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Reducing Food Waste through Entrepreneurial Action: a Tool for Food Security in Dutsin-Ma Local Government Area, Katsina State, Nigeria

[1]Oladejo Lukman Gbolagade, [2]Olusegun Kazeem Lekan & [3]Sonny Emmanuel Braide

[12&3]Department of Business Management, Faculty of Management Sciences, Federal University Dutsinma, Katsina, P.M.B. 5001, Katsina State

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Corresponding Author:
Oladejo Lukman Gbolagade

Abstract

As a result of the negative effect of food wastage in the society and based on the recommendation for further research by previous authors to determine more appropriate entrepreneurial programmes that can be applied to prevent food loss and increase food security in Dutsin-Ma Local Government Area (LGA) of Katsina state, this study focuses on the application of entrepreneurial actions/programmes towards reduction of food waste and improve food security in Dutsin-Ma LGA of Katsina state, Nigeria. The paper provides an empirical analysis of the entrepreneurial actions that can be applied to prevent food loss by farmers at production, post-harvest, and processing stages, and retailers or consumers in the food supply chain in the state. A cross-sectional survey research design was adopted for the study and Frequency distributions, percentage and Contingency Coefficient Cramer analysis are used as data analysis tools via Statistical Package for Social Science (SPSS) version 20. The study revealed a positive statistically significant relationship between entrepreneurial programmes and preservation techniques and food waste reduction at different stages of the food supply chain. It was as a result of this, the study recommends the following appropriate entrepreneurial actions that can prevent food loss and increase food security in Dutsin-Ma Local Government Area, Katsina state: use of mild chemical, sun drying or air drying for food preservation, proper processing and packaging, conversion of fruits to concentrate, and conversion of grains to powder form among others.

Background to the Study

In recent years, food waste and food loss have become great concern to every nation globally. How to improve food security has become focus of researchers, policy makers, business and civil society organizations. This will not be unconnected with the fact that every year around the world, we lose or waste over one third (1/3) totaling about 1.3billion tons of the food we produce FAO (2012). This has affected nearly million people from having enough food to lead a healthy life.

Food loss refers to food that is lost at production, post-harvest and processing stages in the food supply chain. Food waste generally refers to food discarded at the end of the supply chain by retailers or consumers. Food wastage refers to the combination of both food loss and food waste JovisandJeroen (2014). Entrepreneurship involves creation of new things of value to the society. It involves re-branding, re-packaging, re-cycling, and preservation of agricultural produce for sustainable development.

According to the world food summit (1996), food security exists when all people at all times have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life. It includes the availability of food, access to food, utilization of food and stability of all these three elements in the future.

Moreover, food supply chain comprises retail supply chain and individual supply chain. Retail supply chain includes: product (shelf life/formulation, production methods and location), packaging (functionality and labeling), and retail (positioning and storage devices, marketing, price promotions, communications and campaign). While the individual constitutes attitudes, values, motivation, habit, knowledge and skills related to behaviour, awareness of the issue, facilities and resources (FAO, 2015). Meanwhile, the food supply chain above served as framework for the entrepreneurial actions/programmes that would be developed by this study.

Indeed, several international organizations such as African Development Bank (ADB), Entrepreneurial Action Us (ENACTUS), United Nations Development Organization (UNIDO), World Food Programme (WFP), etc are involved in programmes to reduce food waste particularly reducing post-harvest loss and improve food security in developing countries and yet these organizations have not specifically found definite solutions to food security. Thus, this makes this research imperative.

Therefore, in the light of the negative effects of food wastage in the society and based on the studies of Teng and Sally (2012) which suggested that policy strategies to address urban and rural food wastage should take a total supply chain approach in order to achieve systemic change and similar recommendation for further research by Oladejo, Olusegun and Braide (2017) to focus on more appropriate entrepreneurial actions/programmes to improve the effectiveness of value chains or food system in Dutsin-Ma LGA, Katsina state, this study focuses on how to apply entrepreneurial actions/programmes to reduce food waste and improve food security in Dutsin-Ma LGA, Katsina state, Nigeria.

Hence, since waste is generated at every stage of the value chain, this research focuses on typical stages of a product/food production such as producers/farmers, consumers, retailers, wholesalers, distributors, households, but limited to agricultural produce at production, post-harvest, and processing stages, retailers or consumers in the food supply chain. It therefore focuses on how to apply entrepreneurial action/programme to reduce waste or loss at all stages of the food supply chain in Nigeria.

The specific objectives of the study are to:

1. Determine entrepreneurial programmes and preservation techniques that can be applied to reduce food waste at different stages of the food supply chain in Dutsin-Ma LGA, Katsina state
2. Find out entrepreneurial actions to be put in place to improve packaging and preservation of agricultural produce and increase food security in Dutsin-Ma LGA, Katsina state
3. Formulate food waste prevention policy(ies) and effective strategies at the appropriate levels of food supply chain to enhance food security in Dutsin-Ma LGA, Katsina state

Based on the objectives above, the following hypotheses are formulated.

