

Trend Analysis in Budgetary Allocation to Crop Research Program: The Case of EIAR

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Abstract: The study estimated trend equations for budgetary allocation on crop research program in Ethiopian Institute of Agricultural Research between 1992 E.C and 2008 E.C. Secondary data in the form of capital budget allocation records were obtained from Planning, monitoring and Evaluation directorate of Ethiopian Institute of Agricultural Research. Results from the fitted trend equations showed that the capital budget allocation to the research program were high and significant at 1 percent. Annual compound growth rate of expenditure on the sector was also high (12% in crop research program, 6% in cereal crops research sub program, 14% in POFCSRSP, 28 in AMBCRSP and 21% in PPRSP). And insignificant growth rate were exhibited by the CSTCSRSP. Furthermore, the fitted quadratic equations in time variable showed the significant acceleration in budget allocation growth on crop research program. the cuddly della instability index come with the result of moderate instability in CRP, CRCSP, POFCSRSP and PPRSP, while a high degree of instability index in CSTCSRSP and a severe instability in AMBCRSP. Further during the study period 0.8 million birr were utilized per varietal development by the research program. The mean difference test depicted that, there is a significant budget allocation difference between PASDEP I and GTP I. The mean budget allocated during GTP I was less than the mean budget allocated during PASDEP I by 36.4 million birr.

Keywords: CSTCSRSP, AMBCRSP, CRP, CRCSP, POFCSRSP and PPRSP.

1. INTRODUCTION

The Crop Research program is one of the 8 research programs of the Ethiopian Institute of Agricultural Research. It is mandated to develop and adapt environmentally sound technologies, comprising improved high yielding, good quality, pest and disease resistance varieties and improved crop management practices. By this time the research program coordinates and facilitates 29 national commodities under six national case teams. The budget for crop research depends on the total amount of the budget EIAR receives annually from the government and the amount and/or percentage of utilization of allocated budget during the past fiscal year. And also, the amount of loan and/or grant the process received is taken into consideration to allocate the government approved capital budget during budget distribution among the research processes within the institute. On the other hand, after allocating the capital budget to each research processes, the research processes in general crop research process in particular allocate the amount of budget it received to each case teams by taking into consideration: previous budget allocation trend, its budget utilization performance, and the amount of loan and/or grant the case team have. The same procedure is followed by the case teams to allocate the budget approved to each projects under the case team. And commodity leaders also allocate the budge they received from the national case team to each activities and centers where the activities are going to be implemented. They allocate the budget to the centers according to the amount of activities they have and the place where the research centers exist. But there is no clear scientific process for allocation of core research funds to research processes in general and research centers in particular in EIAR. The crop research process has the first priority/focus in the budgetary allocation in the institute. during the 2008 fiscal year of Ethiopia the research process has been allocated 30% of the capital budget of the institute. With this backdrop the present study aimed at assessing the trends, instability and growth of budgetary allocation to the crop research program in Ethiopian Institute of Agricultural Research and measuring the crop research program performance using the varietal output as an indicator from 1992 E.C to 2008 E.C.

2. METHODOLOGY AND DATA

Secondary Data from Ethiopian institute of Agricultural research Planning, monitoring and Evaluation Directorate and Procurement, finance and property management was used. The analysis of this study is based on different econometric models and descriptive statistics. The secondary data on the allocation of budget for the crop research program (CRP) and the sub programs under crop research program (Cereal crops research sub program (CRSP), pulse, oil and fiber crops research sub program (POFRSP), Horticulture crops research sub program (HRSP), Coffee, spice and tee crops research sub program (CTSRSP), Aromatic, medicinal and bio fuel crops research sub program (AMBRSP) and plant protection research sub program (PPRSP) by the national government (from 1992 E.C to 2008 E.C) and external grants awarded and expenditures to the CRP, was collected from different years annual report of the institute and data base of planning, monitoring and evaluation directorate. Semi-log trend function was fitted to the data following the procedure of Gujarati to find out the trend and estimate the growth rate allocated budget to the crop research program in Ethiopian Institute of Agricultural Research.

