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Economics of Butchery Waste Management in Metropolitan Port Harcourt, Nigeria

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A R T I C L E I NFO

Key Words

Solid waste

Pollution

agribusiness sustainability,

Butcheries,

Slaughter houses,

Livestock, value chain

ABSTRACT

The study analyzed the status of solid waste management in butcheries and their effects on butchery firms' productivity. It describes their disposal measures/adequacy; their profitability and firm profit determinants. Primary data were obtained from 30 butcheries within Port Harcourt Metropolis. Using a snowball method, thirty five (35) butcheries were identified out of which thirty (30) were selected in a stratified sampling method to cover the two Local Government areas in Port Harcourt Metropolis. Data were analyzed using descriptive statistics, Net Profit, profitability ratios and three functional forms of Ordinary Least Squares (OLS) multiple regression models. The study found that there were three major disposal measures used by the butcheries: burning, composting, incineration and paying waste authorities to dispose the wastes. The butcheries average profit levels ($15,740.08) were high, efficient with estimated Operating Expense Ratio of 0.37 and very viable with a Net Profit Margin of 50%. The cost of waste handling/disposal for the solid wastes was not a significant factor and depicts market failure. However, the socioeconomic attributes of the butchery operators, especially marital status, household size and working experience that directly affect their profits. It was recommended that authorities and stakeholders should levy tasks for environmental management while the authorities should promote the butchery business as a livelihood source, incentivizing the business owners with better infrastructure, building their capacities. Butchery operators should also be trained to help supply farmers with recycled farm wastes to enhance sustainable development.

1.0 Introduction

Solid waste (SW) mismanagement causes various environmental and social impacts which hinders the attainment of sustainable development (Ferronato and Torretta 2019). Ikebude (2017) notes that refuse accumulation anywhere or in the environment "creates a fertile breeding ground for rodents, flies, which are disease vectors and also affect the aesthetics of the place, this in turns poses health hazard to the public". In Port Harcourt, documented sources of urban wastes were noted to include from domestic, commercial and industrial sources (Ikebude, 2017; Ayotamuno and Gobo,

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2004). The trend of waste generation in Port Harcourt has been increasing owing to factors such as rising urbanization, growth in population, poor waste management and uncoordinated method of waste management systems in the city, filthy cultural attitudes/habits, unavailability of mechanized waste disposal methods and poor funding of the sector (Ayotamuno and Gobo, 2004). Stanley and Ohwor (2018) observes that poor implementation, enforcement and lack of awareness of existing waste management policy constitutes a major challenge to the waste management in Port Harcourt. Unfortunately, a steady increase in the rate may not abate unless attention of policy makers are drawn through research of this nature to highlight possible areas that can be improved or optimized to efficiently manage urban wastes in the ever growing metropolitan areas of Nigeria, African most populous country.

Unless waste management, especially in food production, is addressed as a priority, it is impossible to meet the relevant Sustainable Development Goals (SDGs) (Lenkiewicz 2016). These include SDGs two, six and twelve which are Zero Hunger, Clean Water and Sanitation and responsible consumption and production respectively. The report noted that failing economic models had treated resources as if they were infinite (SDG 12) and that consumption patterns favoured the disposable. The author questioned the possibility of continuing with an ever-growing and rapidly urbanized global population without having the waste management challenge sorted. As indicated by Russ and Pittroff (2004), there are rising concerns about the challenges posed in waste disposal and by-product management in the food processing industry particularly in the areas of sustainability and environmental protection.

According to Jayathilakan et al. (2012), processing acids and the raw and auxiliary materials enter the agricultural value chain or production process and thereafter comes out as either a desired product, a non-product-specific waste or a product-specific waste. In the final analysis, the product-specific waste normally ends up as residuals after the processing of the raw materials. Jayathilakan et al. (2012) noted that even after extraction, other components that can be potentially used can also be found in the residual materials.