1. Entrepreneurial programmes and preservation techniques reduce food waste at different stages of food supply chain in Dutsin-Ma LGA, Katsina state
2. Improvements in packaging and preservation of agricultural produce have significant relationship with increase in food security inDutsin-Ma LGA, Katsina state
3. Food waste prevention policy(s) and effective strategies at the appropriate levels of food supply enhance food security in Dutsin-Ma LGA, Katsina state

Hence, the importance of this research will in no small measure be valuable to Dutsin-Ma Local Government Area, Katsina state and the entire country by providing appropriate entrepreneurial methods of reducing food wastage particularly, in the area of packaging and preservation of agricultural produce and improving access to availability of food. Valuable recommendations on the relevance of future policy and research in the field of the reduction of food wastage for improving access to availability and sustainability of food will be of great assistance to Katsina state, Nigeria and its people particularly. Therefore, result of the research will strengthen general food security in Nigeria. It will enhance food security and nutrition, improve health and well-being and reduce vulnerability among Nigerian people.

Literature Review

Food security is one of the most current concerns for sustainable food production and consumption yet an under-recognized issue in the effort to combat food waste. The magnitude of food waste is too large to be ignored. Gustavsson, Cederberg, Sonesson, Van Otterdijk, and Meybeck, (2011) have estimated that one-third of global food produced for human consumption is lost or wasted, which is about 1.3 billion tons of food per year. Studies commissioned by FAO estimated yearly global food loss and waste by quantity at roughly 30 percent of cereals, 40 –50 percent of root crops, fruits and vegetables, 20 percent of oilseeds, meat and dairy products, and 35 percent of fish. The food security issue is further complicated

by the fact that a considerable amount of food is lost or wasted along the entire life cycle (Liu, Liu and Cheng, 2013). In an annual assessment of global hunger in 2013, the Food and Agriculture Organization (FAO) of the United Nations reported that "the world produces enough food to feed everyone", yet at the same time an estimated one in eight people, or some 870m, suffer from chronic undernourishment. Many other estimates have shown similar range (Hall, Guo, Dore and Chow, 2009; Beretta, Stoessel, Baier and Hellweg, 2013; Monier, Udgal, Escalon, O'Connor, Gibon, Anderson, Ontoux, Reisinger, Dolley, Ogilvie, and Morton, M., 2010; Fox, 2013) For example, the UK Waste and Resources Action Programme (WRAP) found that the food wasted per year is 22-25% of that purchased (by weight) in the UK (WRAP 2009). On the other hand, Engstrom and Carlsson-Kanyama (2004) and Kader (2005) have estimated that 30 to 40% losses occur in developing countries and, therefore, measures to avoid this will have a big effect on food security.

In medium- and high-income countries food is wasted and lost mainly at later stages in the supply chain due to the behaviour of consumers and lack of coordination between actors in the supply chain. Majority of the food waste in industrialized countries occurs at the retail and consumer stages while post-harvest wastage is typically lessened through modernized supply chains. For example, the US Department of Agriculture (USDA) estimates that 31% of food intended for human consumption at the retail and consumer level in the United States was wasted in 2010 (Jean, Hodan and Jeffrey, 2014). According to the FAO, the quantity of food that is thrown away every year in industrialized countries (222m tonnes) almost matches the 230m tonnes of food produced in Sub-Saharan Africa (Barilla, 2012) which demonstrates the stark contrast that exists between food waste in the richest parts of the world and food insecurity in the poorest part of the world.

It was further established that three major components of the food supply chain and the systems that ensure the accessibility, availability and quality of food must be improved at national and regional levels: farming methods, structural infrastructure and the operating environment. Improved farming methods, including increased mechanization and the use of fertilizers and improved seeds, result in increased efficiency during the early stages of the supply chain and minimize losses. Advanced structural infrastructure, including transport and storage systems and processing facilities, mitigates food loss. Finally, a country's operating environment needs to be robust enough to facilitate efficient markets. Proper regulations, including effective import and export systems, stable political environments and minimal corruption, reduce the likelihood of food loss. By addressing these issues, many developing countries will be able to improve their food security while reducing their food loss.

Zeynep, Uris, Tom and Dominique (2014) investigated the impact of reducing global food loss and waste on food security, international trade, GHG emissions and land use. They employed the Simplified International Model of agricultural Prices, Land use and the Environment (SIMPLE), documented by Baldos and Hertel (2013). To reduce food waste, either price of food can be taxed, or household labour can be subsidized. Since food waste is implicit in the model, it cannot be taxed directly. However, it was concluded that this does not bring any disadvantage to the modeling because it is not possible to determine food waste.

