

Emerging Roles for Extension in Promoting Sustainable Rural Environment: Lessons from Food Processing Cottage Industries and Their Wastes in Rural Oyo State, Nigeria

A. O. Ajayi

Department of Agricultural Extension and Rural Sociology, Obafemi Awolowo University, Ile-Ife, Nigeria

E-mail: dayoajayi218@yahoo.com or dayoajayi84@hotmail.com

KEYWORDS Cottage Industry. Wastes. Environment. Sustainability

ABSTRACT This study identified rural based food processing cottage industries and categorized them on the basis of their raw materials and products. In addition the wastes generated were identified and quantified where applicable with environmental implications drawn from them. The data was collected from twelve rural communities in Oyo State using a checklist developed and standardized in the course of a reconnaissance survey. The instrument was exposed to validity and reliability tests. Data collected were analysed and presented in frequency table form. Result of the study showed that wastes being generated are in solid, liquid and gaseous forms. Most of the wastes are just disposed indiscriminately into the environment. This justifiably has environmental and health implications on the immediate and future generation. The study concluded that since extension relates with promotion of well being of rural dwellers who mostly are farmers and food processors, they should seek to understand the rural environmental problems emanating from wastes of food processing cottage industries, collect, process and keep relevant information on same. They should relate with researchers to proffer solutions using participatory approach and embark on public enlightenment of the rural dwellers on importance of sustainable environment.

INTRODUCTION

The concept of extension has various dimensions, as well as approaches. Though the objective of extension remains same that is communication of useful information, helping the beneficiaries to learn how best to use the information provided so as to enhance a better living condition for themselves, their families, communities and the environment. In a bid to describe the areas covered by extension activities Oakley and Garforth (1985) categorized the activities into agriculture and non-agricultural extension. In addition, Obibuaku (1983) opined that extension is concerned not only with agricultural development, but also with rural transformation generally. In sum, extension is interested in farm households, and their activities such that a high quality of life is promoted.

Agriculture, which is the mainstay of rural dwellers and an interest of extension continually, exploits the environment. Exploitation in terms of nutrients from soil and space, though in a cycle. Since the rural environment where farming takes place is consistently exposed to environmental degradation, there is a need to arise in the extension a guided interest in environmental issues as it relates to food processing activities of cottage industries in the rural areas.

In most of the rural areas where farming takes place, the farm products are being processed for consumption within the locality or for onward transmissions to some other parts of the country or even exportation to other parts of the world. These processing activities take place in cottage industries, which are located within the dwelling units and are known to generate wastes and impact on the environment. Advocates of sustainable environment stressed that the interest of future generation be catered for in the contemporary efforts directed at resource utilization (Brindley, 1991). To do these, it is important to follow the path of environmentally sustainable development.

The fact that every aspect of rural life ranging from economic to environment is of interest to extension agents in recent times as established by Adams (1992), Jones and Garforth (1997) and Bolliger (1998) prompted the need to get the agents involved in the promotion of sustainable environment. While exploitation of natural resources could not be stopped out rightly, it would be necessary to ensure sustainability through a well planned extension programme.

OBJECTIVE OF THE STUDY

The main objective of this study is to highlight the adjudged roles of extension in

promoting sustainable rural environment by drawing lessons from rural food processing cottage industries and their wastes. The specific objectives are to:

- (i) identify and categorise the food processing cottage industries in the study area;
- (ii) examine the type of wastes and effluents being generated by the rural based food processing cottage industries;
- (iii) investigate how the wastes being generated are disposed;
- (iv) highlight the immediate and long-term possible effects of such wastes on the environment and
- (v) identify the emerging roles for extension in promoting sustainable rural environment.

LITERATURE REVIEW

Generally, the industrial sector constitutes a major component of the economy in most countries. It plays a major role in economic development of the countries and also in the economic welfare of their citizens. It provides employment for a large proportion of the population and supplies the material goods they consume (UNEP 1987). This sector include a large number of diverse activities involving the extraction and processing, including synthesis, of various materials and their uses in the manufacture of other products. Consequently, there is also a wide range of and environmental impacts created by this sector because various industrial process generate different airborne emissions, waste water or effluents, dusts or particles and solid wastes that can affect human health and environment in many ways (UNEP, 1987). The United States Environmental Protection Agency estimates that approximately 2,000 potential cancer-causing or toxic chemicals are likely to get into the air as a result of releases into the environment (Kean, 1986).