In the livestock processing industry such as the butchery subsector in Nigeria, not much is known about the contributions of these solid wastes to the profitability of butchery firms. However, it is established that the continuous motivation to increase meat production for the protein needs of the ever-growing world population has some problems attached (Kundu et al. 2013). For instance, Henchion et al. (2017) noted that the future global demand for animal-based protein will increase by 50 percent in 2050 with a consequence of increased concerns for both food security and environmental sustainability. One of the reasons is attributed to the fact that animal derived foods emit higher levels of greenhouse gases (GHG) than plant or crop-based foods; besides as noted by Tilman and Clark (2014), such emissions are linked with climate change. Intensive animal production and large-scale slaughtering of food animals in largely sub-standard butcheries in Port Harcourt metropolis has resulted in an increased challenge of waste disposal and management (Nwanta and Adeyemo, 2002).

Research shows that the management of butchery wastes ought to be the direct responsibility of the owners. This however in reality, is not so, reason being that the cost of managing these wastes is relatively high. However, Omole and Ogbiye (2013) observed that proper handling of solid butchery wastes is associated with monetary costs which could be very difficult for managers to afford in their bids to obtain direct outputs of profits from their inputs. Hence it is necessary to conduct an appraisal of the existing butchery waste disposal practices, orientation of

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the butchery owners on their attitude towards the environment and lastly analyze economically the costs of managing these wastes. These can provide evidence for policy making in improvement of air quality and safer food production in Nigeria. Traditionally, butchery wastes can be utilized as either animal feed or fertilizer for crop and vegetable production. This is a form of value addition in the livestock value chain. As indicated by Russ and Meyer-Pittroff (2004), most of the existing agricultural solutions to waste disposal balance out between legal regulations and the best ecological and economical solutions.

Nathanson (2018) defined solid waste management as "the collecting, treating, and disposing of solid material that is discarded because it has served its purpose or is no longer useful." According to this source, disposing municipal solid waste improperly could result in unsanitary conditions, a condition that will, in turn, result in massive environmental pollution and disease outbreaks. This is echoed by Franke-Whittle and Insam (2013) who points out that slaughterhouse wastes are a potential reservoir of bacterial, viral and parasitic pathogens, which are hazardous to both animals and humans. Nathanson (2018) noted that tasks of solid-waste management come with a myriad of technical difficulties which includes social, economic and administrative challenges which are costly for the producing firm and the municipality in which it is located. Omole and Ogboye (2013) also highlighted the issue of land pollution which, in the current instance, occurs when solid wastes such as bones, pieces of flesh and dung are dumped in open spaces and when it rains, these wastes are washed into the surrounding streams. When the animals are slaughtered, all parts must be sold off same day since any unsold part becomes a waste or is ineffectively preserved (Omole and Ogboye 2013). Goblaz et al (2017) points out that managing slaughterhouse wastes can effectively minimize contaminations of the industry to the environment. Taking into account these negative implications, recycling every part of the slaughtered animal could significantly minimize environmental pollution and promote sustainable production.

Globally, it has been noted that much economic studies appeared to be focused more on shaping the policy landscape for Municipal Waste (MSW) management, determining the negative external impacts of MSW disposal and so forth (United State Environmental Protection Agency (EPA) 2018; U.S. Environmental Protection Agency, 2001) thus leaving a wide knowledge gap about the potential of solid wastes utilization to boost the productivity of agribusiness value chain, especially butchery sub-sectors. Even studies carried out to examine urban waste management trends and challenges in Port Harcourt such as There is therefore a need for a study that will explore the contributions of the solid waste from the livestock processing sector, especially, the butcheries in a sprawling metropolis as Port Harcourt, Nigeria. The current study therefore aims to assess the status of solid waste management in butcheries with a view to determining their effects on butchery firms' productivity in Port Harcourt Metropolis.

