastructure and institutions from the production side and historically the involvement of long chain intermediaries in the forward value chain, which prevents farmers from securing a reasonable price for their products and the recurrence of volatile prices. The demand side problems seem to weaken in recent years, to the advantage of agricultural surplus producers, as food prices are rising without relapse.

The main source of agricultural extension services is government, the efficiency of which might be doubted. The predominant reliance on government for provision of extension services and infrastructural facilities has to give way to newer approaches. What is needed is an environment that allows or makes it possible for many other players to invest in the agricultural sector. The situation calls for judicious effort in reorganizing the appropriate institutional set up, adequate infrastructural facility, and favorable links in the value chain required for agricultural development. Introducing and strengthening business models that involve input agencies, large agri-business houses, agri-processing firms involved in contract farming, non-government agencies, ICT based agricultural service providers, financial agencies, agri-consultant, farmer organizations and farmers' co-operatives along with government agricultural departments is of paramount importance.

The study identifies, for further feasibility studies, relevant business models applicable in Ethiopian environment that are likely to remove existing constraints from production and marketing side of agriculture. The business models are meant to address agricultural constraints of:

- low farm level capital use such as: low fertilizers and chemicals, farm machinery and equipment transport and storage facilities
- low infrastructures such as irrigation systems , rural roads, crop clinics, Soil analysis, veterinary services agri consultancy services, Credit and finance services,
- Volatile prices unfavorable to farmers such as long value chains between farmers and consumers low information on market prices, qualities and quantities, lack of farmers long term market partnership with traders, low level of forward markets and assured prices

9.1 Modalities to increase farm level capital use

With the legal framework in place the following modes of cooperation between investors (small or big)with small holder farmers may be initiated.

- Contiguous farm plot possessors could jointly rent the land and secure the priority of employment on the farm, whereby investors get adequate land size and the right to decide what to grow, where and when to sell and at what price to sell.
- Small holders contribute land and raw labor and investors contribute modern inputs and skill with a joint decision what to grow, when, where and at what price to sell while the benefits and risks are shared proportionally to the contribution.
- Small holders take the responsibility of producing with input supplied on credit basis from investors who entered in to a contract agreement to take the produce at predetermined prices in a forward market. The small holder producer agrees on the crop of his/her choice with the investor who wishes to supply the inputs in return for which he /she receive the products.

In all the above modalities either the businesses on consolidated land or small holder farmers joining their fragmented land would be equipped with the necessary inputs while all the actors, constrained by the legal arrangements, would receive their due.

9.2 Modalities to overcome low infrastructures

With the legal framework and incentive structure worked out, the following modes of operation of infrastructural services in agriculture may be initiated.

- Establishment of private irrigation water providers who take the responsibility of availing water for sell on demand, maintaining and running the system up to the farm site. Service providers will have to be protected against defaults in paying fees through some sort of insurance scheme that the government is a party.
- The establishment of other services would follow similar approach so that the service providers will not end up losers from initial difficulties and smallholders will have access to such important infrastructural facilities which they could not have them otherwise.

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Public capital in agriculture and correlates

Public capital in agriculture	Govt deficit	agri gdp-t-1	agr revenue t-1	gov't capital budget	agri capital formed t-1	year	political regime
237.8	-16.6017	27887.7	252.5	1103.7	263.2	1981	0
378.6	-12.958	29210.85	248.00	1206.5	237.8	1982	0
1144.3	-16.9151	28152.4	358.0	1657.4	378.6	1983	0.0
438.1	-31.7246	31979.7	232.0	2984.3	1144.3	1984	0.0
515.3	-19.0887	27968.4	249.0	1691.4	438.1	1985	0.0
769.6	-20.8766	22127.0	175.3	2272.3	515.3	1986	0.0
683.5	-17.7144	25672.0	159.5	3001.5	769.6	1987	0.0
645.8	-15.2648	30487.9	185.4	2737.6	683.5	1988	0.0
620.8	-17.899	29644.4	189.6	2624.5	645.8	1989	0.0
614.0	-21.7338	29949.9	195.5	3513.1	620.8	1990	0
379.4	-23.0408	31540.4	193.3	2188.5	614.0	1991	0.0
321.7	-17.0046	33171.2	134.9	1592.9	379.4	1992	1.0
398.3	-12.6042	32263.6	115.7	1103.5	321.7	1993	1
421.7	-8.81695	34220.3	8.2	2016.4	398.3	1994	1
292.9	-12.5807	32971.1	104.8	2700.3	421.7	1995	1
359.9	-7.27366	34088.7	99.4	3176.5	292.9	1996	1
358.6	-8.56237	39091.3	127.3	3583.7	359.9	1997	1.0
294.1	-3.70718	40435.0	160.6	4280.3	358.6	1998	1.0
695.5	-4.5501	35914.6	196.1	3049.2	294.1	1999	1.0
653.0	-8.63843	37286.5	197.5	2496.2	695.5	2000	1.0
593.6	-10.8888	38106.7	207.3	3103.5	653.0	2001	1.0
561.8	-10.1002	41774.2	225.5	3685.4	593.6	2002	1.0
897.2	-15.1538	40990.8	238.2	3411.2	561.8	2003	1.0
599.7	-9.57923	36693.0	211.0	4491.7	897.2	2004	1.0
744.2	-8.02745	42910.6	196.7	5742.7	599.7	2005	1.0
1042.2	-6.80938	48721.9	214.3	7347.3	744.2	2006	1.0
962.0	-5.28389	54036.7	205.9	7359.8	1042.2	2007	1.0
758.2	-3.39907	59142.3	125.0	7770.4	962.0	2008	1.0
542.7	-3.25793	63578.9	106.7	10042.7			
		67623.1					