MARKET INCENTIVES, FARMERS' RESPONSE AND A POLICY DILEMMA: A CASE STUDY OF CHAT PRODUCTION IN THE EASTERN ETHIOPIAN HIGHLANDS

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Abstract

This paper discusses the reasons for and effects of the dramatic expansion of chat production as a cash crop in the Hararghe Highlands of Ethiopia. Despite the Ministry of Agriculture's deliberate attempt to discourage chat production, farmers continue to shift their scarce resources into chat production. Using data generated by a rural livelihood survey from 197 randomly selected households, economic and non-economic factors contributing to the expansion of chat production are identified and its food and nutritional security impact analysed. The case study confirms once more the power of market incentives in encouraging agricultural activity of peasant farmers even in the absence of functional research and extension systems. The case study shows that households producing chat have good food security status and thus the situation presents a policy dilemma: Should the government promote or discourage chat production?

1. INTRODUCTION

Chat (*Catha edulis*) is a perennial tree crop mainly grown in Eastern Ethiopia. The people living in the Horn of Africa and in some Arab countries chew young and fresh leaves of chat as a stimulant. Very little is known about the effect of chat on human physiology. It is however said that chat increases the sugar level in blood and improves blood circulation. This provides energy, which help workers to withstand fatigue and improve concentration of students when they study.

The major production area of chat in Ethiopia is the Hararghe Highlands (hereafter HHs) located in Eastern Ethiopia. It has however been observed that chat production has also been expanding in other regions especially in areas located south of the capital, Addis Ababa. In some areas of the HHs, in

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particular the chat-belt of Alemaya, it was found that the area of cropland allocated to chat is as high as 75% of total arable land (Save the Children Fund/UK, 1996). In our survey area, cropland allocated to chat, ranges from 21% in Kuni (Chiro district) to 54% in Alemaya. It was also observed that the majority of irrigated land is allocated to chat production and in addition chat enterprises consumes most of the scarce organic manure in farm households. It is not uncommon to find farmers diverting part of inorganic fertilizers provided on credit by the Ministry of Agriculture (MoA) for crop production to chat production. Indeed, if Hararghe farmers have to be admired for their indigenous technical knowledge it has to be because of the way they manage their chat fields. Farmers have developed appropriate spacing, defoliation time, other cultural practices, variety selection and disease control methods including use of chemicals such as DDT. All of these were done independently without any government involvement or assistance from farmers' associations.

Both legal and illegal channels are used to export chat. The volume of chat exported legally from the HHs was about 200 metric tons (Mt) in 1948 and reached 1,400 Mt in 1958 (Klingele, 1998). According to the local branch of the National Bank of Ethiopia, the volume and value of chat exports from the region rose from 2, 746 Mt and 30.2 million birr[3] in 1977 to 3, 496 Mt and 114.4 million birr in 1986 (National Bank of Ethiopia, 1986). Ethiopia earned 618.8 million birr in hard currency in the year 1999/2000 by exporting 15, 684 Mt of chat (National Bank of Ethiopia, 2001). Chat had become the second most important earner of foreign exchange next to coffee in 1999/2000 as shown in Figure 1.

The fact that chat production has replaced staple cereals and coffee is interesting for a number of reasons. Unlike coffee and cereals, chat has never directly benefited from research, extension advise and credit service. Besides its alleged effect on human health, the MoA is concerned that the expansion of chat production might have a negative repercussion on food security of households and on foreign exchange earnings of the country. Chat is also been blamed for decreased productivity as people waste valuable working time sitting and chewing it for hours. Empirical evidence is not yet available and it is not clear whether abusing chat is any different from abusing alcohol.

[3] *Birr is Ethiopian currency. 8.7 birr is approximately equal to 1.00 US dollar.*