However, unlike developed countries, most developing nations have neither toxic chemical control laws nor the technical or institutional capability for implementing such laws (UNEP, 1987). In handling issues relating to waste management developing countries face special problems in implementing waste management programmes which are needed urgently. According to UNEP (1997) the problems include generally poor control of pollution, a lack of

financial resources, shortages of people with technical and managerial skills and a low level of public awareness. It is therefore becoming increasingly obvious that current practices of waste generation and disposal cannot be considered in isolation from overall objectives of controlling pollution and managing natural resources (Suess, 1985). However, it is established that some wastes would continually be generated and disposed on the land, the need to emphasize waste minimization through reclamation and recycling emerged as the best option.

Studies on industrial wastes listed the general headings as general factory nebbish, packaging materials, organic wastes from food processing, acids, alkalis, metaliferous sludge and tarry residues. Accordingly, Batstone et al. (1989); Holmes (1983) and Kharbanda and Stallworthy (1990) opined that the most important feature of industrial wastes is that a significant proportion is regarded as hazardous or potentially toxic thus requiring special handling, treatment and disposal.

In summary, various studies stressed the fact that industrial activities and wastes impacts on the environment however, most of such studies did not references the cottage industries located within rural areas. Traditionally, cottage industries refer to manufacturing or processing activities that are carried on in cottage especially in the rural districts. These industries as in the case of developing countries employed the next largest workers after agricultural sector. Evidence abounds that they also contribute to the environmental problems as they are associated with certain externalities which they generate in form of effluents which in turn pollute the environment. These did not attract the interest of researchers as was the case with small, medium and large industries in the urban and peri-urban centres. This study is therefore carried out to fill this identified gap in knowledge for sustainable rural environment and to seek roles for extension.

METHODOLOGY

The study area was Oyo State, Nigeria. The state is made of thirty three Local Government Areas (LGAs). The thirty three LGAs were stratified into predominantly urban and predominantly rural LGAs as did Awujoola (2000). Twelve LGAs representing approxi-

mately 50% of all the predominantly rural LGAs were randomly selected and one community in each of these LGAs were selected randomly.

A semi-structured interview schedule was prepared and standardized during a reconnaissance survey and used to collect information on the raw materials used by a typical food processing cottage industry, their products, wastes, effluents and methods of wastes disposals. In addition, an observation checklist was used to take an inventory of notable food processing cottage industries in the selected communities.

Results of the survey was analysed and presented using descriptive statistics specifically frequency counts and percentages.

RESULTS AND DISCUSSIONS

Inventory of food processing cottage industries in the study area: In this study, food – processing cottage industries are those industries in which food – processing activities are being carried out on a small – scale, usually home based, employing a few individuals using simple technology mostly inherited skills and depending on local raw materials. A list of food processing industries conforming to the above was compiled. A total of one thousand one hundred and fifty three (1,153) of such industries were listed in the process as identified in the study area. The industries were classified based on their raw materials and products. Ten categories were identified and presented in Table 1. The most frequent category was the tuber processing cottage industries. These industries process cassava and or yam tubers into flour or pastes.

Table 1: Frequency distribution of food processing cottage industries in the study area

Category/ Type of Industries	Frequency	Percentage	Cumulative
Cereal/grain processing	129	11.19	11.19
Tuber processing	247	21.42	32.61
Vegetable oil processing	130	11.27	43.88
Locust – bean processing	77	6.68	50.56
Meat and Dairy processing	73	6.33	56.89
Milling and grinding	163	14.14	71.03
Cowpea processing	120	10.41	81.44
Fish smoking	74	6.42	87.86
Beverage processing	73	6.33	94.19
Soybean processing	67	5.81	100.00
Total	1153	100.00	

The least category was the soybean processing cottage industry. This shows that cassava and yam production is the most popular and since they are highly perishable may require one form of processing or the other to increase their durability and consequent monetary values.

Waste Products of Food Processing Cottage Industries in the Area

Cereal Grain Processing Industries: These industries use maize as their raw material, processing *ogi* (a kind of fermented maize pap) which is either sold as produced or further processed by cooking and wrapping same in leaves to a semi-solid state for consumption. They constituted 11.19% of the total food processing industries in the area. The wastes generated by this industry are shown in table 2.

The fermentation process is annunciated with certain odor which may be detestable when discarded into the environment in an unguided form. Discarded stagnant wastewater serves as

Table 2: Wastes from cereal grain processing industries

Wastes	Form	Approximate quantity/kg	Disposal methods
Waste water	Liquid	15 litres/kg	Discarded
Maize Residue	Solid	20g/kg	Livestock feed
Odour	Gaseous	NM*	None

* Not measured

breeding places for mosquitoes and other insects. However, it was observed that several households also did process *ogi* regularly, not for commercial purposes but for household consumption, which means that there are many more sources of pollution besides the identified cottage industries.

