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Determinants Of Behavioural Intention to Adopt Food Safety Principles Among Vegetable Growers in Punjab India and Nakuru, Kenya: The Case of Good Agricultural Practices (Gaps)

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ABSTRACT

Good Agricultural Practices (GAPs) is a well-structured framework embraced voluntarily to ensure food safety along the entire vegetable value chain. Limited research has explored the perspective of vegetable growers' perspectives across distinct countries and continents regarding GAP. To address this gap, our study sought to understand the factors influencing the vegetable growers' inclination to adopt GAP in Punjab State, India and Nakuru County, Kenya. The target population for the study was 1000 vegetable growers. A sample size of 200 vegetable growers was arrived at by use of Cochran Formula. Employing an ex-post facto study design, we collected primary data through surveys conducted with 200 randomly selected vegetable growers evenly split between Punjab and Nakuru. Utilizing an interview schedule, we assessed the determinants influencing growers' intention to adopt GAP, ranking them using the Relative Importance Index (RII). Correlation of behavioural intention on determinants and behavioural intention multiple regression on determinants were also analysed. Predominantly, growers highlighted production costs, market exclusivity, training, government support, and labour accessibility as pivotal factors influencing their GAP adoption. There was a statistically significant linear relationship between adoption determinants and behavioural intention in Punjab (r=-.225, p < .024) and in Nakuru (r=.275**, p < .006). The overall adequacy of the multiple regression model within Punjab state did not reach statistical significance, as evidenced by an F-statistic of 1.699, yielding a p-value of 0.661 (F (15, 84) = 1.699, p = 0.066), whereas the overall model fitness within Nakuru County exhibited statistical significance, evident from an F-statistic of 8.042 with a p-value less than 0.0005 (F (15, 84) = 8.042, p < 0.0005). Consequently, the study offers essential policy implications concerning GAP utilization within the agricultural sectors of India and Kenya.*

Keywords: Good Agricultural Practices, Food Safety, Determinants, Vegetable growers, Behavioural intention

1. INTRODUCTION

Food safety has become increasingly significant over time due to its critical implications for health and trade. Ensuring the production of safe food is essential for safeguarding consumers against foodborne illnesses and is pivotal for both domestic food business and for enhancing competitiveness in global markets. Risks can arise at various stages of the food supply chain, starting from primary production, involving issues such as residues exceeding permissible levels, microbial contaminants, and heavy metals. Addressing food safety from farm level production is therefore imperative. The implementation of Good Agricultural Practices (GAP) throughout on-farm production and post-production processes is paramount in yielding safe agricultural products, thereby guaranteeing a secure food supply.

Vegetables consumption is central to the human diet due to their high nutritional levels. They provide vitamins, carbohydrates, proteins, and other requisite food elements. Consumption of vegetables has become increasingly popular among individuals who prioritize their health. (Weinberger and Lumpkin 2007), a situation enhanced with the onset of the covid-19 pandemic. Focus has shifted to vegetable safety and quality at the domestic and foreign markets due to the higher risk of contamination, especially on the ready-to-eat variety.

The emphasis on quality and safety in vegetable production has encouraged the development and push for standardized cultivation principles known as Good Agricultural Practices (GAP) (Guddanti, 2015). GAP represents a structured and voluntary approach covering on-farm and off-farm operations for sustainable and fair production practices, particularly among small-scale farmers (Mausch et al., 2006). Among the various GAP standards, GlobalGAP, introduced by the FAO, stands out for its commitment to ensuring high-quality food safety standards in agricultural-producing countries (Wannamolee, 2008). Its establishment followed a significant global surge in foodborne illnesses (Alonso et al., 2019), with Asia alone witnessing sickness affecting over 150 million people and resulting in 175 thousand deaths, a 42% of the global mortality rate (Anonymous, 2015). In Africa, foodborne disease costs exceed $1 billion (Anonymous, 2016a), predominantly linked to vegetables, which, despite their nutritional value, pose significant food safety risks.