$$\ln y_t = a + bt + e$$

Where y = dependent variable (allocated budget to the crop research program); t = trend over specific period, b = coefficient of trend; \ln = natural logarithm; and e = error term. Here, the coefficient of trend (b) measures the constant proportional or relative change in y for a given absolute change in the value of time t . Therefore the compound annual growth rate (CAGR) can be taken as:

$$\text{CAGR} = \exp(b) - 1$$

Instability in the budgetary allocation can be measured by different methods, such as the coefficient of variation (CV), dispersion, Cuddy Della Valle Index (CDI), etc. The present study applies the Cuddy Della Valle Index for measuring the instability. This Index first de-trends the given series and gives a clear direction about the instability. The use of coefficient of variation as a measure to show the instability in any time series data has some limitation. If the time series data exhibit any trend the variation measured by CV can be over-estimated. As against that Cuddy-Della Valle index attempts de trend the CV by using coefficient of determination (R^2). Thus it is a better measure to capture instability in the allocation of budget. A low value of this index indicates the low instability.

In this study, the instability in the allocated budget was estimated using Cuddy-Della Valle index (CDVI).

The estimable form of the equation is as follows:

$$I = CV * \text{SQRT}(1 - R^2)$$

Where: I is the instability index in percent, CV is the coefficient of variation in percent,

R^2 is the coefficient of determination from time trend regression adjusted by the number of degree of freedom.

In this study instability will be characterized based on the following rules of thumb (ISNAR, 1997):

$$0 < S < 0.10 * \mu, \text{ mild instability}$$

$$0.10 * \mu < S < 0.5 * \mu, \text{ moderate instability}$$

$$0.5 * \mu < S < \mu, \text{ high instability}$$

$$S \geq \mu, \text{ severe instability}$$

where S is the standard error of the estimated trend equation and μ is the sample mean. the estimated trend equation was $y_t = a + bt + e_t$, where y is the allocated budget to the crop research program, t is time, a and b are the population regression parameters estimated by ordinary least squares and e is the disturbance term

In order to confirm the existence of acceleration or deceleration or stagnation in budgetary expenditures, quadratic equations in time variables are fitted to the data for the three periods following the procedure adopted by Demenongu, T.S, Ukolhol F.Y, and Daudu,S., 2013 as follows:-

$$\ln y_t = a + bt + ct^2$$

According to the above specification, the linear and quadratic time terms define the secular path in the dependent variables (y), while the quadratic time term (t^2) allows for the possibility of acceleration or deceleration or stagnation in growth during the period of study. Significant positive value of the coefficient of t^2 confirms significant acceleration in growth, significant negative value of t^2 confirms significant deceleration in growth while non significance of the coefficient of t^2 implies stagnation or absence of either acceleration or deceleration in the growth process.

There are various statistical techniques to compare two or more mean values, which generally go by the name of analysis of variance. But the same objective can be accomplished within the framework of regression analysis (Gujarati, 2006). to determine the significant difference between the allocation made to the crop research program during the PASDEP I 1998 to 2002 and 2003 to 2007, the study used the following model:

$$y_i = a + b_1D_1 + u_i$$

Where, y_i = budget allocation of research sub program i

$$D_1 = 1 \text{ if it is PASDEP I}$$

$$= 0 \text{ otherwise}$$

3. RESULTS AND DISCUSSION

Levels and Trends in the allocation of budget to the crop research program (1992 E.C to 2008 E.C):

It can be revealed from the figure (fig 1) that the total allocated budget to the program reached more than 80 million birr during 2008 E.C from 14.3 million birr during the 1992 fiscal year. Budget allocation to the CRP averaged 28, 983.86 birr annually between 1992 to 2008, registering its highest allocation of about 81,508.92 birr in 2008 and the most least allocation of about 10,554.62 birr in 1997.

