

## **SOCIAL VALUE FORMATION AND SWITCHING TO TITHONIA IN NZOIA RIVER DRAINAGE BASIN (NRDB), KENYA\***

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### **ABSTRACT**

Following Ozaki (2009) the paper examines positive social values for switching from inorganic fertilizers to tithonia in the NRDB. The predominance of sugar cane production in the NRDB generates immense water pollutants (mainly because of massive application of fertilizers) that undermine water availability to households in the NRDB. Tithonia, a commonly available weed in the NRDB is an alternative to inorganic fertilizers because of it is rich in nutrients and can detoxify soils. The paper used 416 participants who responded to 101 structured questionnaire items. Two step regression analysis linked participant's characteristics to social values and use of tithonia, respectively. The results indicated that levels of education, participation in environmental organization and personal conviction about ability to make a difference enhanced switching to tithonia. Policy implications are discussed.

### **I. INTRODUCTION**

There is a vast body of literature on consumer switching in marketing and economics (Andrews and Currim, 2003; Burnham et al, 2003; Tsang, 2006; Wieringa and Verhoef, 2007). This strand of literature predominantly focuses on monopolies facing new entrants in marketed goods (Wieringa and Verhoef, 2007). Complexities that belie consumer switching under these circumstances have engaged enormous empirical energy in recent years (Wieringa and Verhoef, 2007, Anton et al, 2009). Underpinning these concerns is the need to liberalize markets especially in countries with hitherto entrenched command and control systems (Wieringa and Verhoef, 2007; Ozaki, 2009). The import of these studies is development of strategic entry for new goods and services. In this respect, extant literature indicate that a variety of barriers confront customers wishing to switch from one product or distributor to another (Tsang, 2006; Wieringa and Verhoef, 2007, Van Noort, 2008). Principal among these barriers are the switching costs, social norms, personal inertia and relational norms. There is an inordinately less focus on the barriers that are face introduction of environmental goods into markets that were hitherto dominated by imperfect markets that distribute environmentally hazardous goods.

Economic notions that deal with consumer switching have significant transfer benefits in the study of innovations (Lam et al, 2008; Ozaki, 2009). Ozaki (2009), for example argues that "Prior to an innovation-decision process, a range of conditions bring the consumer into the process in the first place: previous experiences, existing needs/ problems, innovativeness and social norms."(DOI 10.1002/bse.650). There has emerged a large body of literature that assesses adoption of innovations in recent years (Pagani, 2004; Lam, et al, 2008; Yang, 2009; Zhu et al, 2009). The current paper adds new dimensions to these literature in three ways, (1) earlier works dealt with adoption of sophisticated and established technologies. The importance of these technologies cannot be overemphasized. In many poor countries, however, they remain out of the reach of a vast proportion of the population (Jamma and Pizzaro, 2008). Adoption of appropriate technology is thus, the mantra to overcoming the conditions that continue to confine billions people to a debilitating state want. In Kenya, over half the population lives on incomes that are below one dollar a day (Kenya, Ministry of Planning, 2007). The need for appropriate technology that can serve the needs of this population is urgent. This paper attempts to consider the adoption of a cheap, beneficial and environmentally sustainable technology for farmers in poverty endemic NRDB. (2) Another strand of previous studies has dealt with consumer switching as a problem of consumer satisfaction (Anton et al, 2007; Lam et al, 2008). Anton et al (2007), for example, see consumer

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switching as more prevalent in recent years as "Customers are becoming increasingly intolerant of inconsistency or mediocrity and they can choose to dissolve the relationship as soon as any problem arises" (P. 512).

Admittedly relational satisfaction is critical in environmental hazardous production. However, in poor societies where information flow is more limited relational arrangements may be much more complex. In NRDB farmers persist in the use of inorganic fertilizers even when their water sources have turned unacceptably foul. Besides, environmental goods such as water remain externalized in the economic consideration of many production enterprises in poor societies. Relational investments are thus, made without taking them into account. This paper seeks to study how small holder firms interact with externality generating sugar manufacturers. (3) Earlier studies pursue two contending explanations for consumer switching namely consumer behaviour and the regulatory environment (Warienga and Verhoef, 2007; Azaki, 2009; Yang, 2009). Warienga and Verhoef (2007) for example argue that consumer switching is critical for monopolies to changing their ways in liberalizing economies as "The entrance of new competitors into the market makes it very important for these firms to understand the risk of customer loss and, in particular the determinants of switching behaviour" (P. 175). Yang (2009), however, attributes customer switching to customer characteristics such as knowledge, personal preferences and complexity of innovation. In her study of adoption of telephone banking Yang (2009) concludes that for the system to be adopted it needs "to be secure, convenient and offer a competitive fee structure" (P. 147). Clearly therefore the issue of whether regulation or consumer behaviour should guide policy on customer switching remains unresolved. This paper attempts to contribute by providing new sets of data from a poor country where consumer behaviour is unexplored.

