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DETERMINANTS OF MAIZE IMPORT SUBSTITUTION IN ESWATINI (SWAZILAND)

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Abstract

Eswatini has been importing maize to meet the domestic demand gap according to the available literature. Government has tried to formulate and implement policies that are envisaged to boost local production to catalyze the process towards self-sufficiency of maize production with reduced importation of the product. However, there is limited research related to the trends in production and importation to serve as measures of import substitution. Therefore, this study was aimed at estimating import substitution ratios and determinants of the import substitution. The study used time series data from 1981 to 2019. The methods used in analysis included trend analysis, ADF-unit root test for stationary, and ARDL and ECL models to estimate short-run and long-run relationship between import substitution ratio and other factors used in the analysis. The results showed an average import substitution ratio of -0.1728 which is less than

zero indicating that there is no import substitution of maize, thus Eswatini is still dependent on maize imports under the reviewed years. The trend analysis indicate that the highest maize import substitution occurred in year 2019 with a -0.001 import substitution ratio score and the poorest maize import substitution occurred in 1995 with an import substitution score ration of -0.462. The significant determinants of maize import substitution in the long-run included agricultural production index and in the short-run included foreign direct investment, real effective exchange rate, agricultural production index, maize production index, maize price index, population, gross domestic product and food imports. The study recommends that the country needs to implement pricing policies to encourage local production of maize in order to move towards self-sufficiency.

Keywords: Import substitution, ARDL, ECM, Maize Imports, Maize production, Eswatini

INTRODUCTION

Import substitution started in the 1950s due to many formerly colonialized third world countries seeking independence as they attempted to exchange what had been formerly imported in consumer goods to be locally produced instead (Irwin, 2020). This strategy included established markets for the new industries, government protection of the new industries through bans on competitive imported goods, concessions on sales tax and customs duties in inputs and a reduction in the relative importance of foreign trade leading to reduced vulnerability to externally induced fluctuations. Import substitution though allowing for growth of the industrial sector had some major drawbacks, one of them including companies being more capital intensive as imported equipment was cheap which lead to wide spread unemployment and rapid population growth. (Meilink, 1982; Basu, 2005; Irwin, 2020). In Eswatini, there have been some efforts to promote import substitution in areas where the country envisages greater potential to solve issues of self-sufficiency in agricultural production, including maize subsector. This was thought to improve on food security in the country (Myrzaliyev et al., 2020).

Maize is the staple food of Eswatini and it is the main crop grown by the majority of the smallholder farmers, grown mainly for subsistence purposes (World Food Program [WFP], 2018). The crop is the most predominant crop grown on Swazi National Land (SNL), as it occupies 80 percent of total area under crop production under the SNL (WFP, 2018). On SNL, maize is often produced by smallholder farmers with no access to mechanization and production is affected by climate change, soil acidity, and lack of mechanization and the increasing costs of production (FAO, 2015). The reviewed literature shows that the local maize production is not sufficient to meet the local demand as shown in Table 1 (WFP, 2018, Singh et

al., 2020, NMC, 2017). In order to meet the maize demand gap, Eswatini imports maize mainly from South Africa. There has been an observable increase in maize imports from US$29,744,000 to US$37,644,00 between year 2019 and 2020 indicating an increment of 26% in the value of maize imported (Knoema, 2021). To achieve self-sufficiency in maize production in Eswatini, import substitution is thought to be an option as observed in other countries. Ultimately, this will further improve on food security of the country. Importation of maize from South Africa increases the government import bill which would otherwise be invested in other public sector for economic growth and development. The government of Eswatini is striving to achieve self-sufficiency in maize production through Agro-input subsidies programs (ministry of Agriculture (MoA), 2020). Furthermore, the National Maize Corporation (NMC) is striving to motivate farmers to increase production by offering attractive maize prices in a bid to lead the country to self-sufficiency in maize production and resultantly improved food security. Efforts that lead to the country's self-sufficiency promote import substitution (Mhlanga, 2019).

