

Perceptual Production Behavior of Tobacco Growers in Bangladesh – A Multivariate Analysis

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ABSTRACT

In this paper an attempt has been made to analyze perceptions of Tobacco growers in the framework of multivariate statistical technique namely, Multidimensional Scaling (MDS) in association with some basic statistical tools. We have used the form of Attribute MDS opposite to Non-attribute MDS. Research results suggest that economic factors mainly impact upon propensity to devote to Tobacco growing. Such factors are credit facilities, net profit, input availability and less risk of production and marketing. We can draw one solid inference that tobacco growers have positive attitude towards tobacco cultivation and such attitude bears close link with availabilities of associated factors like loan/credit facilities, land and inputs availability. But, statistical test results as well as regression results very strongly suggest that for health reasons, environmental hazards and food security reasons, tobacco cultivation should be diverted to other food and non-food crops.

Keywords: Contract farming, Production Behavior, Tenureship, Multidimensional Scaling, Stress and Scree plot

INTRODUCTION

Bangladesh has basically an agrarian economy. In addition to contributing to uplift various dimensions of livelihood of people, agricultural sector keeps substantial share to GDP. According to the latest statistical yearbook (2008), total agriculture accounts around 25% of GDP. Among all manufacturing sectors, Tobacco manufacturing sector contributes 0.36% to total value added to GDP.

Tobacco cultivation is massively practiced in the north-western part and Chittagong Hill Tracts region of Bangladesh. Tobacco cultivation is basically 'Contract farming' with a large business organization or multinational Company. Tobacco cultivation in the form of contract *farming* has a significant impact on

the economic, social and environmental condition of the locality and the country as a whole. The majority of the impacts including the externalities have negative or adverse effect on the economic, social and environmental conditions. The major concerns include:

- Tobacco cultivation creates health hazards.
- Profits made from tobacco cultivation concentrated in the hand of a limited few.
- A very common phenomenon in the tobacco cultivation is land grabbing.
- Majority of tobacco labourers are children.
- Tobacco farmers in Bangladesh earn very little.
- Opportunity cost of household labour cannot be offset by profit earned.
- Food cum other cash crops appear to prove to be more profitable than tobacco growing in Bangladesh.
- Tobacco has negative impact on environment and chemicals used in tobacco cultivation pollute soils and water.
- Heavy deforestation happens because of replacing trees by tobacco cultivation.

A BRIEF LITERATURE REVIEW ON TOBACCO RELATED RESEARCH

Not much research work on tobacco is available particularly in Bangladesh. In the paper the author advocated against tobacco cultivation. The reasons identified are spoiling soil fertility due to heavy use of chemicals, health hazards, exploitation of farming labor, less net return. This study also identifies people's willingness to shift to other crops.

Another research has been traced to be done by Julia (1990). It has been done on social and taxonomical issues. The researcher has found that tobacco plant is one of the significant plants and has huge impact on social and economic lives. The paper also asserts that tobacco is one of the most controversial issues to-day having addictive toxin.

Gururaj (2004) conducted a research in India. The main purpose of this research was to identify prevalence of tobacco usage amongst students and also to study behavioral determinants.

The study was done on 4707 students. Main determinants identified were promotional campaign of tobacco, non-restriction on tobacco in schools, family tradition, nearby shops, lack of awareness etc.

Relevantly, it can be mentioned that Indian government has taken plan to direct tobacco cultivation to other crops phase by phase.

From the above discussion some crucial research questions emerge as follows.

Research questions

- a) **Should Tobacco cultivation continue?**
- b) **If yes, why? If not, why not?**
- c) **What Tobacco growers themselves think about Tobacco cultivation?**

The above questions have been attempted to answer in the framework of statistical tools in this paper.

PLAN OF THE PAPER

In section 2 we provide data description. In section 3 we provide methodological issues to be used. In this section we highlight the necessity of adopting MDS for further treatment of the data. In section 4 we present results and analysis of application of basic statistical tools followed by MDS results and analysis in section 5. In section 6 we present concluding remarks in association with some policy implications as emerged from research results.

DATA SOURCE

In 2006 there had been a study on Tobacco growers in Bangladesh conducted by an NGO named Nijera Kori. Sample size of respondents was 2000.