The rest of this paper is organized in five sections. Section II develops the theory and reviews the literature on customer switching. Section III discusses the study setting. Section IV deals with the research methods used in the paper. Section V discusses and interprets the data in line with study objectives. Section VI concludes the paper by reviewing its key arguments and suggesting the way forward.

## II. THEORETICAL FRAMEWORK AND REVIEW OF LITERATURE

There is vast literature that explains the conditions that firms face when dealing with consumers that are under lock in or switching cost market circumstances (Stango, 2002; Anton et al, 2007; Sener and Hazer, 2008; Aggarwal and Zhao, 2009; Azaki, 2009; Yang, 2009). Significant theory has thus, emerged concerning the factors that account for consumer switching. The adaptation of environmentally sustainable goods has benefited from these theories in two ways: (1) Adoption of environmental innovation has increasingly relied on diffusion theories notably advocated in recent years by Azaki (2009). Azaki develops a model of determination of environmental adoption based on a generic of five broad considerations namely (a) perceived benefit; benefits or positive consequences of adoption, (b) compatibility and reflexivity; the extent to which the innovation is consistent with current practices and values and with images, identities and cultural references they like to express, (c) social influence and social norms; whether consumers feel enough pressure or see others adopt, (d) controllability; the perceived ability to cope with hassles associated with adopting the innovation, (e) perceived risk; consumers do perceive risks in terms of functionality and economics (P.5). (2) Switching costs (Stango, 2002); this associates adoption of environmentally sustainable innovations to overcoming of barriers erected by entrenched practices. There are a variety of barriers that producers or suppliers of goods under monopolistic conditions may impose on consumers to ensure that they remain loyal. Wieringa and Verhoef (2007), for example, notes that switching costs in the form of compatibility, transaction costs, uncertainty, discount coupons and similar devices and psychological costs of brand loyalty are critical determinants of consumer switching (P. 176). Thus, there is consensus in literature that consumer costs, perceived benefits and potential risks are the main consideration in the determination of consumer switching especially in the emerging green economy. In Kenya switching is suggested by several recent studies as a means to more environmentally friendly production (Waswa et al, 2009; Duflo et al, 2009). In their study of the Nzoia and Mumia sugar belt, Waswa et al (2009) for example showed that there are significant economies arising from reverting farm investment away from sugar

cane and maize to other crops such as onions, cassava and sweet potatoes (P. 1406). Why such investment changes do not occur is confounding. One possible explanation is the obstacles placed in the way of those intending to do so by sugar companies and millers. One of the critical obstacles in this respect is the use of subsidized fertilizers as a means to earn farmer's loyalty. The negative impacts of subsidized fertilizers on crop output and the environment are widely documented (Duflo et al, 2009). Underpinning these impacts is the notion of overuse where farmers with limited vision of the future tend to over apply subsidized fertilizer to the detriment of the environment. Duflo et al (2009) demonstrates that such negative consequences of subsidized fertilizers may be addressed through timing of subsidies (P. 3). Time inconsistency problems are, however, only part of the problem. In areas such Nzoia River Drainage Basin where fertilizer overuse has had cumulative water degradation effects switching to other forms of fertilizing the soil is desirable. This paper considers the application of a tithonia, a locally available weed rich in soil nutrients and with the potential of reversing the damages caused by long-term inorganic fertilizer over use.

Several studies have dealt with the adoption of environmentally friendly innovations in recent years (Ozaki, 2009; Yang, 2009). Ozaki (2009) who dealt with the adoption of green electricity among consumers in Britain, investigated the role of functionality, usability, costs, intended outcomes and norms in the consumer decision to sign up for renewable energy. The study which was conducted in the Imperial College, London, involved 125 participants. Three data collection instruments were used; (1) focused group discussions (2) survey questionnaire, and (3) semi-structured interviews. Focused group discussion was used to determine the thematic areas of focus to be used for the survey. A questionnaire survey was conducted online with a return rate of 20 percent that is 103 responses. Interview was conducted on 14 participants who were adopters. Data was analyzed using descriptive statistics primarily means and correlation coefficients. The results showed that positive attitudes were critical in the adoption of green electricity. There was, however, significant weakness in the method in that correlation coefficients only show relationship but fail to indicate causation. The present study applies two stage regression analyses to link adoption to social values and switching costs.