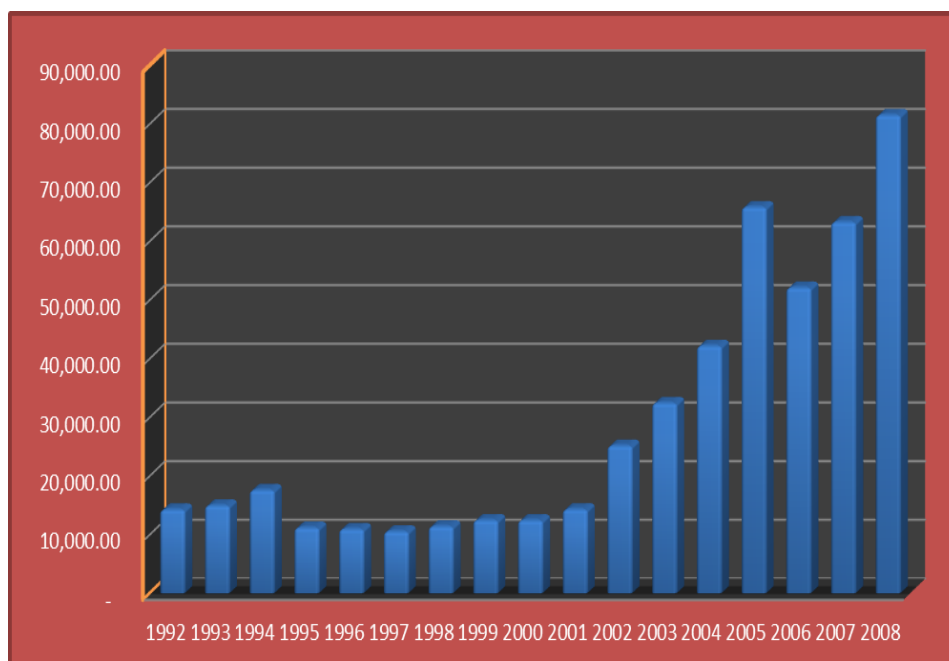


Fig 1. Trends in budgetary allocation of CRP, 1992 E.C to 2008 E.C

Table 1.1. indicates the annual percentage change and proportion of budgetary allocations to CRP by the institute between 1992 and 2008. The result shows that the proportion of the allocation to CRP decreased from 50% in 1992 to 30% in 2008. If we take a look at the budget year of 2001, there is an increase of government budget allocation to the institute than the allocation during 2000, but proportion of budget allocation to CRP by the institute decreased from 22% in 2000 to 17% in 2001. On the other hand the table shows that the changes in allocation from year to year varies. For instance, positive percentage change is exhibited except during 1995, 1996, 1997, 2000 and 2006. Percentage change in allocation changed from 4.6% in 1992 to 22.4% in 2008.

Table 1.1 Annual percentage change and proportion of budgetary allocation to CRP, 1992-2008

Year	Percentage allocation	Percentage change in allocation
1992	50	-
1993	27	4.6
1994	40	14.9
1995	27	(57.5)
1996	28	(2.0)
1997	25	(3.8)
1998	23	7.5
1999	21	8.5
2000	22	(0.3)
2001	17	13.1
2002	29	43.1
2003	36	22.4
2004	31	23.1
2005	38	35.9
2006	27	(26.4)
2007	30	17.7
2008	30	22.4

Compound growth rate and instability analysis:

The compound growth rate analysis on the budgetary allocation to CRP across the period from 1992 E.C. to 2008 E.C shows that, the annual budget grew at a compound rate of 14% per annum at 1% of significance. On the other hand, during the study period the crop research program recorded a moderate instability (44%) of the capital budget funding.

If we take a look at each sub programs of crop research program, cereal research sub program has been allocated about 100,421,269 birr during the study period which is 23% of the budget allocated to crop research process. Pulse, oil and fiber crops research sub program takes the lion share in the allocation of the budget. It was about 108,824,470 birr which is 24% of the total budget allocated to the crop research process. The horticulture crops research sub program, the coffee, tea and spice research sub program, aromatic, medicinal and bio fuel crops research sub program and plant protection research sub program have been allocated 103,400,953 birr, 56,323,739 birr, 28,381,846 birr and 47,324,814 birr which constitutes about 23%, 13%, 6% and 11% of the budget allocated to the crop research process during the study period. Table 1.2 depicts that the percentage change in the allocation to cereal crops research sub program changed from 0.7% in 1993 to 1.5% in 1994 and dropped as low as to -36% in 1995. It then increased to as high as 68% in 2002 and dropped to -23% in 2006 then increased to 16% in 2007. On the other hand, the percentage change in the allocation to the pulse, oil and fiber crops research sub program it shows a positive change during the study period except during 1995, 1996, 1999 and 2006 and also the percentage change in the allocation to the horticultural crops research sub program shows the positive change during the study period except during 1995 and 2006. But, it shows a negative percentage change in the allocation to the coffee, spice and tee crops research sub program during the study period except during 2002 to 2005 and 2007 budget year. Aromatic, medicinal and biotechnology crops research sub program exhibits a negative percentage change in 1993 E.C, 1995 E.C, 1996 E.C, 1999 E.C and 2006 E.C, while that of the plant protection research sub program experienced a negative percentage change in 1995 E.C, 2000 E.C, 2001 E.C and 2006 E.C.