ATTRIBUTES

Following set of attributes was used in the study. Respondents were asked to select only one as the main factor for tobacco cultivation.

1. More profit
2. Less Risk
3. Loan and credit easily available
4. Seed and other inputs easily available
5. Contract farming: availability and profitability
6. Less hassle in marketing

Information on various variables was collected. Considering closeness and similarities we have included those in attribute groups. Here we relevantly mention those variables as included in different attributes.

Attribute	Variables included
1. More profit	<ol style="list-style-type: none"> 1. Production 2. Sales 3. Cost 4. Reasons for switching to tobacco from other crops
2. Less Risk	<ol style="list-style-type: none"> 1. Own family labor 2. Own land 3. Facing no problem in cultivation 4. Companies are consumers 5. Timely sales and payment
3. Credit and Loan	<ol style="list-style-type: none"> 1. Credits provided by companies
4. Seed and other inputs	<ol style="list-style-type: none"> 1. Companies supply seeds and fertilizers 2. Irrigation is available
5. Contract farming: availability and profitability	<ol style="list-style-type: none"> 1. Share cropping 2. Leased-in and leased-out land
6. Less Hassle in marketing	<ol style="list-style-type: none"> 1. Specific companies, middle men and other buyers are available

METHODOLOGICAL ISSUES

In order to attain a reliable and valid conclusion about population scenarios based on sample information as well as for getting insight into it, we have adopted classical **Multiple regression and Test of differences** in addition to descriptive statistical analysis. While multiple regression analysis enables to isolate relative importance of factors, test of difference provides solid reasonings to distinguish between categories like tobacco versus non-tobacco etc. Such results hint at the necessity of applying MDS.

Tobacco cultivation has both positive and negative dimensions, some of which deserve more attention compared to others. Thus, it calls for studying the determinants of Tobacco manufacturing sector. Identification and analysis of various dimensions of tobacco cultivation needs some sound methodological techniques. Statistical tools and their application to analyze different scenarios of tobacco cultivation are very useful in this respect. One such technique is

Multidimensional Scaling (MDS). Such a sophisticated tool enables grouping of objects using a set of attributes. In a set of attributes, some may be collectively important for one type of objects while some other attributes may be determinants for another object and so on. It is used to measure human perception and preferences towards some objects like products, events etc based on personal characteristics.

Thus, considering the fact that a set of large number of variables is associated with notion, motion and cultivation of tobacco in Bangladesh, MDS has been selected as an analysis tool for the present purpose. This method can provide results which may help make strategic plans of action. MDS allows to identify attributes which prompt one to perform something (tobacco growing) and also to determine relative importance of attributes. So far our knowledge goes, not much work on tobacco cultivation and processing, and its impacts on social, economic and natural environment in Bangladesh have been done. It is imperative to derive concrete and valid reasonings for and against tobacco cultivation for greater national benefits. One such research work has been attempted to identify factors which can lead to better analysis of tobacco manufacturing sector so that more benefits out of this sector can be derived for greater national benefits. One such research work is presented in this paper.

CONCEPTUAL FRAMEWORK OF MULTIDIMENSIONAL SCALING (MDS)

Multidimensional scaling (MDS) is a multivariate technique of scaling objects, individuals with minimum amount of information. MDS brings out salient attributes which are primary determinants of making specific decisions. It allows seeing an object from various dimensions simultaneously. MDS involves rank ordering of objects / individuals in terms of similarity (proximity).

It is used to measure human perceptions and preferences towards some objects like products, events, brands, places etc and position them in perceptual space. Scale values of each stimulus may be metric or non-metric. Input as well as output of fully metric form of MDS is ratio - scales. Similarly, input and output of fully non-metric form of MDS is ordinal scaled i.e. input as well as outputs are rank ordered.

MDS basically involves few steps as highlighted below.

1. Identification of dimensions of perceptual space on which individuals perceive some objects
2. Workout judged values of preferences and perceptions of respondents for objects

3. Positioning of objects on perceptual space. Thus MDS output is a perceptual map which consists of location of objects in it.

MDS can be explained by using distances between points in perceptual space. Suppose (x_i, y_i) be the co-ordinates of the i th point in Cartesian plane. Let d_{ij} is the Euclidean distance between two points i and j .

$$\text{Then } d_{ij} = \sqrt{[(x_i - x_j)^2 + (y_i - y_j)^2]}$$

This is a two – dimensional case. MDS takes these distances as inputs and simultaneously obtain the number of dimensions and derived distances as output. This helps construct a configuration of points in such dimension as their derived distances match with input data quite well.