Table 1. Eswatini's Maize self-sufficiency (2007-2017)

Year	Consumption	Production	Self-sufficiency (%)
2007/2008	118 500	67 000	56.5
2008/2009	118 500	83 090	70.1
2009/2010	104 000	75 000	72.1
2010/2011	113 000	84 868	75.1
2011/2012	113 000	83 000	73.5
2012/2013	116 418	81 934	70.4
2013/2014	116 418	101 041	86.8
2014/2015	131 220	81 623	62.2
2015/2016	132 781	33 460	25.2
2016/2017	134 342	84 344	62.8

Source: National maize Corporation (NMC), 2017

This study intended to estimate factors affecting the government of Eswatini's efforts of maize import substitution. Eswatini has been and is currently a net maize importer mostly from South Africa. Dependence of the country on maize imports yet the crop is regarded as a staple food exposes it to high risks of food insecurity and high import bill. In two decades, the country is still struggling to be self-sufficient in maize output to guarantee food security for its citizens through policies and programs. Therefore, purposefully the study was aimed at identifying the drivers of maize import substitution that can guide researchers, policy makers, and government to develop best strategies leading to Eswatini maize output Self-sufficiency.

METHODOLOGY

The study used time series data extracted from UN-FAO and World Bank from 1981 to 2019. The crude measure of import substitution, the growth rates of imports and domestic production were measured. If domestic production increase faster than imports, then import substitution is taking place (Saleem, 1992. The import availability ratio computes the difference between the ratios of import availability during different periods of time and if the change is positive then import substitution is taking place. If M^1 and M^0 are the maize imports during the current and base year and if S^1 and $S^0$are the total availability during current and base year and X^1 and $X^0$are domestic output $S^1=M^1+X^1$ then if

$M^0/S^0 - M^1/S^1 >0$: There is import substitution to the extent of the change in the value of the ratio. (Saleem, 1992).

The trend analysis of import substitution was presented using the data from the import substitution ratio and graph. Additionally, ARDL model was used to determine the factors affecting import substitution in Eswatini. The model was empirically expressed as:

$$Yi= \beta_0 + \beta_1X_1+ \beta_2X_2 + \beta_3X_3+ \beta_4X_4 + \beta_5X_5+ \beta_6X_6+ \beta_7X_7+\beta_8X_8 + \beta_9X_9 +Ei$$

All the variables were expressed as natural logarithms as;

$$LnYi= \beta_0 + \beta_1 LnX_1+ \beta_2 LnX_2 + \beta_3 LnX_3+ \beta_4 Ln X_4 + \beta_5 LnX_5+ \beta_6 LnX_6+ \beta_7 LnX_7+\beta_8 LnX_8 + \beta_9 LnX_9 +Ei$$

Where,

LnY= Natural Logarithm of Import Substitution is the dependent variables affected by the multiple independent variables

β_0=constant

β_1 to β_9-=coefficient of independent variables

The independent variables will be:

LnX_1= Natural Logarithm of Foreign direct investment which represents shares owned by other countries or businesses in Eswatini.

LnX_2= Natural Logarithm of Total food imports being the total quantity and value of food imported by Eswatini.

LnX_3= Natural Logarithm of Agricultural production index (API) this shows the relative level of Agricultural production for each year in comparison with a base year.

LnX_4= Natural Logarithm of Maize production index (MPI) this compares production of maize in different years with the base year.

LnX_5= Natural Logarithm of Population being the total number of people in the country

LnX_6 = Natural Logarithm of Real effective exchange rate represents the weighted average of a country's currency in relation to an index of other major currencies.

LnX_7= Natural Logarithm of Real GDP an inflation adjusted measure that reflects value of all goods and services produced by an economy in a given year.

LnX_8= Natural Logarithm of Maize imports in volume the quantity of maize imported into the country.

LnX_9= Natural Logarithm of Maize price index compares the prices of maize for different years with the base year.

Ei = Error term.

The study used time series and it is prone to non-stationarity, therefore the first step should include the test for stationarity to avoid spurious regression. Augmented Dickey-Fuller test was used to test for stationarity. Furtherance to that, the Bounds Cointegration Test was used to test the cointegration of variables at levels.

RESULTS AND DISCUSSION

Measures of import substitution

Two measurement methods; Crude measure of import substitution and Import availability ratio were used to assess the maize import substitution. The results of these measurement methods are presented separately.