While Good Agricultural Practices (GAP) mitigate food safety risks, challenges persist in their implementation throughout the vegetable production chain. Nonetheless, diligent adoption of GAP principles ensures nutritious, high-quality vegetables while enhancing market accessibility. At the farm level, the efforts involved in implementing GAP aim to guarantee food safety for human consumption, hence improving profitability and healthier harvests for vegetable growers (Anonymous, 2010b). The effective management of GAPhas demonstrated considerable success in reducing the risks of food contamination in agricultural production.

Adoption of GAP depends on the intentions of the vegetable growers, which will then determine their behavior towards GAP. Several studies have focused on farmers' adoption of GAP, with some citing income, the experience of GAP training, information, and farm size as the main determinants (Krause *et al* 2016; Suwanmaneepong *et al* 2016; Amekawa *et al* 2017; Bac *e t al* 2019). Compliance with GAP standards on the use and management of agrochemicals has also drawn interest among scholars (Schreinemachers *et al* 2012; Amekawa *et al* 2013; Srisopaporn *et al* 2014). The focus has also been on vegetables for export, large-scale vegetable farmers, and smallholder vegetable farmers contracted by partnering organizations (Henson and Jaffee 2008; Asfaw *et al* 2011; Holzapfel and Wollni 2014). Information on determinants of intention to adopt GAP is scarce, both from a theoretical component and measurable results.

2. METHODOLOGY

2.1 Study area

The research was carried out in the state of Punjab, India, and Nakuru County, Kenya.

Fig.1Punjab State (source2020 Government of Punjab)

Punjab State is located at 31.1471° N, 75.3412° E, India. Punjab is divided into three distinct regions based on type of soils: central, southwestern and eastern. The soil is classified as flood, loamy, sandy, desert, kandi, sierozems, forest and saline soils. The climate of Punjab State is tropical, semi-arid, hot and subtropical monsoon type with cold winter and hot summer. The maximum temperature experienced in the state is above 40 between May and June. The minimum temperature is from December to February with lowest recorded temperature at 0.2.

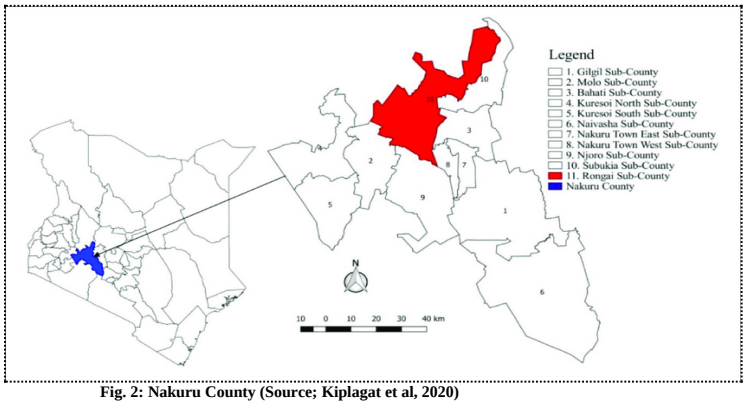

Fig. 2: Nakuru County (Source; Kiplagat et al, 2020)

Nakuru County, situated in Kenya, lies at coordinates 1°00′N 38°00′E. It boasts fertile agricultural land featuring various soil types such as clay, clay loam, loam, sandy clay, clay sandy, clay loam, and sandy loam. Known for its cool climate, Nakuru ranks among Kenya's colder regions, with an average daily high temperature hovering around 25 degrees Celsius. The County experiences two distinct rainy seasons: the long rains from March to May and the short rains from October to December.

2.2 Sampling and data collection

Primary data was collected through an interview schedule. Purposive sampling method was used to select respondents from vegetable growers' groups in Punjab, India, and vegetable growers' association in Nakuru, Kenya. In Punjab, the researcher obtained a list of farmers engaged in vegetable growing activities in each district from the Department of Vegetable Science, Punjab Agricultural University. Similarly, a list of 500 vegetable growers registered with Nakuru County Farmers 'Association (NCFA), was obtained from the Department of Agriculture, Livestock and Fisheries, County Government of Nakuru, hence a target population of 1000 vegetable growers.