Based on attributes MDS obtain recovered points on the space using derived distances. However, the number of dimensions is not generally known. MDS will determine the minimum number of dimensions to represent output such that recovered points in the space are as close as possible to original points. It means that derived interpoints of recovered points are best matched with input data proximities.

Suppose, number of dimensions is n , then distance between any two points in the space specified by MDS in the space is given as

$$d_{ij} = \sqrt{[\sum (x_{ik} - x_{jk})^2]}$$

where

d_{ij} = Distance between point i and j ,

x_{ik} and x_{jk} = Coordinates of point i and j along dimension k respectively.

Between points, distances can be converted into ranks putting rank one for the smallest distance, rank two for the next smallest and so on. This is non-metric MDS of recovering points in space.

At the start MDS begins with objects – attributes matrix. Later this is converted to object- object correlation matrix. Object-object correlation for a pair of objects is the correlation between pair of rows of the corresponding objects in object- attribute matrix. This correlations matrix gives values equivalent to pair wise perception values of objects assigned by respondents. Average perception values of objects are used as inputs. These are treated as inter point distances of objects in perceptual space / map. Output of MDS for this input data reflects positioning of objects on perceptual map involving required number of dimensions. Dimensions as referred to here relate to attributes but which attributes are involved in dimension are not known beforehand. If one dimension does not provide a good fit, two dimensions are tried and if this does not give satisfactory configuration, three dimensions are tried and so on. A lack of fit is called **Stress**

and goal is to find minimum number of dimensions that will eliminate most of the stress. It is usually calculated by computer program and lies between 0 and 1.

MDS aims at determining the number of dimensions of perceptual space. For a given problem MDS selects the number of dimensions so that inter point distances of objects in derived data set best match with corresponding input data. MDS assumes some dimensions initially and the corresponding stress is calculated. Values of such stress decreases along with number of dimensions. So, stress curve has a negative slope.

Thus, MDS increases number of dimensions one by one and corresponding stress values are computed. Thus, like “**Scree Plot**” in Factor analysis, plots of “**Stress**” V_s **numbers of dimensions** are made. Point of steep change in slope of the graph of Stress V_s Dimensionality determines the number of dimensions to be kept. Here there is the best match between derived distances with input data.

RESULTS AND ANALYSES OF APPLICATION OF BASIC STATISTICAL TOOLS

Relation between Perception about Tobacco Cultivation and Use of Land for Tobacco by Land Tenureship Type

Landholding status bears relation with perception about tobacco cultivation which in turn leads to income earning. Considering this we have cross-classified respondents by perceptual factors and proportion of land use for tobacco cultivation for each category of landownership. Results are presented below.

Category: Own Land

Among those who perceive tobacco cultivation is more profitable, 52 percent engage over 50 percent of own land for tobacco growing. Similar picture also applies in case of those who consider that tobacco growing has less risk and credit, and inputs are easily available for it. Of those who do not grow any other crop and do tobacco cultivation traditionally, over 60 percent employ more than 50 percent of own land for tobacco cultivation.

Category: Shared-in Land

Majority of this category of respondents employ less than 10% of land for tobacco cultivation. Variation in this regard by perception about tobacco growing is quite small. Of those who use shared-in land, 100 percent perceive that tobacco growing is possible because of availability of loan/credit and inputs and employ less than 10 percent of land for tobacco cultivation.

Category: Shared-out Land

Shared-in land category and shared-out category of respondents bear resemblance with respect to employing land share (<10 percent) for tobacco.

However, excepting own land category, majority of all other types of land owners, employ <10% of land for tobacco cultivation. Although, tobacco cultivation is perceived to be profitable, use pattern of land for tobacco shows existence of reluctance of growers. It also provides some indication that growers are more inclined towards other crops cultivation.

Land tenureship status has also been incorporated in regression analysis as given below.

Multiple Regression Analysis for Perceptual Groups

As a quantitative tool regression analysis is very powerful in identifying relative importance of factors influencing some dependent variable. We have performed one such exercise here. During the survey, we have attempted to identify perceptual production behavior of tobacco growers. We have several categories by perception namely, more profit, less risk, loan/credit/fertilizer/seed is more easily available, Contract farming is beneficial, less hassle in selling product, no other crop grows; tradition in tobacco cultivation.