The study findings could potentially give statistics that can guide in environmental management policies as well as food processing policies in urban areas of the developing world. Moreover, as highlighted by Frank-Whittle and Insam (2013), slaughterhouse wastes are a potential energy source that could assist in reducing the current dependency on petroleum-based fuels.

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Items	Units	Unit Price	Unit Price in USD	Total Value in USD	Total Value in Naira
Revenue to slaughter firm per cattle	367	11177	60.25	4,101,959.00	22,172.75
By products in Kgs (e.g. ivory, bones, offals sold)	260	52	0.28	13,520.00	73.08
Goats slaughter services values for each count of goat	561	3117.00	16.80	1,748,637.00	9,452.09
Gross Revenue (or Total Revenue)				5,864,116.00	31,697.92
Variable Costs:					
Water cost per month	12	3583	19.32	42,996.00	232.41
Electricity consumed per month	12	6900	37.20	82,800.00	447.57
Firewood cost per month	12	14000	75.47	168,000.00	908.11
Packaging cost per month	12	11200	60.38	134,400.00	726.49
Labour cost per manday worked = 360 mandays 1000	360	1000	5.39	360,000.00	1,945.95
Petrol (Fuel) used per day in litres per day (1440 litres per year)	1440	85.6	0.46	123,264.00	666.29
Transport per month	12	13850	74.66	166,200.00	898.38
Miscellaneous costs per month (e.g. community service payments)	12	5733	30.91	68,796.00	371.87
Solid waste disposal cost per month	12	2055	11.08	24,660.00	133.30
TVC				1,171,116.00	6,330.36
Gross Margin				*4,693,000.00*	*25,367.57*
Fixed Cost Items					
Building depreciation	1	182000	981.13	182,000.00	983.78
Slaughter slab depreciation	1	206,320.00	1112.24	206,320.00	1,115.24
Plumbing depreciation	1	31,682.00	170.79	31,682.00	171.25
Spreader depreciation	1	280,084.00	1509.89	280,084.00	1,513.97
Lairage depreciation	1	95,000.00	512.13	95,000.00	513.51
Total Depreciation				795,086.00	4,297.76
Rent on land	1	266,000.00	1433.96	266,000.00	1,437.84
Tax and rates	12	60,000	323.45	720,000.00	3,891.89
Total Fixed Costs (=Total Depreciation + Rent + Taxes/Rates)				1,781,086.00	9,627.49
Total Cost (TC) = TVC + TFC) i.e. Total Operating Expenses				2,952,202.00	15,957.85
Net Profit				2,911,914.00	15,740.08

Source: Field Data, 2014 NB: The exchange rate for Naira (₦) to 1 US dollar at this time was ₦185 to 1 USD

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timber, tin, columbite dating from 1958. It is an oil hub of the country with a huge refinery that processes petroleum from the oil fields of the eastern Niger River delta. The estimates the population of the city as at 2020 to 3,020,000. This is a 5.12% increase from its 2019 estimate (Macrotrends, 2020). The Latlong.net (2020) notes that the city is well known for as an industrial and transportation centre hosting hoards of multinational petroleum producing companies. The city also prides itself as cultural centre with numerous libraries, gardens/parks and a huge number of markets plus many shopping facilities. Located in Rivers State, Nigeria is located at latitude 4.824167, and longitude 7.033611. Port Harcourt's gps coordinates are 4° 49' 27.0012" N and 7° 2' 0.9996" E (Latlong.net, 2020).

Data gathering

This research study was carried out in Port Harcourt metropolis of Nigeria. Data was gathered from both primary and secondary sources. Varying techniques including a set of well-structured questionnaire administration, field work survey and face to face interviews were employed to collect the primary data. Unpublished research projects, text books and online materials, peer reviewed journals and bulletins were consulted as secondary sources. A structured questionnaire, which contained bio/personal data, was used, with not many options that covered both the objectives and the hypotheses of the study.