Cochran Formula was used to arrive at a sample size of 250 respondents where

$$n_0 = \frac{Z^2 pq}{e^2}$$

Where:

e = 0.062
p =0.5
q = 0.5
$n_o = (1.96)^2 * (0.5)^2 / (0.062)^2$
= 249.8
= 250

However, given that the study was carried out during the Covid-19 pandemic and movement was restricted, there was need to further reduce the sample size. This was done using the modification for the Cochran Formula as follows

$$n = \frac{n_0}{1 + \frac{(n_0 - 1)}{N}}$$

n = 250/ 1 + (250-1/1000) = 200 vegetable growers.

2.3 Empirical model

Determinants for adoption was operationalized as influences that contribute to the adoption of GAP among vegetable growers. A 5-point continuum ranging from very unimportant to very important was used to collect data on this variable.

Relative Importance Index (RII) was used to rank the determinants which influenced intention to adopt GAP among vegetable growers. The Relative Importance index value is between 1 and 0. The following formula was used;

Relative Importance Index (RII) =

$$\frac{5_{n5} + 4_{n4} + 3_{n3} + 2_{n2} + 1_{n1}}{A * N}$$

Where n5 = number of respondents for very important
n4 = number of respondents for important
n3 = number of respondents for undecided
n2 = number of respondents for unimportant
n1 = number of respondents for very unimportant
A (Highest weight) = 5
N (Total number of respondents) = 100 for Punjab and 100 for Nakuru

Intention was operationalized as the motivational factors among vegetable growers that would influence them to adopt GAP. Five intention items were measured on a scale developed by Francis *et al* (2008) on a 7-point continuum ranging from strongly agrees to strongly disagree. Scoring was done by calculating the mean of the five intention scores.

2.4 Measuring behavioural intention

To measure behavioural intention, questions were posed to the respondents on a semantic differential scale with expectation of strongly disagree/strongly agree response on a scale of 1 to 7. The mean score of the responses was taken; and this was used as the behavioural intention score for each farmer.

After testing for assumptions and establishing that they had been met, a multiple regression analysis of behavioural intention regressed on the determinants was carried then out. The variable of behavioural intention was then regressed on predictor variables of determinants

3. RESULTS AND DISCUSSION

Table 1 revealed the factors which highly influenced intention to use GAP among vegetable growers in Punjab and Nakuru. Vegetable growers in Punjab identified cost reduction, exclusive markets for vegetables, training, new varieties of vegetables and influence from their peers as the major determinants on intention to adopt. On the other hand, respondents in Nakuru identified government support, exclusive markets, labour, family concerns and reduction in production costs as the main influencing factors.

Table 1: Determinants influencing intention to adopt GAP

Punjab			**Nakuru**		
Determinant	**RII**	**Rank**	**Determinant**	**RII**	**Rank**
Reduced production costs	0.9	1	Support from government agencies	0.99	1
Exclusive rates for vegetables produced through GAP	0.884	2	Exclusive rates for vegetables produced through GAP	0.928	2
Adequate training on use of GAP	0.88	3	Enough labor to engage in GAP	0.926	3
Profitable varieties for GAP	0.828	4	Farmer and family health	0.924	4
Influence of other farmers and opinion leaders	0.818	5	Reduced production costs	0.922	5
Support from government agencies	0.814	6	Influence of other farmers and opinion leaders	0.918	6
Recommendation from research agencies	0.808	7	Environmental friendliness	0.902	7
Safe use of chemicals	0.802	8	Animal health and welfare	0.898	8
Consumer and societal consideration	0.758	9	Consumer and societal consideration	0.894	9
Enough labor to engage in gap	0.75	10	Recommendation from research agencies	0.89	10
Farmer and family health	0.734	11	Safe use of chemicals	0.888	11
Animal health and welfare	0.7	12	Profitable varieties for GAP	0.886	12
Environmental friendliness	0.696	13	Interested and believes in GAP concept	0.882	13
Interested and believes in GAP concept	0.634	14	Unhappy with conventional farming	0.874	14
Unhappy with conventional farming	0.596	15	Adequate training on use of GAP	0.794	15