Yang (2009) considered adoption difficulties that face consumers in mobile banking. Both cognitive and cost considerations were considered. In particular the Rasch measurement model was applied to ensure stability of the study findings. This model attempts to link adoption to ability to overcome difficulties associated with adoption of a give technology. Yang (2009) study focused on 174 participants drawn from university students. Pre-tested 34 item questionnaire were used to study student's propensity to adopt mobile banking for a variety of independent variables. Data was analyzed using a logit probability model that links responses on difficult to adopt mobile banking to ability of respondents. The results showed that adoption of mobile banking depends on transaction speed, transaction fees and security of transaction. These are important in understanding why sophisticated innovations may be adopted. There may, however, be less relevant to appropriate technology that farmers in poor societies use. The present study focuses on the use of tithonia, a locally available weed, and rich in soil nutrients in place of organic fertilizers.

Besides adoption studies, other studies have dealt with consumer switching from use of one product to another (Stango, 2002; Yang and Peterson, 2004; Wieringa and Verhoef, 2007; Dongjin et al, 2008; Van Noort, 2008; Anton et al, 2009). These studies emphasize the role played by switching costs in determining consumer switching. This role is not adequately articulated in adoption studies (Azaki, 2009; Yang, 2009). Consumer switching studies are also inadequate as they ignore the adoption problem. Stango (2002) for example, focuses on pricing with consumer switching costs in the credit card market. Using time series data drawn from 93 commercial banks and 53 credit unions, Stango (2002) estimated a consumer switching cost model for the period 1989-1994. Using Trans-log regression analysis and one single lag specified time series models, Stango (2002) found that credit issuer's market share, amount of credit issued and competitor's credit issued were positively correlated to switching costs consistent with switching cost theory (P.485). These results suggest a variety of leverages that credit firms may use to control switching. Issuing lots of credit and widening market share are some of the most effective strategies to ensure lock in and thus limiting switching. In NRDB, farmers are often issued with a variety of credit including fertilizers, seeds, and ploughing and farm implements. It is important to assess whether the cost of switching model propounded by Stango (2002) also holds for this category of consumers. This paper focuses on the cost of switching related to adoption of environmentally more sustainable tithonia.

Other studies have linked switching costs to psychological factors such as loyalty and satisfaction. A classic example in this respect is Yang and Peterson (2004) who studied the role of switching costs on customer satisfaction, loyalty and perceived value among users of online products. The study relied on 235 consumer review on their online banking experiences. Data was analyzed using two step Principal factor with Kaiser

Varimax extraction criterion. The first step set to determine the structure of the scale factors. This ruled out the use of common variance method was supported in this stage and there was no general factor structure suggesting the presence of multiple underlying factors that account for variations in consumer perceived value. A second step applied the principal factor Kaiser Varimax criterion which permitted the testing of the hypothesis of multiple latent factors in the data. The results showed that switching behaviour among customers was explainable by four factors namely customers' perceived value, customer loyalty, customer satisfaction and switching costs. Yang and Peterson (2004) thus conclude that "companies striving to improve consumer royalty should focus primarily on satisfaction and perceived value" (P.818). However, the paper admits that switching cost is an important factor especially when customer satisfaction is high. These results show that companies can influence consumer royalty through a variety of levers. However, how consumer switching may be used to enhance sustainable use of environmental resources is not addressed. Clearly levers of consumer loyalty may exacerbate or ameliorate environmental resource utilization especially in poor societies where natural resource decay has significant impacts on wellbeing. This paper focuses on the use of consumer switching as a potential area of leverage in enhancing water quality in NRDB.