On the other hand, the share (proportion) of the allocated budget to the cereal crops research sub program decreased from 47% in 1992 E.C to as low as 12% in 2007 E.C. This is because, grant amounts from different donors to some activities of cereal crops research program was increasing from time to time. So, the allocated budget to the research sub program from the national government has been decreased and the share inclined to the pulse, oil and fiber crops research sub program and the horticulture crops research sub program. The allocation to the pulse, oil and fiber crops, horticultural crops research sub programs exhibited an increase in the share of the allocation of the budget by crop research program

from 20% in 1992 E.C to 33% in 2007 E.C and 15% in 1992 E.C to 32% in 2007 E.C respectively. And also the share of the allocation to the coffee, spice and tea crops research sub program increased from 14% in 1992 E.C to 17% in 2006 E.C and decreased to 9% in 2006 E.C. Aromatic medicinal and bio technology crops research sub program took 2% of the allocation share in 1992 E.C and increased to 11% in 2006 E.C then decreased to 6% in 2007 E.C. The plant protection research sub program has been allocated 5% of the budget allocated to the crop research program in 1992 E.C and increased to 17% in 2001 E.C then the share decreased to 11% in 2007 E.C.

Growth rate and Instability in budgetary allocation analysis:

Table 2. showed the computed annual compound growth rate of budgetary allocation on crop research program and the sub programs under the crop research program across the period from 1992 E.C. to 2007 E.C. And the allocated budget grew at a compound rate of 12% per annum at 1% of significance. The pulse, oil and fiber crops research sub program, Horticultural crops research sub program, Aromatic, medicinal and bio energy crops research sub program and plant protection research sub program showed a positive significant (significant at 1%) compounded annual growth rate of 12%, 14%, 28% and 21% respectively. But, the coffee, spice and tee crops research sub program exhibited an insignificant positive compounded annual growth rate per annum. On the other hand, Table 3 depicted that during the study period the crop research program recorded a moderate instability (47%) of the capital budget funding. And also only the coffee, spice and tee crops research sub program and the aromatic, medicinal and bio fuel crops research sub program exhibited high instability (59.2%) and severe instability (71%) respectively, while cereal crops research, pulse, oil and fiber crops research, horticultural crops research and plant protection research sub programs incurred a moderate instability of 41%, 49.8%, 40.7% respectively.

Estimated quadratic equations:

The estimated quadratic equations in time variable for budgetary allocation on crop research program is shown in Table 2. The coefficient of t^2 for the study period was statistically significant. This result confirms for the significant acceleration in the growth of budgetary allocation on crop research program in Ethiopian Institute of Agricultural Research. In other words, the growth in the allocation of budget on crop research program for the periods under review has been accelerating. This suggests that the crop research program has been consistently given attention in terms of funding by the institute. Where as if we take a look at each sub programs of the crop research program

Mean difference Test:

And the frame work of the regression analysis indicated that there is a significant difference between the allocated budget of PASDEP I and GTP I. The mean budget allocation to the crop research program during PASDEP I was 51165774.61 birr, while the allocation during GTP I was 36385706.07 less from the allocation during PASDEP I.

Varietal output:

A number of national and international research institutions are involved in the development and release of improved crop technologies in Ethiopia. And this study focused in measuring the crop research program of the Ethiopian Institute of Agricultural Research performance in varietal output between the periods 1992 and 2007 Ethiopian budget year. Between 1992 E.C and 2007 E.C 540 crop technologies have been released and registered by the research program in total. It was increasing at a compound annual growth rate of 19% (significant at 1%) releasing/registered technologies. The resulting ratio of total budget allocated in million birr to number of technologies released/registered was 0.8:1 , suggesting that total research expenditure was 0.8 million birr per technology produced. In 1992 it was about 2.4 million birr per technology produced and increased to 7.8 million birr in 1993 and decreased to 1.1 million birr in 2007.