Crude measure of import substitution

Using this measure, the growth rates of imports and domestic production are used. Import substitution is said to happen if the domestic production increase faster than imports (Saleem, 1992). The study findings yielded that the growth rate of maize production was unstable as shown in Figure 1, though maize production had the most growth in the previous year's regardless of the size of growth. The years with the highest and most notable growth rate of maize production were 1983 with 140%, 1988 with 116%, 1990 with 164%, 2008 with 129%, 2017 with 154% and 2003 with the highest growth rate of 529%. On the other hand, the highest growth rates of imports were noted in 1992 with 56%, 1994 with 78%, 1995 with 78% and 1984 recording the highest growth of 394%. According to this measure, import substitution is taking place. In 1991-1995 the (World Bank, 2002) reports that more people migrated from the rural areas to urban areas in search for work also this was the worst drought ever experienced by the country at that time. This had a huge effect on maize production as households were no longer involved in food production because of migration and drought, which led to imports having a higher growth than production.

In 1998 and 1999 there was a massive decline in use of hybrid seeds following the government decision to stop providing farmers with free seeds, this led to a decline in maize

production (FAO, 2005). Between the years 2000 and 2003, there were many issues as according to a report by (NMC, 2017) which affected maize production. The country recorded many deaths due to HIV/AIDS pandemic and it led to a huge decline in maize production decline. This was compounded by a prolonged dry spell and a heatwave with affected maize crops at the tasseling stage, especially in the Lowveld (FAO, 2001).The biggest rise in maize production noted in 2004 was due to the increased usage of chemical fertilizers combined with farmyard manure by the farmers and also favourable weather conditions that came with plenty rainfall (FAO, 2005).

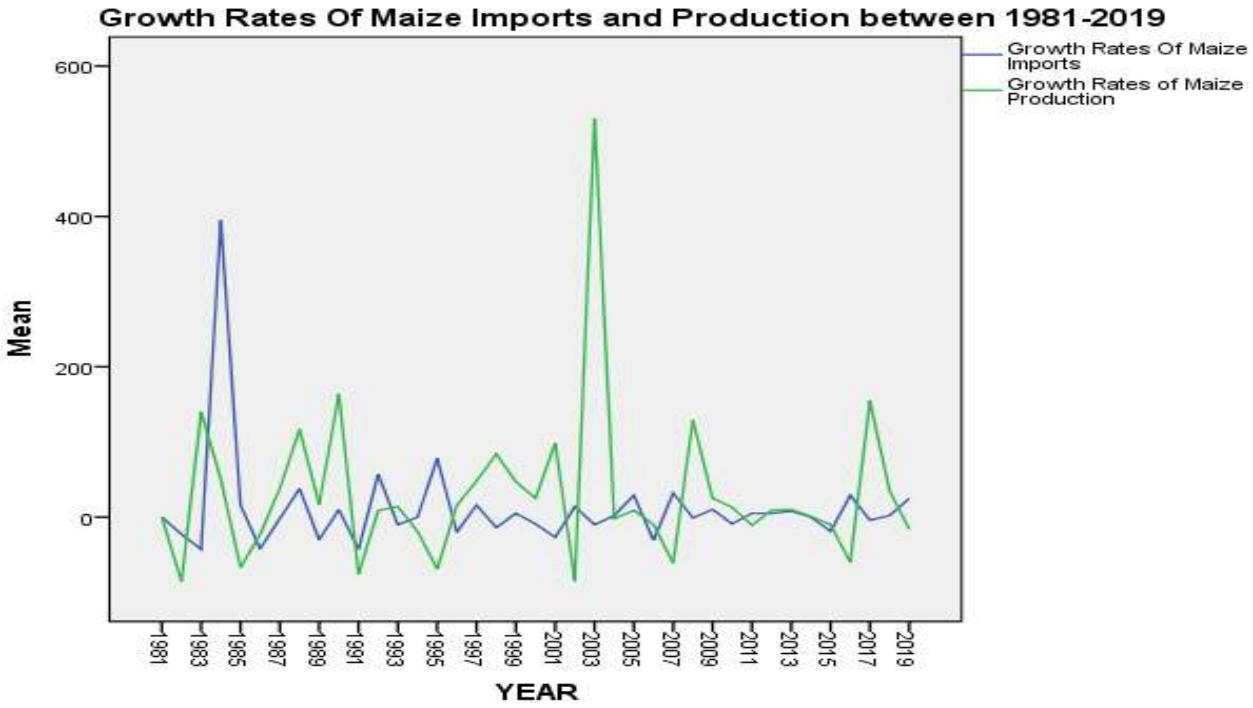

Figure 1: Mean Growth rates of imports and production of maize

Import Availability Ratio

The import availability ratio computes the difference between the ratios of import availability during different periods of time. In the case of a positive change, then import substitution is deemed to be taking place. If M^1 and M^0 are the maize imports during the current and base year and if S^1 and S^0 are the total availability during current and base year and X^1 and X^0 are domestic output $S^1=M^1+X^1$ then if