Recent studies ignore the role of switching in tinkering resource control towards more effective and sustainable use. This is confounding given that earlier works on liberalization of traditional command and control systems relied heavily on the use of consumer switching to break traditional barriers that created lock in customers. Weiringa and Verhoef (2007) for example considered consumer switching in the Dutch energy sector under liberalized economy. Current unsustainable market practices that promote consumption of polluting goods are analogous to yester-year's monopolies that dominated strictly regulated markets. Weiringa and Verhoef (2007) argue that these monopolies "generally are unaccustomed to competition and suffer from bureaucracies, which lead to inflexibility and less competitive market behaviour" (P. 175). Clearly polluting industries are less likely to change because of inbuilt mechanisms that work against competition in more sustainable conditions. Weiringa and Verhoef (2007) use two sets of data (1) survey data (2) Customer database data to generate a final data base of 7, 268 customers. The dependent variable was switching intention which was represented by 11 electricity suppliers from whom customers choose their supplier of choice after liberalization. If they chose the focal supplier, they were considered loyal but if they chose another supplier they were considered disloyal. Customers were also asked questions about the price of electricity supplied, quality perception, trust, word of mouth intentions, risk of switching, attractiveness of switching, and switching costs. Three step data analysis entailing (1) Exploratory Principal Factor Analysis with Varimax is used to distil the variables (2) A Logistic models with switching intention as the dependent variable is estimated and Principal Factor component generated. (3) Latent class analysis to determine the possible existence of different switching segments with differential effects of Principal Components was also done. The results showed that from exploratory analysis principal factor analysis is appropriate for the data set used. Three orthogonal principal components with Eigen value greater than 1 are extracted from the data corresponding to three latent factors (1) relational factor (2) perceived switching costs and (3) attractiveness of switching. These account for 62 per cent of the variability of the data. Analysis of latent factors showed that (a)relational factors were negatively related to switching (b) perceived switching costs were negatively linked to switching (c) attractiveness of switching was positively related to switching, (d) heavy users were less likely to switch (e) customers with contracts were less likely to switch (P. 180). Weiringa and Verhoef (2007) concluded that

"Overall our study reveals that relationship quality provides a particularly important driver for switching intention. Moreover, switching costs and the attractiveness of switching represent significant determinants, as do electricity usage and the number of contracts (P. 182).

Clearly therefore consumer switching in different market conditions has attracted scholarly interest. What is confounding is why consumer switching is largely ignored in literature on environmental innovations. This paper exploits the loyalty problem outlined in literature to argue that critical behaviour change benefits can be realized if consumer switching is used to engender sustainable goods. The paper focuses on titionia, a weed with significant soil amendment benefits in NRDB. Earlier works provide little comparative data especially in poor societies. In more recent times research on consumer switching has emphasized comparison of positive and negative barriers as means of controlling switching among consumers. Van Noort (2008) for example showed that consumer focus on preventive rather than promotion was critical in determining consumer risk perception. It is important to study how risk perception is enhanced or undermined by regulatory processes. Dongjin et al (2008) also suggest that consumer royalty is in large part explained by consumer satisfaction rather than switching cost or purchase interval. Anton et al (2009) who studied the mediating role satisfaction on switching intentions found poor quality services had significant impacts on the switching intentions of consumers.

### III. STUDY SETTING

This study is based in Nzoia River Drainage Basin (NRDB). NRDB falls in agro-ecological zones I and II under Kenya's agro-ecological classification with abundant rainfall and good soils for agricultural production. In the 1960s rural trade and production centres were set up leading to industrialization by promoting cottage industries that utilize local raw material in the NRDB. These industries were largely in the sugar sector where sugar cane farming accompanied with heavy application of fertilizers, insecticides and herbicides was promoted (Mbiti, 2008). The use of inorganic fertilizers has been shown to cause environmental degradation through soil structure deterioration and lowering soil pH (Mbiti, 2008). Besides in Kenya, because fertilizer subsidies are promoted studies have reported high propensity of overuse and poor application timing (Duflo et al, 2008). This problem is greatly enhanced in NRDB because sugar cane farming entails substantial credit to farmers in the form of fertilizers, farm equipment and pesticides (Waswa et al, 2009). Extensive soil erosion caused by soil exposure to eroding agents contaminates surface and groundwater worsening the state of human wellbeing. Rivers, ponds and springs are critical sources of water for domestic use and livestock watering in the NRDB.

Water degradation is a serious especially in the five critical water towers that provides the resource to households in Kenya. In recognition to this problem the Kenya government significantly reformed water governance policy in 2002 through the new Water Act 2002 that put water management under eight water boards. NRDB is under the Lake Victoria North Water Board (LVNWB). LVNWB has a mandate to ensure conservation of water sources by promoting cleaner agricultural production technologies in the Lake Victoria North region which includes Chelangani hills (Kenya, Ministry of Water, 2002). NRDB falls within Chelangani hills water towers, which is a resource that the government recognizes as critical the country's long term development (Kenya, Ministry of Planning, 2007). Ensuring clean agricultural production is an imperative for guaranteeing the conservation the natural resource values of NRDB. Devolving of power on water management as contained in the Water Act 2002 presupposes that clean production choices would voluntarily be made by farmers relying on water user associations. There are, however, very few active water user associations in LVNWB. Thus, there is little policy percolation to the primary water users.