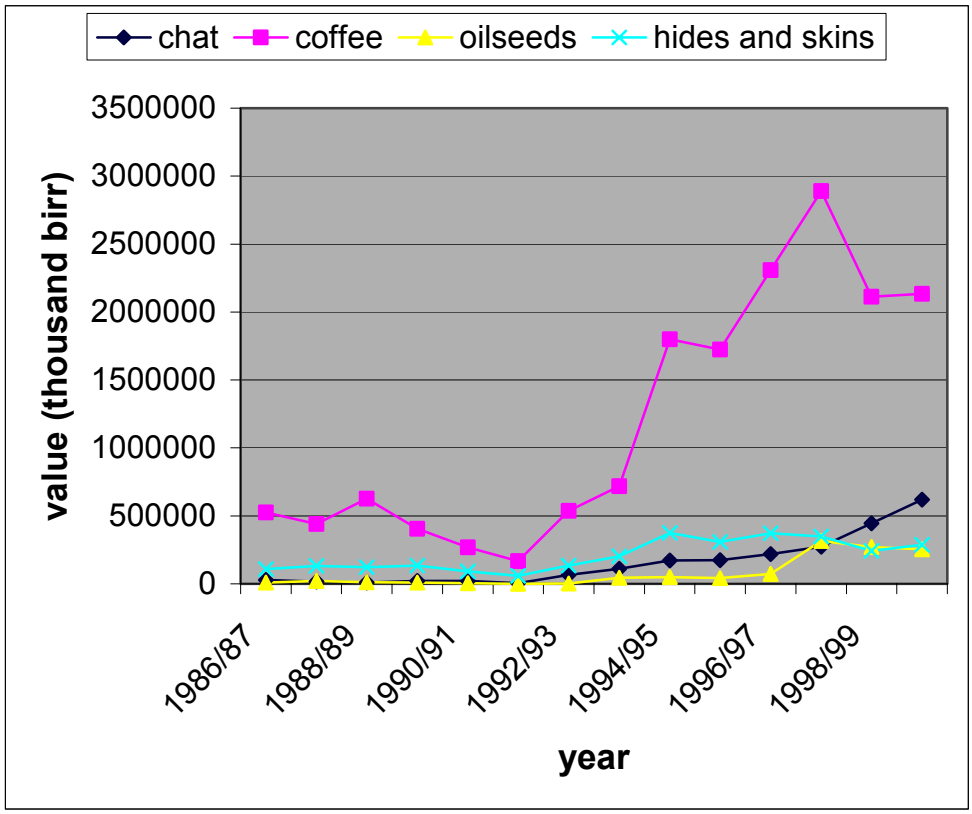

Figure 1: Value of major agricultural exports (in thousand birr)

Source: Developed from data reported by the National Bank of Ethiopia, 2001.

This paper examines the economic and non-economic factors contributing to the rapid expansion of chat production and empirically assesses at household level the income, food security and nutritional impact of growing chat. To our knowledge, there is little empirical evidence on this issue partly because chat has deliberately been excluded from any research agenda in Ethiopia. The only exception to this is a preliminary study conducted by the Ethiopian Institute of Nutrition Studies in the mid 1980s which found that although chat growers income was three times greater than non-chat growers, the nutritional status of preschoolers was the same among the chat-growers and the non-chat growers (Seyoum *et al*, 1986:40).

This paper is organized as follows: section two describes the study area while section three briefly describes the research method followed to obtain the necessary data. Section four and five present the results of the analysis; and finally, section six draws major lessons from the case study and presents a policy challenge regarding the fate of the growing chat sector.

2. STUDY AREA

The study region is located in Eastern Ethiopia south of Djibouti and west of Hargessa town of Somalia. The Ethio-Djibouti railway passes through the region while good air connections exist with Addis Abbaba, Djibouti and Somalia. A fairly good gravel road connects the HHs with neighbouring regions. Sorghum and maize are the staple crops and coffee has traditionally been the single most important cash crop. Chat is replacing coffee in the HHs except in remote and inaccessible areas where coffee retains its importance. The Hararghe highlands' farming economy is furthermore characterised by small and fragmented land holdings caused by increasing population pressure.

3. RESEARCH METHOD

Both qualitative and quantitative data generated from a rural livelihood survey of 197 randomly selected households conducted between mid March 2001 and mid January 2002 form the database for the analysis. Included in the survey were variables related to demography, resource endowment, income and expenditure, and household food security. A once-off anthropometric assessment (age, sex, height) of pre-schoolers (children aged between 6 and 60 months) was also taken from the same households who had pre-school children at the time of the survey (a total of 103 households). The procedure recommended by the United Nations' Sub-Committee on Nutrition (Beaten *et al*, 1990) and Nutrition Guidelines by Médecins Sans Frontières (Arbelot *et al*, 1995) was followed and a public health officer provided technical assistance in the execution of this component of the study.