For each of these groups we have run a multiple regression of the form

$$Y = \beta_0 + \beta_1x_1 + \beta_2x_2 + \dots + \beta_px_p + U$$

where

Y= dependent variable, (in our case we have considered yearly profit (last year) as dependent variable).

x`s= are independent variables and U is the random disturbance term.

Independent variables are, own land, Sharecropped-in land, sharecropped-out land; Leased-in land, leased-out land, mortgaged-in land, family labour only, hired labour only, received credit facility, received seed, received fertilizer, received pesticides, whether received health care facility, both family and hired labour. We provide analysis of regression results separately for each perceptual group as discussed below.

Regression Results by Perception Group

Category: More Profit

Among the regressors, highly significant impact accrues from sharecropped-out land, leased in land, mortgaged-out land, credit facility, seed input availability.

Category: Less Risk

For this category family labor has highly significant effect on profit earning.

Category: Loan/Credit Available

For this category only one regressor namely, credit received has highly significant impact on profit earning.

Category: Less Hassle in Selling the Product

Several regressors namely, mortgaged-in land, credit receipt, family labor, fertilizer input receipt, and pesticides receipt put significant impact on profit earning.

Category: No other Crop Grows

For this category credit facility, credit receipt, seed and pesticides receipt played significant role.

We have adopted the above analysis tool for the whole sample and results are discussed below.

Regression Results for the Whole Sample

Dependent variable and Independent variables considered are as above. Relative importance of factors impacting tobacco production has similarity with those of separate regressions run above. For example, share-cropped-out land plays significant role for individual group as well as for the whole group. Similar case is with leased-in land, mortgaged-in and out land, credit facility and seed input availability.

Both individual group regression results as well as whole sample regression results suggest that tobacco growers are concerned with factors like credit facilities, inputs like seed, pesticides and irrigation and land availability.

In connection with net return, we have run Multiple Regression to identify how does net income from different crops affect overall net income. Regression equation is of the form,

Yearly Income= f (net income from tobacco, potato. etc.)

The estimated results are given below.

Analyses of Multiple Regressions between Total Net Return and Return from Different Components

For further verification of question mark about tobacco cultivation, we have constructed a Multiple Regression Model taking yearly net income as dependent

variable. Our purpose is to estimate how such variable is impacted by individual net return from different crops as independent variables. Our constructed model is of the form,

$$y = \beta_0 + \beta_1x_1 + \beta_2x_2 + \dots + \beta_px_p + U$$

y = dependent variable (Net annual income)

X 's = explanatory variables (net return from cultivating tobacco, potato, chili and other crops)

Our estimated regression is

$$Y = 28149.5 + 2.28X_1 + 0.44X_2 + 1.07X_3 + 2.27X_4 + 0.54X_5 + 2.08X_6 + 2.00X_7 + 2.02X_8 + 0.52X_9 + 1.01X_{10}$$

Table I. Estimation Results of Multiple Regressions

Independent Variables	Unstandardized Coefficients		T- value	Sig.	Confidence interval	
	B	Std. error			Lower	Upper
Constant	28149.451	2555.421	11.016	0.000	23140.80	33158.08
Net return per bigha Tobacco (X_1)	2.278	0.287	7.941	0.000	1.72	2.84
Net return per bigha Wheat (X_2)	0.437	0.488	0.896	0.371	0.52	1.39
Net return per bigha Maize (X_3)	1.067	0.919	1.161	0.246	0.73	2.87
Net return per bigha winter vegetable (X_4)	2.268	0.524	-4.324	0.000	1.24	3.30
Net return per bigha Potato (X_5)	0.543	0.221	2.461	0.014	0.10	0.98
Net return per bigha Sweet potato (X_6)	2.084	2.057	1.013	0.311	1.95	6.12
Net return per bigha Chili (X_7)	1.997	0.542	3.687	0.000	0.94	3.06

Net return per bigha Onion (X ₈)	2.022	1.023	1.977	0.048	0.02	4.03
Net return per bigha Aman (X ₉)	0.523	0.418	1.252	0.211	0.30	1.34
Net return per bigha summer vegetable (X ₁₀)	1.010	1.050	0.962	0.336	1.05	3.07