The save food initiative launched by FAO and Messe (2011) at the interpack trade fair for the packaging and processing industry, held in Dusseldorf, Germany rests on four pillars: collaboration and coordination of worldwide initiatives on food waste reduction, awareness raising on the impact of food waste and security, research on policy, strategies and programmes development for food waste reduction, and support to projects for piloting and implementing food loss reduction strategies by the private and public sectors.

It is evident from the aforementioned studies that empirical evidence which explicitly look at the impact of entrepreneurial action to reduce food waste and increase food security is lacking or insufficient both in the developing and developed countries. In particular, quite a large number of studies focus on food waste and food security. So, drawing clear-cut conclusion might be complicated. Therefore, this study addresses the issues of food security in Nigeria with major emphasizes on the contribution of entrepreneurial actions to food security.

Research Methodology

The study adopted a cross-sectional survey research design which is expository in nature. The available data to answer the research questions are readily qualitative and subjective in nature, and were obtained mainly through primary source. A sample of 175 respondents were randomly selected out of the population of 318 registered small and medium scale farmers with 'Nigerian Farmers Association' Dutsin-Ma LGA, katsina state through Krejcie and Morgan 1970 table of sample size determination. Based on the table, one hundred and seventy-five (175) farmers are adequate for a population size of 318 at a margin error of 0.05 and p value of 0.5 with a predetermined critical value of 1.96.

A structured questionnaire in closed-ended and opened-ended questions was used to gather the study data. The questionnaire was grouped into four parts. Part one consists of items relating to demographic profile of the respondents. Part two focuses on items on entrepreneurial programmes and preservation methods that can be applied to reduce food waste at different stages of food supply chain. Part three covers items on entrepreneurial actions to improve packaging and preservation of agricultural produce while Part four comprises items relating to food waste prevention policy and strategies to enhance food security at the appropriate levels of food supply chain.

The face and content validity of the questionnaire was ascertained by the assessment of specialists on the topic in order to determine the appropriateness of the items of the instrument, ascertain relevance and clear ambiguity. The coefficient of the Cronbach's Alpha was employed to determine internal reliability of the instrument which was 0.82 thus, indicated that the items used for the measurement model are technically free from error. Descriptive statistics, mainly the frequency and percentages, were used to analyze the data while Kendall coefficient of concordance was applied to test the hypotheses via SPSS version 21. All statistical tests were carried out at 95% significant level. The results of the hypotheses are presented in the next section.

Data Analysis and Interpretation

Descriptive Analysis

The study sought to establish how entrepreneurial programmes and food waste prevention policy(ies) improve packaging and preservation of agricultural produce and increase food security at different stages of food supply chain. The study discovered that out of 175 respondents there were 105 (60%) food and technology experts, 52 (30%) entrepreneurship consultants, 10 (6%) food processing experts and 8 (4%) management consultants. The majority of the respondents, a total of 99 (56.5%) respondents had 4 – 6 years of experience in food and technology sciences while 38 (22.2%) respondents each had 1 -3 years and 10 and above years of experience in management of agricultural produce and entrepreneurship studies respectively. All respondents acknowledged occurrence of food loss at different stages of food supply chain and emphasized increasing roles of entrepreneurial action towards reducing food loss at production, post-harvest and processing stages.

In the quest to reduce food loss and enhance food security, various entrepreneurial programmes and preservation techniques were suggested for different agricultural produce at different stages of food supply chain. Available information showed that 149 (85%) respondents affirmed that farmers awareness and orientation about food loss, timely harvest, proper storage, effective packaging with processing and sun drying, smoking, salting, and canning were the most effective programmes and techniques for preserving cassava, maize, onion, tomatoes, peppers, yam, fish, meat etc at all stages of food supply chain while 26 (15%) respondents adopted food additive, efficient transportation system, plastic container as effective programmes and air drying, freezing as ideal preservation methods for agricultural produce.

Similarly, it was apparent from the descriptive data that more than two thirds of the respondents proposed improved modern harvesting technology and equipment, hygienic environment, genetic modified system, air tight containers to improve packaging and preservation of agricultural produce. With regards to food waste prevention policy (ies) and effective strategies to enhance food security at the appropriate levels of food supply chain, respondents emphasized that government need to play a greater role in the forms of good road construction to ease problem of transportation of farm produce and improve on the subsidy given to farmers so as to enable them to purchase some mechanical equipment. 156 (89%) respondents suggested that timely planting and harvesting of farm produce, proper handling of agricultural produce, effective transportation system, product sequencing, good packaging, competitive market, and efficient storage facilities would in no small measures reduce food loss but enhance food security. However, 19 (11%) respondents support nearness to farm, proper drying, canning, government subsidy, farmers awareness and orientation as effective strategies to reduce food loss at any stage of food supply chain.

