

IMPACT OF CLIMATE CHANGE ON PLASTIC PRODUCT USAGE AMONG AGRO-MARKETERS AND HORTICULTURAL ENTERPRISES IN CALABAR AGRICULTURAL ZONE, CROSS RIVER STATE

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Abstract:

This study assessed the impact of climate change on the use of plastic products among agro-marketers and horticultural enterprises in the Calabar Agricultural Zone of Cross River State, Nigeria. A structured questionnaire was used to collect primary data from 200 respondents selected through a multistage sampling procedure. The findings reveal that climate change significantly influenced the socioeconomic characteristics of respondents, leading to an increase in labor demand (mean = 2.7), enhanced membership in professional, cooperative, and market organizations (mean = 2.53), and improved knowledge on plastic products and climate change awareness (mean = 2.47). Moreover, climate change impacted agro-market enterprises through the imposition of carbon emission taxes (mean = 2.94), rising packaging costs due to unfavorable plastic policies (mean = 2.92), and an increase in the release of harmful chemicals from plastic waste caused by higher temperatures (mean = 2.75). The study recommends raising climate change awareness among agro-marketers and horticulturists in the region to mitigate the adverse effects of climate change on plastic usage. Additionally, government agencies should closely monitor plastic production to ensure the elimination or reduction of harmful chemicals, which are particularly sensitive to climate variations, thereby affecting the quality of products in plastic packaging.

Keywords: Climate Change, Plastic Products, Agro-Marketers, Horticultural Enterprises, Cross River State

Introduction

Climate change, driven by global warming, has introduced increasing variability and unpredictability in weather patterns, leading to significant shifts in environmental conditions across the globe. This phenomenon has resulted in persistent rises in temperature, changes in precipitation patterns, and the occurrence of extreme weather events, all of which affect the natural balance of the environment. The effects of climate change are not just limited to the physical environment; they also significantly impact various human activities, including agricultural enterprises. Agro-enterprises, which once thrived in a stable environment with predictable weather patterns, are now grappling with the challenges posed by fluctuating climate conditions. These challenges include rising temperatures, shifting rainfall patterns, and extreme weather events such as floods and droughts, which directly affect the livelihoods of those involved in agriculture and related sectors.

The use of plastic products has emerged as a significant factor in agricultural and horticultural enterprises, especially in packaging, storage, and other essential activities. Plastics, due to their versatility, have become an indispensable tool for agro-marketers and horticulturists. These materials are favored for their low cost, durability, light weight, resistance to corrosion, and ability to provide safe and hygienic storage solutions for agricultural products. Agro-enterprises, including those in the horticultural and agricultural markets, have greatly benefited from the ability to package food, store fertilizers and chemicals, protect crops from harsh weather conditions, and preserve harvested products. Furthermore, plastic materials such as plastic roofs, nets, frames, and containers have improved the efficiency and productivity of these businesses.

However, despite the numerous advantages of plastics in agro-enterprises, the use of plastic products has brought about significant environmental concerns. The non-biodegradable nature of plastic products means that they accumulate in the environment, causing pollution and contributing to long-term environmental degradation. Over time, the improper disposal and accumulation of plastic waste have disrupted soil health, harmed aquatic ecosystems, and contributed to the emission of greenhouse gases such as methane, which further exacerbates climate change. Plastics, through the release of harmful chemicals and the disruption of ecological systems, have become a significant environmental concern that negatively affects agro-enterprises. This plastic pollution can damage not only the environment but also the products being stored or transported, thereby increasing operational costs and reducing product quality.

The increasing environmental pollution from plastic waste has compounded the negative effects of climate change on agro-marketers and horticulturists. As temperature extremes rise due to global warming, agro-enterprises face new challenges related to the storage and packaging of perishable goods. For example, the higher temperatures may lead to the degradation of products that are stored in plastic packaging, as the plastic material becomes more susceptible to heat damage. Additionally, the increased prevalence of extreme weather events, such as heavy rainfall or prolonged dry spells, further complicates the storage of agricultural inputs and products. For instance, excess moisture in the environment may cause plastic containers to weaken, reducing their ability to properly store products. Conversely, extreme dryness may increase the need for water-intensive activities such as irrigation and cooling, which increases the cost of production.