Tuber processing Cottage Industries: These cottage industries accounted for 21.42% of all the listed industries. A breakdown of the type and frequency distribution is presented in table 3.

Cassava tuber based processing cottage industries constituted 78.14% of the tuber processing industry. It is being processed into *gari* (a fermented fried product) *lafun* (flour) and *fufu* (meal of retted cassava). Yam is processed into *elubo* (yam flour). The types and approximate quantity of the wastes as well as methods of wastes disposal are presented in table 4. The data in the table showed that most of the

Table 3: Types and frequency distribution of tuber processing industries

Indus-tries	Type of raw material	Frequ-ency	Percen-tage	Cumu-lative
Gari	Cassava	65	26.32	26.32
Lafun	Cassava	88	35.63	61.95
Fufu	Cassava	40	16.19	78.14
Elubo	Yam	54	21.86	100.00
Total		247	100.00	

cassava peels are being used to feed livestock while excess are dumped and burnt. This act of burning the wastes to a large extent constituted a great deal of environmental pollution from the smokes being emitted.

In addition, wastewater is being discarded indiscriminately and at times into existing body of water. This is also a source of environmental pollution which must be addressed for a sustainable environment.

Vegetable Oil Processing Industries: Two types of oil bearing seeds are commonly processed in

the study area. They are oil palm fruits and shea butter. Palm oil and palm kernel oil are the products from oil palm while shea nuts produce edible shea butter (ori) a valuable source of fat for cooking in the rural areas, which is also used for medicinal purposes. As in table I, this class of industry constitutes 11.27% of the total number of industries in the inventory. Activities of this industry generate wastes of various types – solid and liquid as presented in table 5. Hot water is used to increase the yield of the nuts, this produces thermal emissions and oil-lateen wastewater which flows freely into the surrounding land area.

Locust Bean Processing Industries: The only condiment processing industry identified within the study area was iru-processing industry. Iru, the fermented product of locust bean is used as a condiment widely consumed by people in the rural and urban areas. They constituted 6.68% of the listed industries. The waste products of

Table 4: Waste products from tuber processing industries

Industry	Wastes	Form	Approximate Quantity	Treatment Disposal
Gari	Cassava peel	Solid	250-500g/kg	Live
	Waste water	Liquid	20-30 litres/ton	stock feed/dumped and burnt
	Grating residue	Solid	100g/1 kg	Discarded indiscriminately
	Effluents from pressing	Liquid	4 litres/50kg	indiscriminately Consumed by man
	Fried residue	Solid	1kg/50kg	Discarded / used for local soap.
	Ash from fuel wood	Powdery	1kg/50kg fuel wood	Consumed by man
Lafun	Odour	Gaseous	*N M	Discarded None
	Cassava peel	Solid	250-500g/kg	Live
	Waste water	Liquid	200 litres/ton	stock feed/dumped and burnt
	Residue	Solid	1kg/50kg	Discarded / re-used Livestock feed
Fufu	Odour	Gaseous	*N M	None
	Cassava peel	Solid	250-500g/kg	Lives tock feed/dumped and burnt
	Waste water	Liquid	200 litres/ton	Discarded / re-used
	Residue	Solid	1kg/50kg	Live stock feed
	Ash from fuel wood	Powdery	<1kg/50kg fire wood	Discarded/used
Elubo	Odour	Gaseous	*N M	None
	Yam peel	Solid	250-500g/kg	Live stock feed/dumped and burnt
	Waste water	Liquid	200 litres/ton	Discarded / re-used
	Residue	Solid	1kg/50kg	Livestock feed
	Ash from fuel wood	Powdery	<1kg/50kg fire wood	Discarded / used
	Odour	Gaseous	*N M	None

N M = Not measured

Table 5: Wastes from vegetable oil processing industries

Industry	Wastes	Form	Approximate Quantity	Disposal/Treatment
Palm oil	Waste water	Liquid	3-5 litres / kg	Discarded/re-used
	Residue (shaft)	Solid	1kg/5 litres of oil	Used as fuel
Palm kernel	Kernel shell	Solid	2kg/kg kernel	Used as fuel
	Residue (PKC)	Solid	3kg/PKC/kg oil	Livestock feed
Shea Butter	Nut shell	Solid	1kg/10kg nut	Fuel/Discarded
	Waste water	Liquid	2 litres / 10kg	Live stock feed
	Residue (slurry)	Solid	100g/2kg fat	Discarded

* N M = Not measured PKC=Palm Kernel Cake

this industry are presented in table 6. Most of the wastes are discarded into any open space.