4. REASONS FOR THE EXPANSION OF CHAT PRODUCTION

There are a number of factors that contributed to the expansion of chat production in the HHs. The first, perhaps the most important, is growing domestic and export markets for chat and improved access to these markets through an improved transport network. The export market is substantial and expanding. This includes countries such as Djibouti, Somalia and some Arab countries such as Yemen. It is also exported to Europe but is banned in Canada and the US. The HHs' location and its superior transport network have played an important role in the expansion of chat since the product has to reach its final destination fresh and therefore fast transport is needed. In the domestic market it is quite evident that chat chewing has become a recreational activity and now also forms part of the culture of the urban youth.

The export price of chat has also been rising since the mid 1970s (Gebissa, 1994, cited in Nega & Degefa, 2000). While chat enjoys a relatively stable price in the world market, coffee suffers from both fluctuating export volumes and prices. Coffee berry disease, the increasing prices of chemicals following the removal of subsidies under the structural adjustment program and declining world coffee prices have all contributed to the decline of the Ethiopian coffee sector. Producing chat has thus become a viable and important alternative to ensure continued cash income. Chat production has the additional advantage because it can be harvested at least twice a year under rain fed agriculture while up to five harvests per year is possible under irrigation. This ensures that households have a well-distributed flow of income.

Another economic reason for the growing interest in chat production is related to its cost of production relative to other competing enterprises. Labour is the most important cost item in the production of chat. Rapid population growth in the HHs has provided enough family labour or cheap hired labour for labour-intensive production, making chat production feasible. In the second place, chat is hardly affected by any disease except some damage by insects that can easily be controlled by locally developed methods at little or no cost. The need for minimum off-farm inputs makes chat production compatible with poor farmers' limited access to credit. Table 1 gives an overview of the relative profitability of chat in the HHs economic systems.

Table 1: Income possibilities for staple food and major cash crops in the HHs

	Food crops		**Cash crops**			
	Sorghum	**Maize**	**Coffee**	**Chat**	**Potato**	**Onion**
Yield/ha – rainfed (kg)	700-1200	1000-1300	400-700	700-1000	5000-7000	3500-8000
Gross income/ha (birr)	560– 1800	700- 1820	4800- 11200	16100-23000	7500-10500	9100-20800
Production cost	Low	Low	Low-high	Low	High	High
Average net income	Low	Low	Medium	High	Medium	Medium-high
Risk factor	Low-medium	Low-medium	High	Low	High	Medium-high

Soure: Klingele, 1998.

Economic considerations are very important in peasant farmers' resource allocation decisions, however, there are other equally important factors that should be accounted for to understand their complex decision-making process. Risk is one such factor. Although the average precipitation in the HHs is generally considered adequate for viable rainfed agriculture, its amount and abnormal distribution exposes crops to frequent weather hazards (Storck *et al,* 1997). Intercropping is one of the widely used indigenous strategies to manage risks associated with weather, diseases and pests. Chat is less affected by these risks and perfectly fit for intercropping unlike coffee. Chat is usually intercropped with sorghum, the crop preferred for its drought tolerance. In order to describe the extent of its resilience against the vagaries of weather the local people say: "Sorghum dies seven times and resurrects seven times".

Finally, the topography of the HHs coupled with cultivation of steep hillsides and diminishing vegetation covers make soil erosion a critical problem in the highlands. Although land tenure insecurity is generally believed to discourage investment in soil improvement in the country (Rahmato, 1994), Hararghe farmers practice different soil conservation methods as a survival strategy. The farmers have always chosen soil and water conservation methods that take little land out of cultivation although the improved conservation methods promoted by the extension service take more land (Sutcliffe, 1995). Thus, planting of chat hedgerows on sloping land is preferred to the other methods by the farmers as an economically attractive conservation method that at the same time generates some income.

5. EFFECTS OF CHAT PRODUCTION ON THE WELFARE OF HOUSEHOLDS

5.1 Income effect

As the information presented in Table 1 implies, chat not only generates the highest revenue but also involves much lower production costs and risks. From this it follows that income of chat growers should be higher as shown in Table 2. One should however keep in mind that the reliability of income data in subsistence farming where record keeping is limited is always questionable. To deal with this problem we have recorded proxy indicators of income such as livestock ownership, value of farm implements, expenditure and ownership of houses with iron sheet roofs. Again the data shows chat growers are significantly better off than the non-growers in all the proxy indicators, validating the income data.