These impacts are not only environmental but also socio-economic. The rise in the cost of production, storage, and transportation due to climate-induced disruptions and plastic-related issues has placed considerable strain on agro-marketers and horticulturists. Increased costs associated with climate change adaptation—such as refrigeration to preserve perishable goods, the need for more resilient plastic packaging, and the higher price of raw materials—have reduced the profitability of agro-enterprises. Moreover, the increase in the frequency and intensity of climate-related events has led to reduced product shelf life, making it more challenging to manage product quality. This, in turn, affects the marketability of products and increases the cost of doing business, potentially driving small-scale agro-marketers out of business.

In response to these challenges, agro-marketers and horticulturists have started to adopt various coping strategies. Many enterprise owners have increased their awareness of climate change and its potential impacts on their business operations. They have also joined cooperatives and other professional organizations to share knowledge, resources, and strategies for mitigating the negative effects of climate change. These organizations play a crucial

role in helping agro-enterprises navigate the complex challenges of climate change by facilitating access to subsidies, grants, and new technologies that improve efficiency and resilience.

Despite these efforts, the use of plastic products continues to be a double-edged sword for agro-enterprises. While plastic materials have revolutionized agricultural practices and facilitated the growth of many agro-marketing businesses, the associated environmental costs and the impact of climate change on plastic materials cannot be ignored. The degradation of plastic packaging due to rising temperatures, the increased cost of acquiring durable packaging, and the rising need for refrigeration and cooling due to hotter conditions further strain the resources of agro-marketers and horticulturists. The difficulty of properly disposing of plastic waste and the impact of plastic pollution on the environment are pressing concerns that require urgent attention.

In conclusion, while climate change and the use of plastic products have brought numerous benefits to agro-enterprises, these innovations have also led to significant environmental and socio-economic challenges. The combination of climate-induced disruptions, rising costs, and plastic-related pollution has created a complex set of issues that agro-marketers and horticulturists must address in order to ensure the sustainability of their businesses. The adaptation of new technologies, improved waste management practices, and better climate change awareness are crucial to mitigating the adverse effects of climate change and plastic use in agro-marketing and horticultural enterprises. As the global climate continues to change, it is imperative that strategies are developed to address these challenges and create a more sustainable future for agro-enterprises worldwide.

STATEMENT OF THE PROBLEM

Flexible and non-flexible plastic products have varied use in horticulture and agro-markets. Plastic bags and plastic containers have been widely adopted by various users but the effect of climate change has also affected the efficiency of plastic and stored products to impact negatively on the environment and on life forms (Etim, 2018). Researchers such as Kerri (2021) and UNEP (2021) have asserted that agricultural plastics are major contributors to climate change. Whereas other authors (Nyarko and Adu (2016); Michael and Williams (2015) have highlighted that plastic use in agriculture is highly beneficial. The occurrence of global warming has created a reverse trend for plastic usefulness which also affect stored products, enterprises, enterprise owners and the socioeconomic characteristic of farmers and marketers. They are many literatures on the effect of climate change in agriculture, little or nothing has been done on the impact of climate change on plastic users in agro-marketing and horticultural enterprises. This is the essence of the study which assesses climate change impact on the use of plastic products among agro-marketers and horticultural enterprises in Calabar Agricultural Zone of Cross River State.