Interpretation of Regression Results

As seen in Table I, highest contribution in yearly net income comes from unit increase in per bigha net return from tobacco. Such marginal contribution is also statistically significant. However, similar positive and significant marginal contributions are also kept by winter vegetables, sweet potato, onion and chili. Although from economic viewpoint, tobacco cultivation sounds fine, when one considers morbidity scenario among tobacco versus non-tobacco growers, there is enough reasons for not encouraging tobacco cultivation rather motivate farmers to grow food and non-food crops. Such assertion is spectacularly clear from following results.

With a view to identify whether income earning from tobacco and that of other crops differs significantly, we have performed statistical tests. Such test results are given below.

Test of Significance of Difference

In order to assess statistical significance of difference between average net income from tobacco and those of some other food items some tests have been performed. Following tests of difference in mean net income have been done.

1. Tobacco Vs winter vegetables, 2. Tobacco Vs Potato, 3. Tobacco Vs Chili,
4. Tobacco Vs onion, 5. Tobacco Vs Summer vegetables

We present results of t-test for mean difference for net return per bigha of tobacco cultivation with those of other food items for the whole sample.

All the (Table II) results suggest that there is a highly significant difference between average return per bigha from tobacco and those of other essential food items. Such differences are in favor of food items. Such results indicate that in a country like Bangladesh where food problem and nutrition problem are of great

concern, cultivation of food items instead of cash crop tobacco will make the growers much better-off from health and economic view point

Table II. Calculated t-values for Mean Difference of Net Income between Tobacco and Some Food Items

Type of crops	Calculated t-values	P-value
Wheat	5.56	0.000
Pulses	3.70	0.036
Potato	10.51	0.000
Chili	4.85	0.000
Rice	7.5	0.000

Test of Difference in Net Mean Income

Similar exercises have been performed for those tobacco growers who perceive that tobacco is more profitable. In this case also test results boil down to conclusion that instead of cash crop tobacco, cultivation of food items like winter vegetables, chili, and summer vegetables bring lot more net return and makes significant difference. Calculated t-test results are shown below.

Table III. Calculated t-values for Mean Difference of Net Income between Tobacco and Some Food Items for Group Who Perceive Tobacco is More Profitable

Type of crops	Calculated t-values	P-value
Winter vegetables	4.88	0.000
Chili	4.24	0.003
Summer vegetables	4.75	0.000

Test of Difference in Morbidity Pattern

Among adverse impact of tobacco cultivation, one vital impact is health hazard. Thus, occurrences of various types of diseases among tobacco and non-tobacco cultivators were investigated in the study. Remarkable differences are

observed between two types of cultivators with respect to proportion experiencing tobacco related diseases. Thus, we attempted to test how such differences are statistically significant. We provide such test results below.

Table IV: Calculated Z-values for Difference of Proportion Test

Diseases Reported	Z	Z_{tab}	Decision
Green Tobacco Sickness (GTS)	13.28	1.96	Z _{cal} >Z _{tab}
Cancer	1.53	1.96	Z _{cal} <Z _{tab}
Acute cough	3.51	1.96	Z _{cal} >Z _{tab}
Chronic cough	2.45	1.96	Z _{cal} >Z _{tab}
TB	2.13	1.96	Z _{cal} >Z _{tab}
Heart disease	2.78	1.96	Z _{cal} >Z _{tab}
Other disease	-14.33	1.96	Z _{cal} >Z _{tab}

From our test results we see that there is a significant difference between tobacco cultivating households and non-tobacco cultivating households in green tobacco sickness, acute cough, Heart disease and other disease but there is no significant difference in tobacco cultivating households and non-tobacco cultivating households in cancer. Test results suggest that tobacco related diseases prevail more among tobacco growing households. Such difference is also statistically significant.

Association between Smoking Habit and Duration of Tobacco Culture

As we notice in Table V, number of smokers in the household bears a close link with the time length of tobacco growing culture. For example, among households practicing tobacco growing over 30 years, about 67 percent did not have any smoker in the household earlier (0 smoker) but at present time only 39 percent of such households report 0 smokers. In another extreme, households which have entered tobacco cultivation just 5 years ago, exhibit that propensity to smoke has increased. Over 50 percent of these households did not have smokers before but only 34 percent of such households have non-smokers at present. Similar assertion is true for single smoker in the household. Households practicing tobacco cultivation over 30 years had previously single smoker only is 23 percent cases. But, at present time about 48 percent of such households have single smoker.