RII-Relative Importance Index

The costs involved in switching to GAP among vegetable growers require a lot of investment. Technology adoption in Punjab in the past was influenced by easy accessibility and affordability, thus making cost reduction an important consideration among the respondents. In comparison, technology adoption levels in Kenya have always been low, partly due to the costs involved, and hence is a significant factor in intention to use GAP. Various authors have reported the same findings on cost reduction as a determinant for technology adoption (Ogada *et al* 2010; Omamo and Mose 2001; Kirago 2015; Banzon *et al* 2013).

Exclusive market rates and market access is another determinant for intention to adopt GAP. The perceived economic advantage for vegetables produced through GAP is an influencing factor complimenting findings by Banzon *et al* (2013).

The provision of new crop varieties was another factor influencing the intention to adopt in the two regions. Similar findings in Punjab were reported by Syan *et al* (2019). In Nakuru, new or improved cultivars have not adequately met the local demand due to the importation of most seeds and lack of appropriate stock plants. There are also no proper marketing systems in place for nursery products. Wambugu and Kiome (2001) also reported on challenges in access to nursery products.

Additionally, training on GAP, support from the government, access to cheap labor, and influence from peers was ranked highly as determinants for intention to adopt. Training would improve farm practices while friendly government policies would encourage adoption for instance, in Punjab, the Minimum Support Price system (MSP) has led to a bias in production towards wheat and rice.

Hired labor is preferred among vegetable growers because it is associated with efficiency. Most respondents claimed that labor from family members reduced efficiency and hence would consider adoption if there was an assurance of access to hired labor. The observations agree with findings by Chepngetich *et al* (2015). Influence from other farmers and opinion leaders increase the probability of adoption as respondents realize the potentiality of GAP from their peers. The vegetable growers from the two regions considered this form of social learning salient, findings which corroborate those by Conley and Udry (2010) and Bandiera and Rasul (2006).

3.1 Comparative distribution of Theory of Planned Behaviour Constructs

Table 2 shows how behavioural intentions is spread out amongst the vegetable growers in Punjab and Nakuru.

Table 2: Distribution of vegetable growers according to their behavioural intention

S/NO	Construct	Categories	Punjab		Nakuru	
			f	*(%)*	*f*	*(%)*
1	Behavioural Intentions	High Intenders	78	78.0	85	85.0
		Low Intenders	22	22.0	15	15.0

**Data represented in frequency (percentages)*

The findings above show that majority of the sampled vegetable growers in Punjab (78%) as well as those in Nakuru (85%) fell into the high intenders group. Adoption of GAP among them would therefore be easy as (Cherotich & Kaur, 2022).

3.2 Comparative distribution of Theory of Planned Behaviour Constructs

Our exploration compared the correlation of behavioural intention and determinants in Punjab State and Nakuru County. The results are as shown in Table 3.

Table 3: Correlation of behavioural intention and determinants

		Punjab		Nakuru	
		Behavioural Intention	Determinants	Behavioural Intention	Determinants
Behavioural Intention	Pearson Correlation	1	-.225*	1	.275**
	Sig. (2-tailed)		.024		.006
	N	100	100	100	100
Determinants	Pearson Correlation	-.225*	1	.275**	1
	Sig. (2-tailed)	.024		.006	
	N	100	100	100	100

The results above reveals that behavioural intention and determinants for adoption have a statistically significant linear relationship in Punjab (r=-.225*, p < .024) and in Nakuru (r=.275**, p < .006). The direction of the relationship in Punjab is negative whereas in Nakuru, the direction of the relationship is positive. The magnitude, or strength, of the association is for the two regions is approximately moderate (.2 < | r | < .5).