$M^0/S^0 - M^1/S^1 >0$

Calculating the average ratio using 1981 as the base year and the total averages for both imports and availability gave -0.1728 as the average ratio for import substitution. The result

of the import substitution ratio gave negative figures which according to Padma Desai means that there is no import substitution (Saleem, 1992).

$M^0/S^0 - M^1/S^1 > 0$

$$=\frac{71327}{138966} - \frac{104843.3077}{152815.8718} = 0.5133 - 0.6861 = -0.1728$$

Figure 2 shows the instability of the import substitution ratio, the figures have no constant direction but overall they are all negative meaning no import substitution is taking place. Import Substitution for the different years was decreasing but not at a constant rate or specified rate the decrease was at random the years with the lowest negative import substitution figures were 2001 with -0.0204, 2006 with -0.0206, 2010 with -0.0282, 2015 with -0.0256, 2019 with -0.0014 meaning these were the years closest to reaching import substitution. The years furthest from reaching import substitution were 1985 with -0.4215, 1986 with -0.403, 1995 with -0.462, 1996 with -0.4289, 1997 with -0.4138. The Average of the import substitution ratios was -0.7128.

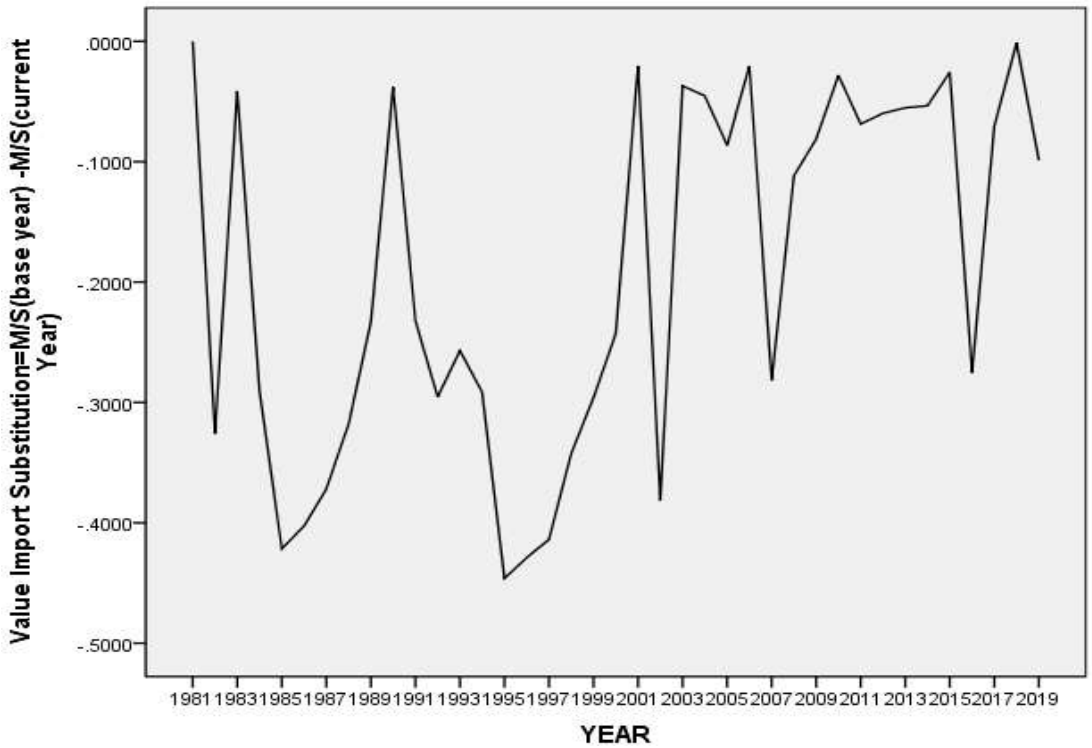

Figure 2: Line graph showing import substitution between the years 1981-2019

Estimating the relationship among the variables

The study presents the ARDL and ECM model results to determine the determinants of maize import substitution. Augmented Dickey Fuller test was conducted to check the stationarity of the data.