Households with one and two smokers have tremendously increased at current time compared to previous time - from 37 percent to 58 percent.

The facts presented in Table V indicate that although tobacco cultivation sounds good from economic viewpoint, it alerts about health hazards

We have further verified how health hazard like smoking habit differs between tobacco and non-tobacco cultivations. We have calculated proportion of smokers among household members in both tobacco and non-tobacco cultivators. Such proportions are 16 percent for tobacco and 12 percent for non-tobacco groups. We have performed Z-test and calculated Z-value is 3.12 which are highly significant at 5 percent level. This implies that, propensity to smoke is significantly high among tobacco growers compared to non-tobacco growers.

Similar exercise has also been done for proportion of smokers at present time and before tobacco cultivation. Such proportion was only 10.5 percent before tobacco cultivation. In this case calculated Z-value is 3.17 which clearly shows statistically significant rise in smoking habit among household members of tobacco growers.

APPLICATION OF MDS AND ANALYSES OF RESULTS

So far we have adopted several basic statistical tools for analyzing a given data set. Collected information spells out that some people favored and some people did not favor tobacco culture. Positive attitude and financial gain is associated with negative health and environmental impacts.

From all the results presented above, one issue/question arises about how tobacco growers view tobacco cultivation particularly its different forms like,

Objects

1. Absolute Tobacco growing.
2. Tobacco cum other agricultural products
3. Shifting from other crops to tobacco cultivation.
4. Planning to grow tobacco.

Here we can gainfully adopt Multidimensional Scaling (MDS) to see how the respondents view the above objects in terms of different attributes.

Using the objects and attributes mentioned before we have performed an MDS analysis whose results are given below.

Following tables show the regression coefficient value matrix for the regression run using attribute ratings as independent and dimensional co-ordinates as dependent (criterion) variable for different categories of tobacco growers.

Table VI. Regression Coefficients for the Category of Absolute Tobacco Growers

Attribute	Dimension 1	Dimension 2	Dimension 3
1. More profit	0.8914	0.3161	0.0962
2. Less risk	0.1735	0.1968	0.8678
3. Loan and credit easily available	0.2132	0.7987	0.2676
4. Seed and other inputs easily available	0.3019	0.8465	0.1966
5. Contract farming: availability and profitability	0.9112	0.1799	0.1868
6. Less hassle in marketing	0.4612	0.1996	0.8175

Stress curve obtained is as follows.

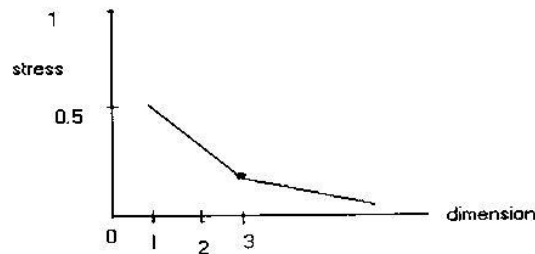


Figure 1

From results of the above table and as seen in stress curve, we can retain 3 dimensions for this category of tobacco growers as follows.

Dimension 1: Economic gain. It is associated with more profit and contract farming

Dimension 2: Facility Factor. It is associated with loan and input facilities.

Dimension 3: Risk factor. It is associated with comfort in production and marketing.

Our results suggest that tobacco cultivators are more inclined to economic gains. Side-by-side they also desire supports like availability of facilities like credit and loan, inputs (seeds and fertilizers). Risk factors like timely sales, timely payments, less hassle and less uncertainty is also concern of tobacco farmers.

Table VII. Regression Coefficients for the Category of Tobacco cum Other Agricultural Products

Attribute	Dimension 1	Dimension 2
1. More profit	0.3961	0.3099
2. Less risk	0.2166	0.2168
3. Loan and credit easily available	0.8789	0.6996
4. Seed and other inputs easily available	0.2969	0.7964
5. Contract farming: availability and profitability	0.1971	0.1699
6. Less hassle in marketing	0.1969	0.1996

We notice in Table VII that for respondent category of growers of tobacco cum other agricultural products, there are two dimensions namely, Dimension 1 and Dimension 2. But, types of attributes perceived by this category concern only availability of credit and input facilities. It shows that producers of other agricultural products intend to be associated with tobacco cultivation depending on degree of availability of inputs. These growers can be termed as “**comfort seeking growers**” of tobacco.