Table 2: Means of income associated variables for chat growers and non-chat growers in the HHs

	Chat growers	Non-chat growers	F	Significance
Cash crop income	2499.95	444.84	34.56	.000
Total expenditure	2506.95	1226.57	18.201	.000
Value of farm implements	914.62	223.51	4.122	.044
Livestock owned in tropical livestock unit	2.72	1.70	19.7	.000
Percent with iron-sheet cover house	58.7%	40.6%		

Source: Computed from own survey data.

5.2 The household food security impact of chat production

The effect of cash crop production on food security and nutrition of farm households is less straightforward than the income effect discussed above. Whether increased income from cash crop production is translated into improved food security and nutritional status of households depends on a number of factors including expenditure behaviour, gender relations, availability and prices of grain, etc. Cash crop production can result in deterioration of food security and nutritional status of households in situation where expansion of cash crop production increases prices of staples or where male-headed households mainly spend increased income on non-food items (Von Braun *et al*, 1991; Kennedy *et al*, 1992; Von Braun & Kennedy, 1994).

From the qualitative and quantitative information presented in Table 3, it seems as if chat-growers are not just more food secure but also more food self-sufficient than the control group. Nevertheless, the table doesn't give sufficient information that enables one to make any conclusion regarding the relationship between food security status of the households and growing chat.

In order to test this intuitive interpretation, a logit maximum likelihood model was developed and estimated to rigorously explore the relationship between chat growing and food security status of the households. In addition to 'chat production' other explanatory variables included in the analysis were: gender, family size converted to adult equivalent, cropland area per adult equivalent, livestock ownership, access to extension, vegetables (the most important cash crop next to chat) production and participation in off-farm/nonfarm activities.

Table 3: Food security indicators for chat and non-chat growers in the HHs

	Chat growers	Non-chat growers
Level of self-sufficiency in staple crop		
Produce surplus	15.2%	11.4%
Self-sufficient	25.6%	11.4%
Self-insufficient	59.2%	77.1%
Years of food shortage in the past 5 years		
Never faced food shortage	44.8%	35.7%
One year	17.6%	17.1%
Two years	19.2%	18.6%
Three to five years	18.4%	28.6%
Net grain available per adult equivalent for consumption (kg)	255.2	214.2
Don't sell grain	56%	44.3%

Source: Own field survey.

We opted for logistic regression based on theoretical considerations and the nature of our dependent variable that assumes the value of one (food secure households) or zero (food insecure households) based on food security status of the households. Although there are alternative probability functions, such as probit probability function, that can accommodate dichotomous dependant variables, the logit probability function is usually preferred for its mathematical simplicity, flexibility and ease of interpretation (Aldrich & Nelson, 1984; Gujarat, 1998).

In this study, net cereals available for consumption at household level is used as a proxy indicator of the food security status of the households. Quantity of cereals available for consumption at household level was estimated from cereals produced, cereals bought and cereals sold, i.e., net cereals *available for consumption = (cereals produced + cereals bought + cereals received as gift/transfer) – (cereals sold + gift/ transfer given),* ignoring the amount stored since households rarely store cereals beyond the beginning of the next cropping season in the study area. Data on cereals harvest and transaction was collected periodically from the end of one cropping season (March, 2001) to the beginning of the next harvest season (January, 2002).

Emana (2000) citing FAO (1999) and Ethiopian Institute of Nutrition Studies (Agren & Gibson, 1968) indicates that cereals constitute 74% of the calories of the Ethiopian rural households and estimates, based on the assumption that 1 kg of cereals provides 3 400 kcal, that 236 kg of cereals is needed per adult equivalent per year to meet the recommended minimum calories of 2 200 kcal

per day. The same quantity was used as a cut-off point to distinguish the food secure households and the food insecure households.