Table 6: Wastes from locust bean processing industries

Wastes	Form	Approximate Quantity/kg	Disposal/Methods
Waste water	Liquid	25litres/2kg product	Discarded
Residue (shell)	Solid	1kg / 5kg	Discarded
Locust bean sluny	Solid	1kg / 3kg	Discarded
Odour	Gaseous	N M*	None.

* N M = Not measured

Meat and Dairy Processing Industries: The number of meat and dairy processing industries was 73 which is 6.63% of the total industries. The constituent industries include 11 abattoirs, 34 cow skin (ponmo) processing and 28 local cheese industries. The wastes generated in abattoirs and cow skin processing are cow dung, blood, bones, burnt hair residues, horns, hooves and wastewater. The commonly used method of disposal of these wastes includes open dumping on garbage heaps and discharge of effluents into nearby streams. Local cheese processing generates wastewater, which is also discharged into the surroundings. Thermal emissions and smokes were also common in these industries. **Milling and Grinding Industries:** A variety of milling and grinding activities were identified. These industries engage in wet and dry milling processes on a variety of food materials. The wastes generated by the industries include food waste, dust, waste water, engine oil and grease. The machines also generate a lot of noise, vibration, smokes and heat. Although the noise level was not determined as well as vibration, it was observed that they interfere with conversation in the area. The decaying food wastes and wastewater being discharged from the milling activities emit unpleasant odour, and also breed flies, maggots and mosquitoes.

Fish smoking industries located within the study area constituted about 6 percent of the total. The wastes generated in this group of industries are smoke, wastewater, heat and odour. In addition, the fuel wood also generates ashes, which are used for non-food purposes such as the manufacturing of local soap.

Cowpea processing industry also generates wastes. The main products of the industries in this category are fried cowpea balls and steamed

cowpea pudding. The wastes are presented in the table 8.

Table 8: Wastes from Cowpea processing

Wastes	Form	Approximate Quantity/kg	Disposal
Bean coat	Solid	100g / kg	Open dumping/ livestock feed
Wastewater	Liquid	8 litres/kg	Discarded indiscriminately

Beverage Processing Industries: A traditional alcoholic drink known as Otika was also being produced in the study area. The raw material is guinea corn and its locally sourced. There were 73 of such cottage breweries. The waste commonly generated by the industry is mostly water put at about 5 litres per kilogram of grain which is indiscriminately discharged into the surroundings. In addition, brewery wastes are generated but are largely used to feed livestock.

Soyabean Processing: Soyabean is being adopted and gradually integrated into the diet of the people in the study area. Commonly produced from soyabean are soyamilk and Soya wara, a type of local cheese. Both solid and liquid wastes are being generated in the industry. The wastewater is being discarded into the surrounding while soybean coat and meal residue are fed to livestock.

On a general note, most of the wastes being generated were discarded into the surrounding environment without any form of care. The environmental and public health implications are therefore numerous. Land pollution for example can result and pollutants can be leached into the ground water resulting in water pollution. In addition, untreated solid and liquid wastes dumped near water source remains a potential source of microbial and chemical contaminants. Subsequently fresh water would become progressively scarce and the ecology could be disturbed to a dangerous level. This would impact on flora and fauna adversely and treat the further existence of some beneficial organisms.

Decaying waste matter as well as stagnant waste water do not only give off offensive and obnoxious odours, but also serve as breeding space for maggots, flies and mosquitoes all of which can pose some dangers to the rural dwellers health.

The health implications of dust, smoke and

other suspended particulates include eye, nose and throat irritation and acute respiratory infections in children and chronic respiratory diseases in adults. Noise and vibration condition could affect health adversely by producing noise induced hearing loss in people exposed to above normal levels of noise for a long period of time (WHO, 1995). Emissions from heat could result in serious health problems such as heat stroke, heat cramp and headache.

From the above, it became obvious that significant environmental impacts arise from rural based-food-processing cottage industries as demonstrated in this study. Although they play an important role in the economy of the rural populace, they could as well pose problems when adequate environmental safety and sustaining awareness are lacking. While their products are used for the benefit of the present population, the long-term damaging effects on the environment being caused are left for the future generations to contend with. The situation would be appreciated in a better way if the number of such industries in the sampled communities are considered in addition to non-existence of proper and environmentally sustainable waste treatment and disposal methods. This situation calls for adequate attention of stakeholders.

The following are the relevant recommendations emanating from the study in identifying roles for extension in order to ensure effective environmental management and sustainability in the rural areas.