OBJECTIVES OF THE STUDY

This study assesses climate change impact on the use of plastic products among Agro-marketers and horticultural enterprises in Calabar agricultural zone of cross river state. The objectives of the study were to;

1. examine climate change impact on the socioeconomic characteristics of respondents
2. determine the impact of climate change on agro-marketing
3. assess the impact of climate change on horticultural enterprises

MATERIALS AND METHODS

This study was conducted in the Calabar Agricultural Zone of Cross River State which consist of Akamkpa, Biase, Odukpani, Calabar South, Calabar Municipality, Bakassi and Akpabuyo. The study population is made up of the 447 registered Agro-market Enterprise and Horticultural Enterprises in the zone. The respondents are the owners of the 447 enterprises. The study adopts a multi-stage sampling technique. The First stage; was the purposive selection of 100 enterprises in each block in the southern agricultural zone of Cross River State. The second stage; was the simple random selection of 16 enterprises from Calabar Municipality, and 14 enterprises from the other blocks in the zone. This makes up the cell. The third stage; was the selection/sampling of the enterprise owners of the selected cells which makes up the farm family.

Primary data were collected by the use of a structured questionnaire which was administered by the researcher. Secondary data was collected by request from the Cross River State Ministry of Agriculture on the number of registered Agro-marketing enterprises and Horticultural enterprises in the zone. This also included publications, articles and journals. Data analysis adopted the descriptive research statistics which involves the use of simple percentages, the score of means and ranking to sort and code data for analysis/examination, interpretation and discussion.

Measurement of Variables

Objective 1: variables on the climate change impact on the socioeconomic characteristics of respondents were measured using a three-point Likert type of Scale for; „Agree“ which is coded as 3, „Undecided“ coded as 2, and *Disagree* coded as 1, and presented using mean score and ranking. Objective 2: variables on the impact of climate change on agro-marketing were measured using a three-point Likert type of Scale for; Agree“ = 3, „Undecided“ = 2, and „Disagree“ = 1, and presented using mean score and ranking.

Objective 3. Variable on impact of climate change on horticultural enterprises were measured on a three-point Likert type of Scale for; Agree“ = 3, „Undecided“ = 2, and „Disagree“ = 1, and presented using mean score and ranking.

RESULTS AND DISCUSSION

A. climate change impact on the socioeconomic characteristics of respondents

Table 1 – Distribution of Respondents Based on the ratings of climate change impact on their Socioeconomic Characteristic

S/No. Rank	Variables	Agree	Undecided	Disagree	Mean	
1.	Enhances expansion of business	77	21	102	1.87	Insignificant 15 th
2.	Enhance enterprise ownership	76	12	112	1.82	Insignificant 17 th
3.	Leads to change of occupation/trade	124	10	66	2.29	Significant 7 th
4.	Enhances additional income	85	20	95	1.95	Insignificant 12 th
5.	Improves sources of income	66	34	100	1.83	Insignificant 16 th
6.	Increase physical stress factors	140	10	50	2.45	Significant 5 th
7.	Increases labour demand	170	0	30	2.7	Significant 1 st
8.	Increases the cost of input	120	15	65	2.27	Significant 8 th
9.	Improves value addition	68	24	108	1.8	Insignificant 18 th
10.	Improves knowledge through plastic and climate change awareness	139	16	45	2.47	Significant 3 rd
11.	Enhances membership in professional, cooperative, market or farm organization	152	3	45	2.53	Significant 2 nd
12.	Improves skill/experience	99	50	51	2.24	Significant 9 th
13.	Improves farming/marketing methods	95	49	56	2.19	Significant 10 th
14.	Improve my standard of living	59	70	71	1.94	Insignificant 13 th
15.	Improve my social status	49	40	111	1.69	Insignificant 20 th
16.	Improve my access to plastic inputs	43	67	90	1.76	Insignificant 19 th
17.	Positive change in attitude and personal development	120	21	59	2.30	Significant 6 th
18.	Enhance employment	44	92	64	1.9	Insignificant 14 th
19.	Increase my expenditure for packaging	98	43	59	2.19	Significant 10 th
20.	Cause health problems to my body	10	60	130	1.4	Insignificant 21 th
21.	Affect my environment with health hazard from waste	87	28	85	2.01	Significant 11 th
22.	Makes cleaning difficult	142	8	50	2.46	Significant 4 th