Titonia is a shrub which grows locally in the NRDB and is often used for hedges and boundaries of sugar cane farms. The shrub is shown to be rich in nutrients and has immense potential for restoring soils in the NRDB and reducing fertilizer related water pollution. Furthermore the shrub is fast growing with an average 10 t/ha/yr harvestable in the NRDB. The propensity of farmers switching from fertilizers to Titonia is, however, greatly compounded by practices in sugar cane production in Kenya.

According to the Sugar Act 2001 the management of sugar cane production in Kenya falls under the Kenya Sugar Board (Kenya, Ministry of agriculture, 2001). The board is made of elected representatives of farmers, millers and representatives of the Ministries of Agriculture, Industry and Finance. This board has a mandate to make laws on how sugar cane farming should be conducted in Kenya. One of the sugar board's roles is to promote environmentally friendly production practices. The use of inorganic fertilizers that pollute soils and water is clearly in contradiction to this role. Mercantile goals of increasing sugar cane production rarely find recourse in long-term strategies. This paper seeks to determine how changes in sugar production may be initiated at the farm level that have wider and long-term well-being benefits to residents of the NRDB.

There are seven major sugar factories in Kenya with an estimated production capacity of 550,000 to 600,000 tonnes annually. Nzoia sugar produces 12 per cent of this amount. Small scale farmers contribute 85 per cent of this amount. These are contracted from Nzoia sugar company which produces 15 per in the nucleus. The small scale farmers that supply Nzoia are largely out growers who are distributed in the vast upper catchment of NRDB. This paper focuses on Webuye and Bungoma divisions. The choice of these divisions is because of the high pollution levels recorded in these areas by earlier studies (Mwamburi, 2003; Simuyu et al, 2009). Tithonia is also widely available in these two divisions with possible behavioural changes likely to have immediate application.

### IV. THE METHODS

The data used in this study depended on two data collection methods (1) Focused group discussions that involved 30 leaders of water users associations in NRDB. These were identified using information collected from LVNWB that indicated the names and contacts of leaders of active water user associations. This

category was considered critical because of their understanding of the water pollution problem in the NRDB. Their contributions thus, assisted in developing thematic areas of data collection in the second phase. (2) Survey questionnaires distributed to 416 farmers drawn from NRDB. Administrative information collected from the provincial administration permitted identification of 28 villages distributed 4 locations in NRDB that formed the target village population. Communication and consultation with village elders were initiated to determine the villages with the highest and lowest perceived water pollution impacts to permit stratification using a critical valuable of interest. Additionally water samples were collected from springs, ponds and shallow wells in different villages to run confirmatory pollution level tests. Extensive chemical tests were conducted at Masinde Muliro University, department of chemistry and at the LVNWB. From the results twelve villages were classified as having the most polluted water sources, eight as moderately polluted and four were classified as lowly polluted using Biochemical Oxygen Demand (BOD). Proportionate random sampling was used to select nine villages in NRDB which were used to supply respondents from among farmers. Radial sampling technique was employed that allowed random selection of farmers around water sources. In total fifty six water sources were identified using village elders and water user's association leaders.

Data was collected using a structured questionnaire containing 101 items consisting fifteen thematic areas (1) six items on perceived water quality, (2) twelve items on human capital, (3) eighteen items on satisfaction, (4) four items on trusts, (5) four items on water collection costs, (6) four items on non-monetary incentives, (7) six items on subsidies, (8) four items on switching costs (9) Eight items on debts owed to the sugar miller, (10) Eight items on personal characteristics, (11) ten items on environmental norms, (12) two items on loyalty, (13) eight items on contracts (14) two items on location, and (15) one item on water source. The vast coverage was considered important because of the exploratory nature of the study that made many variables relevant. Consistent to other studies on consumer switching data was analyzed using a multi-step method that permitted data reduction and identification of principal factors (Weiringa and Verhoef, 2007; Anton et al, 2009). Two step inferential statistics methods are used to analyze the data; (1) Principal component analysis with varimax rotation and Kaiser Normalization was used to identify latent factors and reduce variables to only the ones that accounted for the greatest proportion of variability. (2) A logistic regression function was estimated that permitted loyalty to fertilizers to be explained using latent factors and independent variables.