Table 4: Model specification for determinants of food security of households in the HHs

Variable	Expected sign	Variable description
Gender of household head	+	Dummy, male-headed household = 1
Consumption unit	-	Family size converted to adult equivalent
Cropland size per adult equivalent	+	Cropland in hector/adult equivalent
Have access to extension	+	Dummy, favourable response = 1
Livestock ownership	+	In tropical livestock unit
Grow chat for market	+	Dummy, at least 10% of total cropland area planted with chat = 1
Grow vegetables for market	+	Dummy, favourable response = 1
Participate in off/non farm activities	?	Dummy, favourable response = 1

The results are provided in Table 5. All the variables included in the regression have expected signs. The goodness of fit of the model is high with 75.4% of the cases correctly grouped and in addition the Hosmer and Lemeshow's test shows that the model fits the actual observations fairly well. Participation in off-farm/non-farm activities and access to extension are insignificant in predicting food security status. This corresponds with the limited scope of the non-farm economy in the survey region. The positive sign of 'access to extension' shows a potentially positive contribution of extension to food security through increased productivity. Livestock ownership is positively and significantly correlated with food security status of households, i.e, it increases the probability of a household being food secure. Oxen provide drought power that enables timely land preparation and increase yield. Cows provide milk that is directly consumed or sold on the market to purchase grain during deficit.

All the other variables, except family size, are significant and positively related to food security status of households. Based on selected observations we expected that chat production contribute to an improved food security status of households. Our results reported in Table 5 confirm this expectation with the finding 'chat production' increase the probability that a household will be food secure. However, it is clear from the results that land per adult equivalent and the production of vegetables make a far greater contribution to household food security status.

Table 5: Logistic estimation of determinants of food security status of households in the HHs

	B	Wald	Significance
Cropland area per adult equivalent	4.623	3.630	.057
Livestock owned	.530	11.098	.001
Grow chat for market	1.040	5.262	.022
Grow vegetables for market	1.910	11.538	.001
Participation in off-farm/nonfarm	-.303	.622	.430
Have access to extension	.046	.009	.923
Consumption unit	-.581	17.230	.000
Male-headed household	.837	3.501	.061
Constant	-.982	1.034	.309
Sample size	195		
-2 Log likelihood	192.657		
Percent of correct prediction	75.4		
Hosmer and Lemeshow test	$X^2 = 6.938$		0.593

Source: Own data and analysis.

Field observation also indicates that the decrease in land allocated to staple crops as a result of the expansion of production of chat is more than offset by increase in yield through adoption of land productivity enhancing technologies financed by proceeds from chat sales and other cash crops. Descriptive analysis shows that 74.4% of chat growers used chemical fertilisers for food crop production, whereas only 24.3% of non-chat growers used chemical fertilisers. Besides, 56% of chat producers didn't sell grain for cash (Table 3). The sorghum harvest season coincides with the period of high prices for irrigated chat. Those who are not self-sufficient in grain production buy grain from the market immediately after harvest at low prices for immediate consumption and reserve what they produce to consume when grain prices are at their seasonal high (usually in the pre-harvest season commonly known as 'season of poverty'). Grain availability on the markets has never been a problem since the HHs are located close to one of the major surplus grain producing regions, the central highlands. We can, therefore, conclude that expansion of chat production has improved chat-growing households' production-based as well as income-based entitlement to food.

5.3 The effect of chat production on the nutritional status of pre-schoolers

A multivariate linear regression analysis and binary logistic regression analysis were run to empirically establish the effect of chat production on pre-schoolers' long-term nutritional status. Measuring the nutritional status of pre-school children (6–60 months) is, together with other relevant demographic and health related variables, commonly used as a proxy for the nutritional status of the respective households. Height and age data of pre-schoolers was converted to a Z-score[5] and the internationally accepted cut-off point (-2Z or 2 standard deviations) was used to distinguish the malnourished and the non-malnourished pre-schoolers. Similar methods are employed elsewhere (Von Braun *et al*, 1991; Kennedy *et al*, 1992; Von Braun & Kennedy, 1994). Kirsten *et al* (1998) used both OLS and logistic regression model, and Garrett & Ruel (1999) used two stage least square in addition to OLS to address simultaneity bias in analysing the factors influencing nutritional status. Unfortunately, from the 197 sample households included in the livelihood study only 103 had pre-schoolers during the time of the survey. The sample size is obviously low for such study (the previous study by the Ethiopian Institute of Nutrition Studies used a sample size of 389).