Research design and Sampling Technique

A survey design using the cross-sectional survey design was applied in this study. The population of this study constitute of butcheries/slaughter houses firm operators in Port Harcourt metropolis, which presently was not certain but assumed to be located (scattered) in different areas in Port Harcourt metropolis. Hence a snowball method was used to identify thirty five (35) butcheries. A list was drafted out of which thirty (30) butchery operators were selected using a stratified sampling method to cover the twp Local Government areas in Port Harcourt Metropolis. The two (2) Local Government Areas that make up the city include; Port Harcourt Local Government Area (PHALGA) and Obio/Akpor Local Government Area.

Data analysis procedure

Data were analyzed using both descriptive and inferential tools. Descriptively, data obtained were analyzed and presented using tables, maps, pie charts, histograms, frequencies and measures of central tendencies. The Net Profit Margin, being the difference between gross revenue and total cost of production was used to compute the profitability of the butcheries. The computed Net Profits of the butcheries were then used as the dependent variable in the OLS multiple regression used to determine the effects of cost of waste disposal and other determinants of butcheries profitability.

The study applied budgetary techniques in its performance analysis. Park, Lee and Kim (2014) confirms the validity of this approach when they note that a study designed to measure the financial performance of a business should measures net income, return on investment, or return on equity developed by Ittner and Larcker (1998). The budgetary techniques used in determining the Net Profit is specified as follows:

TPC = TVC + TFC

TR = P × Q i.e. unit price of product × total product

GM = GR – TVC

NP = GR – TPC; = GM - TFC

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Where;

TPC = Total Production Cost incurred by butchery operators in the study area; TVC = Total Variable Cost incurred by butchery operators in the study area; TFC = Total Fixed Cost of all fixed inputs used by the butchery operators in the study area; TR = Total Revenue obtained by butchery within the study area; P = Output price; Q = Volume of output; GR = Gross revenue made by butchery annually and GM = Gross margin calculated annually.

Model Specifications and Variables selection Criteria

In testing our hypotheses, the profitability level of the butcheries was the dependent variable while the cost of waste disposal alongside other production factors' costs and other demographic characteristics (e.g. age, sex, educational attainment, marital status and household size) were the independent variables.

A study conducted in Kenya found that socioeconomic factors were largely influential in determining the performance of the butcheries in the country. Empirical evidence from studies analyzing determinants of small scale business performance have also indicated that socioeconomic factors are influencers of business performance. For instance, Rotich, Cheruiyot and Yegon found that small scale business performances in Kenya were significantly determined by entrepreneurial experience, firm's profile and culture. Gelgelu (2018) found that factors such as low level of education attainment, poor business skills, access to business information, access to financial services and poor infrastructure significantly influenced small scale business performance in Ethiopia. Empirical studies from Nigeria (Aworemi, Abdul-Azeez and Opoola, 2010) finds that socio-economic attributes of small scale entrepreneurs determine the performance and productivity of Small Scale Enterprises in the country. Specifically they note that gender, age and educational qualifications exert significant influences on the performance

of small-scale enterprises. Based on these findings, our regression models attempt to evaluate the possible effects of some socioeconomic characteristics of the butchery operators or managers on their productivity proxied by the firms' profits. Some of these variables chosen agree with Cicea, Popa, Marinescu and Ștefan (2019).

Park, Lee and Kim (2014) agreed that a regression analysis model is a veritable statistical tool to use when analyzing the relationship between a firm's management environment and its corporate performance. Hence we adopted the method using three variants of the model to analyze the decision influencers in a butchery industry in this study.

The functional forms explored for each hypothesis test included: linear, semi log double log, and exponential log forms were tried before selecting the best based on standard econometric criteria.