Extension is basically directed at educating the public on the ways to ensure high quality of life and promote good well-being. In the case of food processing cottage industries, extension should therefore seek to understand the environmental problems associated with rural based cottage industries and ensure a link with subject matter specialists who are scientists and researchers to find solutions to the problems of environment identified in this study as revealed in the case of rural cottage industries.

In addition, data on the food-processing industries, their emergence, coverage, locations and wastes should be collected analysed and carefully stored such that they could be retrieved and used in problem identification and subsequent programme planning on sustainable rural environment.

Operators of the rural-based food processing cottage industries and the rural public should be

targeted for environmental education and awareness programme. This should include women and children who dominate the food processing sector and are relatively disadvantaged in terms of education and enlightenment. The link between women children and environmental management has been recognised as a crucial aspect of sustainable environmental development (Racelis and Aguirre, 2002).

Extension should appropriate their stake in ensuring sustainable rural environment through the promotion of participatory approach to problem identification and solution by ensuring that rural dwellers also plays their expected roles in ensuring sustainable environment.

Local leaders and the various government and non governmental agencies should be informed of the need for a better environment by putting in place a practical and functional environmental protection and waste management strategy and or programmes.

Extension and related agencies should work closely with media houses in creating awareness through radio and television programmes on the importance and essentials of sustainable environment. Also, printed materials such as hand bills, posters and pamphlets should be designed to teach the essentials of sustainable environment to the literate rural dwellers and operators of cottage industries.

There is a danger in waiting until the problem is out of scope before taking action, therefore the biodegradable wastes should be recycled or converted and used for the sustenance of the environment. Uses such as preparation of organic manure livestock feed within the areas where they are being generated should be encouraged. This would ensure a cleaner environment and good economic gains. Extension is known to promote such gains and good quality of life. Doing this would mean goal attainment.

ACKNOWLEDGEMENT

The author acknowledges the support provided by Quality of Life Foundation, Ibadan, Nigeria for supporting the data collection used for a larger study from which this study benefited.

REFERENCES

- Adams, M.E.: *Agricultural Extension in Developing Countries*. Longman, England (1992).

- Awujoola, S.F.: *A Geographical Analysis of Revenue Generation and Public Expenditure in Oyo State, Nigeria*: An Unpublished Doctor of Philosophy Thesis. Department of Geography, University of Ibadan (2000).
- Batstone, R., Smith, J. and Wilson, D. (Eds.): *The Safe Disposal of Hazardous Wastes: the special Needs and Problems of Developing Countries*. World Bank Technical paper Number 93. World Bank, Washington D.C. (1989).
- Bolliger, E., Reinhard, P. and Zellweger, T.: *Agricultural Extension Guidelines for Extension Workers in Rural Areas*. (1998).
- Brindley, B.: *What is Sustainable?* Ceres 128 p 35-38 March-April 1991- Food and Agriculture Organisation, Rome (1991).
- Holmes, J.: *Practical Waste Management*. John Wiley and Sons, Chuchester (1983).
- Jones, G.E. and Garforth, C.: The history, development and future of agricultural extension. Pp. 3-12 In: B. E. Swanson, P. R. Beutz and A. J. Sofranko (Eds.): *Improving Agricultural Extension A reference Manual*. FAO, Rome (1997).
- Kean, T.: Dealing with toxic air pollutants: new initiatives. *Issues in Science and Technology*, **2(4)**: 19 (1986).
- Kharbanda, O. and Stallworthy, E.: *Waste Management Towards a sustainable Society*. Grower, Aldershol, Surrey (1990).
- Oakley, P. and Garforth, C.: *Guide to extension Training*. Food and Agriculture Organisation of the United Nations, Rome (1985).
- Obibuaku, L.O.: *Agricultural Extension As a Strategy for Agricultural Transformation*. University of Nigeria, Nsukka (1983).
- Racelis, M. and Aguirre, A. D. M.: Child rights for Urban Poor Children in Child Friendly Philippines Cities; Views from the Community. *Environment and Urbanization*, **14(2)**: 97-113 (2002).
- Suess, M.T. (Ed.): *Solid Waste Management: Selected Topics*. World Health Organisation, Regional/office for Europe, Copenhagen (1985).
- UNEP: *The State of the World Environment*. UNEP Nairobi, Kenya (1987).
- UNITED Nations Environment Programme: *Chemical Pollution: A global Overview*. The International Register of potentially Toxic Chemicals and The Global Environment Monitoring System's Monitoring and Assessment Research Center: UNEP Nairobi, Kenya (1992).
- WHO (World Health Organisation): *Global Strategy on Occupational Health for All*. Geneva WHO. Document WHO/OCH/95.1 1995 (1995).