## V. RESULTS:

Exploratory Principal Component Analysis with varimax rotation and a Kaiser normalization is used to distil the factors underlying the survey as these were not defined *ex ante* in the study (Weiringa and Verhoef, 2007). This has several advantages including maximizing variability and reducing multicollinearity in the logistic function. The results of this analysis are reported in Table 1. Table 1 indicates that four latent factors consistent to consumer switching theory account for switching behaviour among farmers in NRDB. Bartlett's spherical test ( $p$  value = 0.000) and KMO test at 0.78 show that Principal Component Analysis is an appropriate method for this type of data. Four principal components with eigenvalues of more than unit which combined explain 76.8 per cent of the variations in the data are extracted. These are (1) Relationship which has significant loading from variables such as research support, educational scholarship support, trusts and contracts, (2) Perceived switching costs both psychological and economic, (3) attractiveness of the titonia innovation, and (4) personal characteristics including age, gender and exposure to polluted water. To test the robustness of the result, the sample was split into two subsamples. The principal component analysis results for the two samples are similar and do not significantly diverge from the results of the pooled data. Confirmatory tests are done using coefficient alpha tests. The smallest of this is 0.62 which is within the acceptable range for robustness. Clearly therefore consumer switching among farmers in NRDB requires that relational, switching costs and attractiveness of the titonia innovation be enhanced.

Table 1: Principal Component Analysis Results

Items	PC1 Relationship Quality	PC2 Switching Costs	PC3 Attractiveness of innovation	PC4 Personal Factors	Communality
Age				0.722	0.543
Gender				0.718	0.586
Education				0.854	0.687
Personal convictions				0.711	0.534
Quality of Water				0.829	0.741
Cost of water collection				0.856	0.671
Incentive		0.876			0.678
Risk of switching		0.789			0.567
Credit		0.857			0.733
Cheap Fertilizer		0.784			0.628
Seed research	-0.847				0.694
Size of debt owed	-0.833				0.587
Contracts entered	-0.767				0.648
Level of Trust	0.944				0.764
Educational Sponsorship	0.783				0.673
Transport services	0.702				0.543
Knowledge about Titonia			0.885		0.622
Effort to adopt			-0.912		0.706
Explained Variance	29.8%	15.3%	9.2%	22.5%	76.8%
Coefficient alpha	0.872	0.754	0.623	0.844	

The second step in the analysis of data entailed using a logistic binary regression model. Following Wairinga and Verhoef (2007, P. 180) this study presupposes that switching intentions of consumers are determined as a choice problem where consumers attempt to maximize a subjective utility function. In this paper a logistic probability function is estimated that links choice to switch to principal components, usage of fertilizer and diversification of crops respectively. The results of this estimate are reported on Table 2.

**Table 2 Results of the Logistic Model Estimate**

Variable	Parameter (Standard Error)
Constant	2.46 (0.146)
PC1: Relationship (Low to high)	1.984* (0.018)
PC2: Switching Cost (Low to High)	0.384* (0.001)
PC3: Attractiveness of Innovation(Low to High)	0.234* (0.011)
PC4: Personal Characteristics(Low to High)	0.427* (0.022)
Usage of Fertilizer	-0.848* (0.016)
Crop Diversity Index	0.567* (0.004)
R <sup>2</sup> (McFadden)	0.312
% Correct Predicted	88.4%
% (Proportional Criterion)	56.8%
% (Maximum chance criterion)	68.9%

From Table 2, consumer switching behaviour of farmers in NRDB appears to follow an underlying logistic model. This model is determined by factors in the control of the cane manufacturers including relationship and switching costs. To reduce this influence policy must aim at increasing investment in counter factors including enhancing the attractiveness of tintonia

#### IV CONCLUSION

Consumer switching is critical as an instrument of social change. This paper considers how consumer switching may be used to promote sustainable agriculture in NRDB through reducing fertilizer based water degradation. Farmers in NRDB are studied concerning their consumer switching propensities from inorganic fertilizers to tintonia, a locally available shrub that is rich in soil nutrients. The results show that a variety of



levers may be used to promote switching. Primary among these is enhancing the attractiveness of the product, and reducing switching costs. These provide critical policy levers that may be used to enhance sustainable agriculture in NRDB.

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