Implicitly the model was expressed as follows;

$Y = f(X_1X_2X_3X_4X_5X_6 ...X_n + e)$

Explicit forms are as follows;

$\pi = \beta_0 + \beta_1 age + \beta_2 marstat + \beta_3 educ + \beta_4 hshdsz + \beta_5 expr + \beta_6 wastecost + \beta_7 hoshdexp + \beta_8 gender + \mu$ (Linear form)

$\ln\pi = \beta_0 + \beta_1 age + \beta_2 marstat + \beta_3 educ + \beta_4 hshdsz + \beta_5 expr + \beta_6 wastecost + \beta_7 hoshdexp + \beta_8 gender + \mu$ (Semi-log form)

$\log\pi = \log\beta_0 age + \beta_1 logmarstat + \beta_2 logeduc + \beta_3 loghshdsz + \beta_4 logexpr + \beta_5 logwastecost + \beta_7 loghoshdexp + \beta_8 loggender + u$ (double log form)

$\pi = \beta_0 + \beta_1 lnage + \beta_2 lnmarstat + \beta_3 lneduc + \beta_4 lnhshdsz + \beta 5 lnexpr + \beta 6 lnwastecost + \beta_7 lnhoshdexp + \beta_8 lngender + \mu$ (exponential log form)

Where;

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π is the dependent variable = profit in Naira; age = Age of butchery operators (Years); marstat = Marital status of butchery operators (1=Single, 2=Married, 3=Divorced, 4=Widowed); educ = Educational attainment level of butchery Operators (Years); hshdsz = Household size of butchery operators (Number); expr = Working experience of butchery operators (Years); wastecost = Cost of solid waste disposal in butchery (Naira); hoshdexp = Household expenditure of butchery operators (Naira); gender = Gender of butchery operators (1=Male, 0.0001=Female) and μ= stochastic error term, while β_o = intercept or constant; β_1 .... β_8 = parameter estimates/coefficients of the slope of respective variables; and ln= natural logarithm to base e.

Results and Discussion

Nature of Solid Wastes generated by Butcheries

The result presented in Table 1 indicates that all the sampled butchery firms (100%) generate bones as a type of solid waste. The bones may or may not be sold to companies that manufacture ceramics. About 93.3% of these butcheries generated guts as a type of solid waste, these guts (stomach contents) are according to Ezeoha and Ugwuishiwu (2011), rich in calcium, magnesium, iron, phosphorous and sodium act as good organic soil fertilizer when decomposed. The results also show that 100% of the slaughterhouse firms generate fats and offals, hooves, fur and horns as major types of solid wastes. Also, 96.7% of the butcheries in Port Harcourt metropolis produce blood as a type of solid abattoir waste. Slaughtering of these animals is mostly done on concrete slabs. These slabs are usually constructed to have some kind of flow-pathway either to a nearby river source or to a collector. In most cases, the blood is collected and transferred to containers for sale, while others let it flow into nearby rivers.

Table 1: Distribution of the nature of Solid Wastes generated by Butcheries

Types of waste	Number of firms	Percentage of firms generating the waste
Bones	30	100.0
Guts	28	93.3
Fats and Offals	30	100.0
Fur	30	100.0
Hooves	30	100.0
Horns	30	100.0
Blood	29	96.7

Source: Field Survey, 2014. NB: Multiple responses recorded

In butcheries where blood is allowed to flow into rivers, it was therefore observed to be a major source of contamination. This is because blood constitutes the highest pollution load of all the components of butchery effluents (Aniebo et al. 2009). Kundu et al (2013) highlights that blood, which forms a major component of dissolved pollutants in slaughterhouse wastewater, has the highest COD of any effluent from slaughterhouse operations. When the blood from a single cow carcass is allowed to discharge directly into a sewer line, the effluent load equates to the total sewage produced by 50 people on average day (Aniebo et al, 2009).