Although these limitations should be considered while interpreting the results, the analysis indicates that chat production has a positive effect on pre-schoolers' nutritional status that is significant at less than 2% (OLS) and at less than 7% (logit model). The number of livestock units is also positively and significantly related to pre-schoolers' nutritional status at less than 2% (OLS) and at less than 10% (logit model). Dairying is particularly important in this case. Children are given priority in milk consumption. Women commonly control income from the sales of milk and other milk products such as butter. This increases the probability that the proceeds from selling milk spend on goods and services that improve children nutrition and health. All the other non-significant variables have theoretically expected signs except birth-order of children. Participation in off-farm/non-farm activities coefficient changed from a negative in OLS to a positive in logistic model, but insignificant in both. R^2, the measure of overall fit of the OLS model, is comparable to the other studies (*cf.* Garrett & Ruel, 1999). The logit model predicted about 71% of originally grouped cases correctly. Furthermore, prevalence of malnutrition among preschoolers, school age children and adolescents (less than 18 years

[5] *Z score* = $\frac{\text{Observed value – Median reference value}}{\text{Standard Deviation of reference population}}$

Height for age value expressed in Z-score measures retardation in skeletal growth that is a reflection of nutritional inadequacy and unhealthy environment.

old) taken together is 37.5% in Alemaya (highly chat dominated area), 45% in Sabale (moderate chat growing area) and 50% in Kuni (where chat is not important) lending support to the results of the regression analysis.

Table 6: OLS and Logistic estimation of determinants of long-term nutritional status of preschoolers in HHs

	OLS estimation (y= height for age Z)		**Logistic estimation (y =1 when the child is not malnourished)**	
Variables	B	Sig	B	Sig.
(Constant)	-2.477	.000	-1.238	.254
Child less than/equal to 24 months	-1.824E-02	.886	-.260	.298
Birth order of the child	7.708E-03	.895	.127	.268
The child is sick two weeks prior the survey	-.509	.109	-.531	.363
Have access to pure drinking water	.103	.365	.525	.345
Mother has formal education	.136	.452	.162	.631
Male-headed household	-.331	.376	-.079	.911
Adult equivalent	-7.858E-02	.429	-.298	.135
Tropical livestock unit owned	.208	.014	.333	.080
Grow chat for market	.729	.011	1.010	.069
Grow vegetable for market	.258	.347	.172	.738
Participation in off/nonfarm activity	-2.316E-02	.931	.434	.399
Religion	.339	.305	.945	.108
F	.223		-2 Log likelihood	117.48
R^2	.229		Percent of correct prediction	70.9%

Source: Own data and analysis.

6. CONCLUSIONS AND A POLICY DILEMMA

The case study demonstrated that subsistence farmers respond to market incentives in terms of improved access to market opportunities and better prices more than is conventionally believed. The most important lesson that policy makers can learn from the chat case study is that the provision of research and extension services on its own is insufficient to get smallholder agriculture 'moving'. Delivering research and extension service will only bring the urgently needed quantum leap in the increase in production and productivity to feed mouths growing at unprecedented rate in Ethiopia and elsewhere in the Sub-Saharan Africa if and only if it is combined with creation

of market incentives. At the heart of the miracle of the Asian Green Revolution is the success of Borlaug in winning better prices (comparable to world prices) for producers through his persuasive power both in India and Pakistan (see Borlaug, 1988).

Expansion of chat in the Hararghe Highlands of Ethiopia has mainly been driven by market incentives. Shifting the scarce land and other resources to chat production has significantly increased rural income, positively contributed to food and nutrition security of the households and soil conservation. It has also become an additional source of the badly needed foreign exchange earnings for the country. According to a study conducted in the mid 1980s, about two–third of farmers in the Hararghe Highlands did not have enough land to meet their minimum nutritional requirement (Adnew & Storck, 1992). A major shift to chat production and using proceeds from chat sales to finance adoption of improved technology and fill the grain deficit has prevented or postponed the total collapse of livelihoods in this part of the world.

The policy dilemma for government is vested in two possible alternative policy scenarios. One option is to accept chat production as a major contributor to livelihoods of the households and to use some of the tax revenue it generates to support this enterprise. A second option is to continue considering it as a 'drug' and perhaps enforce a shift to other cash crops as the previous government attempted in vain. The second option is the most difficult, and perhaps most frightening one since it requires creating alternative livelihoods that can sustain people's life in such a land scarce area and where the population is still growing despite the level of hardship. Few non-farm job opportunities will exist in the absence of the chat sector since chat processing, packaging, transporting and distribution is currently the single most important source of alternative employment and income. The policy makers should also be reminded that the serious health effects of smoking are scientifically well established yet production and marketing of cigarettes has continued to protect income and employment. Indeed the health impact of chat is not yet well established and likely to be tolerable!

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