3.2 Behavioural Intention multiple regression on determinants of adoption

In our exploration of the determinants of behavioural intention among vegetable growers in Punjab State and Nakuru County, we employed a multiple linear regression model to assess the contributions of government support (X1), influence of farmers and opinion leaders (X2), consumer consideration (X3), safety (X4), reduced production costs (X5), Environmental friendliness (X6), conventional farming (X7), belief in GAP concept (X8), health (X9), Labour (10), animal welfare (X11), research scientists opinions (X12), profitability (X13), Training (X14), and exclusive rates (X15) . The model, specified as $Y = \beta0 + \beta1X1 + \beta2X2 + \beta3X3 + \beta3X4 + \beta3X5 + \beta3X6 + \beta3X7 + \beta3X8 + \beta3X9 + \beta3X10 + \beta3X11 + \beta3X12 + \beta3X13 + \beta3X14 + \beta3X15 + \varepsilon$, where Y represents behavioural intention, aimed to provide a comprehensive understanding of how these variables collectively influence GAP adoption in vegetable production. The results are are seen in Table 4.

Table 4: Behavioural Intention –multiple regression on determinants among vegetable growers

Independent Variable	Punjab	Nakuru
	Coefficient	
Support from Government agencies (e.g. subsidies)(specify kind of support)	-.361(.719)	1.364(.176)
Influence of other farmers/opinion leaders	1.449(.151)	-.070(.945)
Consideration for consumers/ society	-1.497(.138)	-1.438(.154)
Safe use of chemicals	1.231(.222)	1.950(.054)
Reduced production costs (e.g. saving on pesticide costs)	.571(.570)	-.022(.982)
Environmental friendliness	-.061(.952)	.402(.689)
Unhappy with conventional farming	1.585(.117)	-.261(.794)
Interested/believe in GAP concept	-.293(.770)	3.002(.004)
Farmer and family Health	-1.074(.286)	.702(.485)
Enough labor to engage in GAP farming	1.132(.261)	.380(.705)
Animal health &welfare	-1.217(.227)	.565(.573)
Adequate recommendations from the research agencies	-.354(.724)	-1.870(.065)
Profitable varieties for application of GAP	1.653(.102)	.315(.754)
Adequate training facilities on GAP in vegetable production	2.574(.012)	-.767(.445)
Exclusive rates for the vegetables produced through GAP	-2.528 (.013)	-2.023(.046)
Constant	-2.293(.024)	
R^2	.233	
F	(15, 84) 1.699= .066	(15,84)8.042=<.0005
n	n = 100	

Note: Coefficients are unstandardized OLS partial regression slopes with standard errors in parentheses

Model Summary: The overall fit of the model in Punjab state was not statistically significant, as indicated by an F-statistic of 1.699 with a p-value of 0.661, F (15, 84) =1.699, p= .066. Two variables (adequate training on use of GAP in vegetable production and exclusive rates for vegetables produced through GAP) added statistically significantly to the prediction at $p<0.05$. This suggests that the model does not explain a significant portion of the variance in behavioural intention. The adjusted R^2 value of .233 further illustrates that our model can only account for approximately 23.3% of the behavioural intention to adopt GAP. In comparison, the the overall fit of the model in Nakuru County was statistically significant, as indicated by an F-statistic of 8.042 with a p-value less than .0005, F (15, 84) =8.042, $p<0.0005$), suggesting that the model explains a significant portion of the variance inbehavioural intention to adopt GAP. The adjusted R^2 value of .590 further illustrates that our model can account for approximately 59% of the behavioural intention, highlighting the included predictors' substantial impact.

4. CONCLUSION & RECOMMENDATION

Most vegetable growers identified production costs, market exclusivity, training, government support and access to labour, access to new varieties, family health concerns, and influence from other farmers as the key determinants to the use of GAP in their activities.

There should therefore be an introduction of price premium paid to vegetable growers who adhere to GAP standards, aptly expressed by vegetable growers as market exclusivity. This will act as a motivating factor towards full adoption of GAP. There should therefore be an introduction of price premium paid to vegetable growers who adhere to GAP standards, aptly expressed by vegetable growers as market exclusivity. This will act as a motivating factor towards full adoption of GAP.

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