Empirical Analysis

Kendall's tau-c statistic is applied to test whether entrepreneurial programmes and food waste prevention policy (ies) improve packaging and preservation of agricultural produce and increase food security at different stages of food supply chain. The alternate hypothesis is

accepted if the significance value is large enough (conventionally sig. value must be less than .05) then we reject the hypothesis that the variables have negative relationship and gain confidence in the hypothesis that have positive correlation.

Hypothesis 1
Hypothesis one states that entrepreneurial programmes and preservation techniques reduce food waste at different stages of the food supply chain.

Table 1: Summary of Kendall tau-c showing the result of hypothesis 1
Symmetric Measures

		Value	Asymp. Std. Error[a]	Approx. T[b]	Approx. Sig.
Ordinal by Ordinal	Kendall's tau-c	.54	.040	13.21	.000
N of Valid Cases		16			

a. Not assuming the null hypothesis.
b. Using the asymptotic standard error assuming the null hypothesis.

Source: Authors' Computation May, 2018

The value of the Kendall tau-c statistic is .54 with p-value < .05 indicating that a positive significant relationship exists between the two variables. This suggests that entrepreneurial programmes and preservation techniques reduce food waste at different stages of the food supply chain.

Hypothesis 2
Hypothesis two states that improvements in packaging and preservation of agricultural produce have significant relationship with food waste reduction and improvement in food security.

Table 2: Summary of Kendall tau-c showing the result of hypothesis 2

Symmetric Measures

		Value	Asymp. Std. Error[a]	Approx. T[b]	Approx. Sig.
Ordinal by Ordinal	Kendall's tau-c	.59	.033	16.31	.000
N of Valid Cases		16			

Source: Authors' Computation May, 2018

The value of the Kendall tau-c statistic is .59 with p-value < .05 indicating a positive significant relationship between the improvements in packaging and preservation of agricultural produce and increase in food security.

Hypothesis 3
Hypothesis three states that food waste prevention policy(s) and effective strategies at the appropriate levels of food supply enhance food security.

Table 3: Summary of Kendall tau-c showing the result of hypothesis 3

Symmetric Measures

		Value	Asymp. Std. Error[a]	Approx. T[b]	Approx. Sig.
Ordinal by Ordinal	Kendall's tau-c	.63	.039	19.53	.000
N of Valid Cases		16			

Source: Authors' Computation May, 2018

The value of the Kendall tau-c statistic is .63 with p-value < .05 indicating a positive significant relationship between the two variables. This suggests that food waste prevention policy(ies) and effective strategies at the appropriate levels of food supply enhance food security.

Discussion, Conclusion and Recommendations
In this paper, empirical analysis of how entrepreneurial programmes and food waste prevention policy (ies) improve packaging and preservation of agricultural produce and increase food security at different stages of the food supply chain was conducted to accomplish the objectives of the study and contribute significantly to the body of the literature. The hypotheses were analyzed statistically with Kendall coefficient of concordance. The finding of the first hypothesis revealed a positive statistically significant relationship between entrepreneurial programmes and preservation techniques and food waste reduction at different stages of the food supply chain.

The second major finding was that the value of the Kendall tau-c statistic (.59) with p-value < .05 indicates a positive significant relationship between improvements in packaging and preservation of agricultural produce and increase in food security. Similarly, the result of the third hypothesis showed that that food waste prevention policy (ies) and effective strategies at the appropriate levels of food supply enhance food security.

Based on the findings above, the study concludes that there should be effective entrepreneurial programmes and food waste reduction techniques at different stages of the food supply chain.

Therefore, the study recommends the following appropriate entrepreneurial actions that can prevent food loss and increase food security in Dutsin-Ma Local Government Area, Katsina state, Nigeria:

i. The use of mild chemical, sun drying or air drying for food preservation, proper processing and packaging, vegetable blanching, conversion of fruits to concentrate, and conversion of grains to powder.

ii. Ensure effective packaging with processing, smoking and salting, and canning of such food as (cassava, maize and yam),(fish and meat) and (onion, tomatoes and peppers)etc
iii. With regards to food waste prevention policy (ies) and effective strategies to enhance food security at the appropriate levels of the food supply chain,

a. Nigerian government should encourage industrialization in rural areas to ensure nearness to farm in order to reduce rate of farm produce spoilage and microbiological spoilage.
b. Governments at all levels should embark on training and empowering Nigerian youthson how to recycle all discarded food using entrepreneurial skills
c. Government should introduce sanctions on any citizen of Dutsin-Ma LGA, Katsina State and Nigeria in general that is found wasting food intentionally. Such sanctions should include sending the affected individual(s) to work in the farms or expose them to face public disgrace.
d. Glutting products should be purchased by government during harvest period for proper storage and later released to the general public at affordable rates.
e. Government should continuously give subsidies to farmers in order to enable them purchase required mechanized equipment and storage facilities.

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