ADF unit root tests

The study used the Augmented Dicky Fuller unit root test to test for stationary to avoid sporous regression. The tests results showed that the variables were both stationary and non-stationary. Foreign Direct Investment was the only variable stationary and the others; Population, Import Substitution, Maize Production Index, Agricultural Production Index, Food imports, Exchange Rate, Maize Import Quantity, Maize Price Index were stationary at first difference while Gross Domestic Product was stationary at second difference.

The Bounds Co-integration Test and Diagnostics

After determining that the time series data was stationary at different levels the Johansen co-integration test was no longer valid (Engel, 1987, Johansen, 1990). The variables were stationary at level I (0), after first differencing I (1) and after second differencing I (2) and therefore the Bounds Co-integration Test were conducted (Pesaran, Shin and Smith, 2001).

Decision Criteria for the bounds test states that rejection can be at 10%, 5% and 1% critical level. The decision criteria used was that; Accept if F < critical value for I (0) regressors and Reject if F > critical value for I (1) regressors.

The hypothesis tested was; H_0: There is no co-integration and H_1: There is co-integration.

F = 4.035

t =-2.538

Critical Values (0.1-0.01), F-statistic,

Table 2*: Results of Bounds Test Co-integration*

	| [I_0]	[I_1] |	| [I_0]	[I_1] |	| [I_0]	[I_1] |	| [I_0]	[I_1] |
	| L_1	L_1 |	| L_05	L_05 |	| L_025	L_025|	| L_01	L_01|
k_9	| 1.88	2.99 |	| 2.14	3.30|	|2.37	3.60 |	| 2.65	3.97|

The results presented in Table 2 shows that the model variables were co-integrated because F-statistic is greater than critical value for both upper bound I (1) regressors, hence the null hypothesis is rejected. The time series variables exhibit a long term relationship which implies that the time series are related and can be combined in linear fashion. Therefore, the study will estimate both long run and short run models.

The ARDL and ECM models were used to estimate the both the long-run and short-run relationship between the variables. The study estimated the required lag length to order avoids the spuriousness of ARDL bounds testing approach to co-integration results. The results reported in Table 3 imply that lag order is 4 based on the value of SBIC.

Table 3: Lag length selection

lag	LL	LR	DF	p	FPE	AIC	HQIC	SBIC
0	-2783.59				1E +57	159.63	159.787	160.078
1	-2366.94	833.3	100	0	1.7E +49	141.54	143.227	146.428
2	-2125.8	482.29	100	0	2.8E +46	133.47	136.696	142.806
3	1889.39	8030.4	100	0	9.1e +48*	90.25	-85.4955	-76.4751
4	6694.12	9609.4*	100	0		-362.52	-357.152*	-346.967

Long-run results of the relationship amongst variables

The results presented in Table shows that most of the variables were found to be insignificant . The Agricultural Production Index (API) was found to be positively significant at 5% in the long run. An increase of 1% in API results in an increase of 0.056 units in import substitution which means that as agricultural production increases maize production also increases which decreases the overall maize imports and resultantly the import substitution occurs.

Table 4: Long Run ARDL results of relationship amongst variables

logImportSubstitution	Coefficient	Standard. Error	t -value	P-value
ADJ logImportSubstitution				
L1.	-0.7801450000	0.30743260000	-2.54	0.029**
LR				
logFDI	-0.0000000010	0.00000000236	-0.41	0.689
logFM	0.0000009580	0.00000055100	1.74	0.113
logAPI	0.0558775000	0.02272790000	2.46	0.034**
logMPI	-0.0070728000	0.00416480000	-1.70	0.120
logPopulation	0.0000022100	0.00000275000	0.80	0.440
logER	0.0507362000	0.04903090000	1.03	0.325
logMIQ	-0.0000058500	0.00000440000	-1.33	0.213
logGDP	-0.0005333000	0.00034000000	-1.57	0.148
logMPindex	-0.0031392000	0.00343130000	-0.91	0.382