Table 1.2: Annual percentage change of budgetary allocation (1992 E.C to 2007 E.C)

Budget year in E.C	Cereal	POF	HORTI	CTS	AMB	PP
1992						
1993	0.724	16.665	7.852	-9.449	-9.449	32.566
1994	1.503	26.287	41.635	23.253	23.253	17.745
1995	-35.589	-42.773	-42.000	-29.976	-40.843	-11.305
1996	-5.465	-2.802	1.597	-2.859	-21.586	13.902

1997	-11.610	4.362	4.742	-28.675	178.136	1.510
1998	-1.758	7.568	15.381	-2.517	45.361	23.048
1999	-2.240	-9.007	5.631	5.877	-3.406	92.258
2000	4.193	6.189	10.479	-3.027	10.186	-24.347
2001	6.712	21.827	7.172	-96.376	15.354	-3.271
2002	68.121	48.686	67.117	9527.760	55.193	134.684
2003	13.148	47.298	39.506	30.314	49.898	11.648
2004	22.826	34.197	22.900	24.210	82.285	31.565
2005	57.684	56.256	77.017	45.408	80.197	23.596
2006	-22.499	-17.300	-25.443	-5.729	-0.429	-48.849
2007	16.428	172.014	181.075	5.669	6.107	73.014

Table 2: Growth rate in budget allocation

	CRP	Cereal	POF	HORTI	CTS	AMB	PP
CAGR	12*	6	12*	14*	12	28*	21*

* significant at 1%

Table 3. Estimated coefficient of variation as a measure of funding instability

Research program/sub program	Estimated coefficient of variation in percent	Classification
CRP	46.7	Moderate instability
CRSP	41	Moderate instability
POFRSP	49.8	Moderate instability
HORTIRSP	48.3	Moderate instability
CTSRSP	59.2	High instability
AMBRSP	70.6	Severe instability
PPRSP	40.7	Moderate instability

Table 4 Estimated quadratic equation in time variables for the allocation of budget on crop research program for the period between 1992 E.C and 2007 E.C

Program/subprogram	a	B	c	R ²
CRP	16.8	-0.2	0.017	0.904
	(91.031)*	(-3.622)	(5.971)*	
CRSP	9.1	-0.3	0.018	0.843
	(51.695)	(-5.184)	(6.572)	
POFRSP	8.4	-0.2	0.018	0.905
	(43.180)	(-3.722)	(6.079)	
HORTIRSP	7.9	-0.1	0.015	0.911
	(39.368)	(-2.072)	(4.675)	
CTSRSP	8.5	-0.5	0.035	0.424
	(9.248)	(-1.948)	(2.456)	
AMBRSP	5.5	-0.3	0.016	0.940
	(19.862)	(0.678)	(3.755)	
PPRSP	6.5	0.059	0.008	0.901
	(23.823)	(0.792)	(1.779)	

t-values in parenthesis

"*" significant at 1%

4. CONCLUSION

Using Semi-log model the study documents that the budgetary allocation to the crop research program was increasing significantly at a compound growth rate of 12%, while cereal research sub program exhibited a positive compounded growth rate of 6%, Pulse, oil and fiber crops research program, Horticultural crops research sub program, Aromatic, medicinal and bio fuel crops research sub program and plant protection research sub program incurred a growth rate of 14%, 28% and 21% compounded per annum, while Coffee, spice and tee crops research program showed no significant growth during the study period. On the other hand, using quadratic equations in time variable, the study have confirmed acceleration in capital funding on the crop research program in Ethiopian Institute of Agricultural Research. This is an evidence of a little bit of financial commitment to the program, which is the major focus of research program in the Institute (EIAR). further this study documented that, cereal crops research sub program, pulse, oil and fiber crops research sub program, horticultural crops research sub program and plant protection research sub program exhibited a mild instability of capital budget funding, but the coffee, spice tee crops research sub program was incurred a higher instability and aromatic, medicinal and bio fuel crops research sub program recorded a severe instability index in the capital budget allocation.

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