Source: Field Survey, (2022). Benchmark mean ≥ 2.0 Implies significant Table 1 represent the distribution of respondents based on the mean rating of climate change impact on their Socioeconomic Characteristic. Findings indicate significant impact of climate change on the socio-economic characteristic of both agro-marketers and

horticulturists in the study area. They include; increases labour demand ($\bar{x} = 2.7$: rank 1st), enhances membership in professional, cooperative, market or farm organization ($\bar{x} = 2.53$: rank 2nd), improves knowledge through plastic and climate change awareness ($\bar{x} = 2.47$: rank 3rd), and makes cleaning difficult ($\bar{x} = 2.46$: rank 4th). Table 1 also reveal insignificant variables on the impact of climate change on respondent's socio-economic characteristics which implies that climate change does not; improves value addition ($\bar{x} = 1.8$: rank 18th), improve my access to plastic inputs ($\bar{x} = 1.76$: rank 19th), improve my social status ($\bar{x} = 1.69$: rank 20th) and cause health problems to my body ($\bar{x} = 1.4$: 21st).

Supporting the findings of this study, Agbola and Fayiga (2016), asserted that extreme climate conditions have caused flooding, extreme heat and drought which has led to the degradation of the soil resulting to poor yield and this may affect the farmer's livelihood by a reduction of income.

S/N	Variables	Agree	undecided	Disagree	Means	Remark	Ranking
1.	Reduce the shelf life of stored product	69	0	31	2.38	Significant	5th
2.	Increase the degradation of product quality	65	6	29	2.36	Significant	6th
3.	Increase cost of packaged goods due to unfavourable plastic policies	96	0	4	2.92	Significant	2nd
4.	Scarcity of plastic packages	29	12	59	1.7	Insignificant	10 th
5.	Increase the cost of waste evacuation in the market environment	67	0	33	2.34	Significant	7th
6.	Payment of Carbon emission tax	96	82	2	2.94	Significant	1st
7.	high consumption of water is not economical	69	8	23	2.46	Significant	4th
8.	Increase the release of harmful chemicals from plastic waste due to higher temperatures to the environment	87	1	12	2.75	Significant	3rd
9.	Increase consumption of plastic packaged food	42	0	58	1.84	Insignificant	9th
10.	Causes business failure	69	0	31	2.38	Significant	5th
11.	Increases the leaching effect of plastic chemicals into stored products	62	0	38	2.24	Significant	8th
12.	Displacement and redundancy of old technology to climate change mitigation technology	69	0	31	2.38	Significant	5th
				29	2.36	Significant	6th
13.	Reduce business asset value						

Source: Field Survey, (2022).

B. The Impact of Climate Change on Agro-marketing

Table 2. Mean rating of plastic users based on Climate change impact in agro-market enterprises

Table 2 show the ratings of the means of respondents based on climate change impact in agro-market enterprises. Findings indicate that most variables were highly significant on the impact of climate change on Agro-marketing enterprises. There are; payment of Carbon emission tax (\bar{x} = 2.94), increase cost of packaged goods due to unfavorable plastic policies (\bar{x} = 2.92) and increase the release of harmful chemicals from plastic waste due to higher temperature to the environment (\bar{x} = 2.75). Other significant variables were that; high consumption of water is not economical (\bar{x} = 2.46), reduce the shelf life of stored products (\bar{x} = 2.38), increases the leaching effect of plastic chemicals into stored products (\bar{x} = 2.38),

Displacement and redundancy of old technology to climate change mitigation technology (\bar{x} = 2.38), increase the degradation of product quality (\bar{x} = 2.36), Reduce business asset value (\bar{x} = 2.36), increase the cost of waste evacuation in the market environment (\bar{x} = 2.34), increase the leaching effect of plastic chemical into stored products (\bar{x} = 2.24). some variables were insignificant such as; increase consumption of plastic packaged food (\bar{x} = 1.84) and scarcity of plastic package (\bar{x} = 1.7). This implies that climate change has a significant impact in the agro-market enterprise which affect their income, environment and health.

The findings of this study correspond with the assertion of Wikipedia, (2021) that climate change affect agriculture both directly and indirectly with adverse outcomes which affect temperature, rainfall and climate extremes causing changes in the nutritional quality of some foods.