Stress curve obtained is as follows.

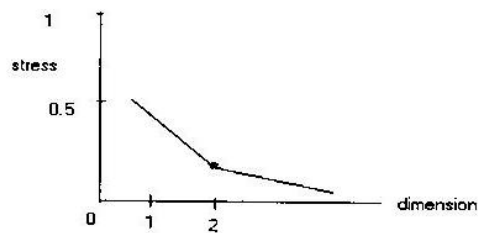


figure 2

In table VIII we notice a different scenario. These growers can be termed as “**genuine growers**”. They shifted their growing potentials from other crops to tobacco. In this case also there are three dimensions but lot more attributes are of concern for growers. From regression coefficients it is clear that these growers consider profit, loan and seed facilities and availability of contract farming as their main attractions for diverting to tobacco cultivation.

Table VIII: Regression Coefficients for the Category of Absolute Tobacco Growing Who Shifted from Other Crops

Attribute	Dimension 1	Dimension 2	Dimension 3
1. More profit	0.8914	0.3061	0.0982
2. Less risk	0.1735	0.1865	0.8718
3. Loan and credit easily available	0.2132	0.8987	0.2576
4. Seed and other inputs easily available	0.9019	0.8465	0.1865
5. Contract farming: availability and profitability	0.6112	0.8790	0.1666
6. Less hassle in marketing	0.4612	0.1996	0.8017

Stress curve obtained is as follows.

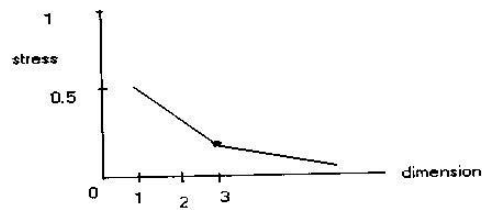


figure 03

Table IX. Regression Coefficients for the Category of Planning to Grow Tobacco

Attribute	Dimension 1
1. More profit	0.2161
2. Less risk	0.1868
3. Loan and credit easily available	0.8997
4. Seed and other inputs easily available	0.8345
5. Contract farming: availability and profitability	0.1678
6. Less hassle in marketing	0.1694

Currently, Non-growers planning to grow tobacco can be considered “**potential tobacco growers**”. As shown in Table IX for this category, only one dimension has been revealed by MDS. Attribute regression coefficient for loan facility and input facility appear to be high and positive. Probably, this is due to spillover effect from surrounding environment. Being motivated by knowledge of availability of those attributes currently not-growers have developed a propensity to divert their growing potentials to tobacco. At present time micro credit and micro finances are easily accessible.

Stress curve obtained is as follows.

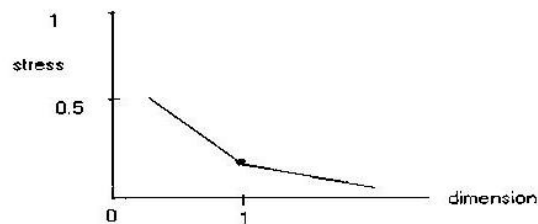


figure 04

CONCLUSION AND POLICY IMPLICATIONS

Like a consumer, a producer also considers the composite of a number of different attributes for producing some items. It is true that to comprehend the complex interaction of attributes is a hard task. It is also hard to accommodate lot of factors in conceptual framework as well as in computations. MDS provides satisfactory results in most cases. However, results of the present study sound good and provide some guidelines of invigorating the tobacco sub-sector of Agricultural Sector of Bangladesh economy. It is to admit that the subjective way of naming the attribute dimensions is a limitation of MDS. As a gist of all discussions given before, we can draw one solid inference that tobacco growers have positive attitude towards tobacco cultivation and such attitude bears close link with availabilities of associated factors like, loan/credit facilities, land and inputs availability. But, our basic statistical analysis-results very strongly suggest that for health reasons, environmental hazards, food security reasons, tobacco cultivation should be diverted to other food and non-food crops.

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