***, ** and * indicates significant 1%, 5% and 10% respectively.

Short Run results of relationship amongst variables

The study results in Table 5 shows that in the short-run; Import substitution is dependent on Foreign Direct Investment, Food imports, Agricultural production Index, Maize Production

Index, Population, Gross Domestic Product and Maize prize index. A unit change in FDI will cause a 0.0000000019-unit increase in Imports substitution which means that as FDI stimulates the exports of Eswatini it will cause the substitution of maize to occur. A unit change in total Food imports will cause a 0.00000116-unit decrease in Imports substitution meaning that an increase in total food import insinuates that maize imports also increase which will decrease import substitution as production will be lower than imports. A unit change in Agricultural production index will cause a 0.042757-unit decrease in Imports substitution meaning that as agricultural production increases import substitution of maize which should also be increasing will decrease.

Table 5: Short run results of relationship amongst variables

logImportSubstitution SR	Coefficient	Standard Error	T	P>T
Constant	-4.8997	1.51870800000	-3.23	0.009***
logFDI	0.0000000019	0.00000000092	2.11	0.061*
logFM	-0.00000116	0.00000055800	-2.09	0.063*
logAPI	-0.04275700	0.01633470000	-2.62	0.026**
logMPI	0.005815800	0.00207380000	2.80	0.019**
logPopulation	0.000164600	0.00008840000	1.86	0.092*
logMIQ	0.000001640	0.00000211000	0.78	0.455
logGDP	0.000203100	0.00008710000	2.33	0.042**
logMPriceindex	0.003993200	0.0016027	2.49	0.032**

***, ** and * indicates significant 1%, 5% and 10% respectively.

A unit change in Maize Production Index will cause a 0.0058158-unit increase in Imports substitution meaning that as maize production is increasing there will be an increase in the substitution of maize imports, because an increase in production means that maize imports required will decrease. A unit change in population will cause a 0.0001646-unit increase in Imports substitution which means that as the population of Eswatini increases more maize production will occur as, more people are producing which will increase import substitution by 0.0001646 units. A unit change in GDP will cause a 0.0002031-unit increase in Imports substitution meaning that an increase in the countries income will affect the production of maize in a positive way such that imports are reduced as people will be able to afford locally produced maize. A unit change in Maize price index will cause a 0.0039932-unit increase in Imports substitution which means that an increase in prices of importing maize will cause people to buy locally produced maize more which will reduce imports thereby increasing substitution of maize imports.

CONCLUSION

The study findings depicts that maize production in the country is growing but not at the rate where it is enough to cover the required level of domestic consumption demand, hence imports are always needed to cover the lacking areas which are usually higher due to the amounts produced being low. This is shown by the changes in the import substitution ratio which in some years is less negative than others meaning that some year's maize production is closer to substituting imports or at least being at the same level as imports but the continual challenges faced by farmers in maize production which include climate and high prices of inputs derail the growth of the industry and caused sharp drops in the domestic production in the country. The factors determining imports substitution were in the long run not significant except for Agricultural production index. While in the short run almost all factors were significant except for Maize import quantity. The significance of the variables was sadly negligible as it gave numbers way below zero.

RECOMMENDATIONS

In the long Run Agricultural production index was the only determinant of import substitution. Focusing on this the government of Eswatini should improve production related policies and the spread of information about agricultural subsidies such as making rural farmers more aware of the available input subsidies. The availability of extension officers would boost the production as farmers would have easily accessible sources of knowledge and assistance in their immediate vicinity. In the short run the ministry of agriculture should provide extension services and also make government assistance such as tractor hire more affordable for rural farmers. This would have a positive effect on both the agricultural production index and maize production index which would promote the substitution of maize imports. In the short run an increase in population would increase the amount of available labour for domestic production hence the government focusing on reducing mortality rates due to viruses such HIV and Covid-19 by improving the existing health sector through investment into hospital equipment. The government of Eswatini focusing on export based growth would improve Eswatini's currency therefore increasing the exchange rate of lilangeni and prompting more investment into the country. The export focused growth would require an overall increase in Eswatini's domestic production which increases national output and would improves the country's purchasing power. This would make it easier for Eswatini to purchase capital equipment and technology that would address the current problems such as buying improved cultivars, assisting farmers to irrigate and reduce dependence on rain fed agriculture.

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