C. The Impact of Climate Change on Horticultural Enterprises

Table 3.

Mean rating of plastic users based on Climate change impact in Horticultural enterprises

S/N	Variables	Agree	Undecided	Disagree	Means	Remark	Ranking
1.	Reduce the shelf life of stored product	78	5	17	2.61	Significant	2nd
2.	Increase the degradation of product quality	69	6	25	2.44	Significant	4th
3.	Increase cost of poly bags/ plastic flower pots due to unfavourable plastic policies	46	12	42	2.04	Significant	7th
4.	Scarcity of plastic bags/container	20	10	70	1.5	Insignificant	11 th
5.	high utilization of water is not economical	82	2	16	2.66	Significant	1st
6.	Payment of Carbon emission tax	42	9	49	1.93	Insignificant	9th

7.	Reduction in the amount of work/hour in the garden/farm due to not weather	42	10	45	1.94	Insignifican t	8th
8.	Increase the release of harmful chemicals from plastic waste due to higher temperatures to the environment	71	7	22	2.52	Significant	3rd
9.	Increase purchase of plastic flowering/ seedling for insurance or reseeding due to harsh weather	69	1	30	2.38	Significant	5th
10.	Displacement and redundancy of old technology to climate change mitigation technology	50	10	40	2.1	Significant	6th
11.	Increases the leaching effect of plastic chemicals into flower pots/soil.	32	10	58	1.74	Insignifican t	10 th
12.	Causes business failure	78	5	17	2.61	Significant	2nd
13.	Reduce business asset value	46	12	42	2.04	Significant	7th

Source: Field Survey, (2022). Benchmark mean ≥ 2.0 Implies significant

Results from the mean ratings of respondents on the impact of climate change on activities by horticultural enterprise owners in Table 1 indicate that climate change impact on horticultural activities include; high consumption of water is not economical ($\bar{x} = 2.66$), reduced the shelf life of stored products ($\bar{x} = 2.61$), causes business failure ($\bar{x} = 2.61$) increase the release of harmful chemicals from plastic waste due to higher temperatures to the environment ($\bar{x} = 2.52$) and increase the degradation of product quality ($\bar{x} = 2.44$). These ranked 1st, 2nd, 3rd, and 4th respectively. Some insignificant factors/variables on the impact of climate change on horticultural enterprise are; reduction in the amount of work in the garden/farm ($\bar{x} = 1.94$), payment of Carbon emission tax ($\bar{x} = 1.93$), increase the leaching effect of plastic chemicals into flower products ($\bar{x} = 1.74$) and scarcity of plastic bags/containers ($\bar{x} = 1.5$). This implies that respondents in horticultural enterprises do not pay charges on carbon emission and that the presence of climate change do not reduce the amount of work/hour in the garden/farm. The result on table 3 corresponds with the study of Karen (2021), that the superfluous accumulation of plastic materials on the environment has disrupted the production of soil nutrient and enhanced the release of methane gas which leads to climate change.

CONCLUSION AND RECOMMENDATION

Climate change has impacted agro-market enterprises and horticultural farms in the study area negatively, while also influencing the socio-economic characteristics both positively in terms of improvement in knowledge, skills, membership in professional or cooperative organizations and associations, while also impacting their income, input and labour negatively. It has also created an additional cost and input such as freezing, which comes with

fueling a generator which also comes with the purchase of a generator plant and refrigerator. This also increases the bills in terms of market tax and utility bills from the power holding company.

Recommendations advocated improvement in the level of climate change awareness on the use of plastic products for agro-marketers and horticulturists in the study area in order to improve the knowledge of respondents and help them reduce the severe impact of climate change on products in plastic packages. Also, that the production of plastic products be monitored by government agencies to ensure a total removal or lowest rate of incorporation of hazardous chemicals that are easily influenced by the climate to alter the quality of products in plastics. More research on heat resistant materials for coating on plastics which can reduce the amount of heat passage and alteration of product in package be carried out to support plastic use by agro-marketers and horticultural farmers.

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