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Measures Used in Disposing Solid Butchery Wastes and Cost of Waste Disposal to Butchery Owners

The summary of the results showing the various disposal measures used by butchery firms in Port Harcourt Metropolis is summarized in Table 2. From the results, three major disposal measures are employed by butcheries within the study area. They include; burning/, composting and disposal by waste authorities. The results show that 83.3% of these butchery firms dispose of solid wastes by burning. Open fire burning took place where waste products were burned on open fires fuelled by using kerosene or diesel. Burning is mostly done for bones, horns and

Table 2: Distribution of the Processes used in Disposing Solid Butchery Wastes

Disposal Measures	Frequency	Percentage
Burning	25	83.3
Composting	6	20.0
Pay waste authorities (payments to help them dispose in government land fills)	5	16.7

Source: Field Survey, 2014. NB: Multiple responses recorded

hooves. About 20% of the butchery firms visited agreed to disposing solid wastes through the process of composting. Composting, which according to Misra et al (2003), is an aerobic biological process used to decompose organic material, is carried out mostly in pits dug around these abattoirs. This method is commonly used to treat slaughterhouse wastes with high moisture content.

Farmers within these areas collected these composted wastes and used them as organic fertilizers. This is in line with the findings of Pan, Dam and Sen (2012) who noted that renewable resources such as organic manure are veritable means of maximizing crop production and while conserving the environmental by minimizing hazards arising from chemical fertilizer applications. Approximately 17% of these butcheries paid waste authorities to help them dispose of these solid wastes. This method of disposal was mostly done for guts (stomach content), fats and offals.

Solid Butchery Wastes and their by-products

From the data presented in Table 3, about 86.7% of these butchery firms processed these solid abattoir wastes, and 70% agreed to selling these solid wastes and their by-products. Solid wastes such as bones, horns or hooves are processed and sold as raw materials for the production of ceramics. Butchery solid waste by-products which are rich sources of nutrients such as protein and vitamins are sometimes preserved and used as animal feed supplements for regular feed

Table 3: Frequencies of Processing and Sale of Solid butchery wastes and their by-products

Waste Utilization by butcheries	Percentage
Do you process these solid butchery wastes?	86.7
Do you sell these solid wastes or their by-products	70.0

Source: Field Survey, 2014

Costs of waste management to Butcheries and butchery wastes as externality

The task of disposing wastes effectively are estimated from the private sector perspective in this study with a brief mention of what needs to be

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examined beyond the component of this costing to the management. The butcheries in Port Harcourt perform tasks of cleaning their wastes by washing of slaughtered animal parts and the slaughter house facilities, before any further processing through burning, composting and payment to public (government) waste authorities to help dispose wastes in landfills. The most significant sources of costs to the average Port Harcourt butchery in waste management comes from cost of water and payment to local authorities for disposing some unsold parts of their disposed animal parts. As indicated in Table 4,the estimated cost of water to an average butchery in the metropolis is $232.41 per year and the cost of fees to the state waste management authorities to dispose their unused wastes is only $133.3 per year. When you add these the effective cost borne by the average butcheries hovers around $365.71 annually. This does not reflect a huge cost to the butcheries as the entire cost represents only 2.29% of the average butchery operating cost. The dismal cost to the butcheries reaffirms earlier theories on market failure in environmental management fields. Langeveld (2017) and UN-FAO (2013) had examined this issue when they note that food wastage is a market failure and hence an externality. Langeveld (2017) and Winston (2017) note that market failure occurs partly because market players are not paying the full costs of the wastes they generate to the society. Such costs, they notes can be linked to production and "end-of-life disposal of the waste" (Langeveld,2017). According to UN-FAO (2013) and UN-FAO (2013) wastes from food, besides reducing the availability of limited natural resources pose a severe threat to the society at a time when climate change impacts are being felt globally through stress and decomposition of the landfills and in the process generating methane – GHG emissions. The challenge of market failure needs to be urgently addressed especially as the current rapid global population growth will pose a threat annually to attainment of a clean and sustainable environmental development. However, since it is very difficult to gather information on these environmental costs to the society (Langeveld, 2017; Winston, 2017) abattoir waste management can regarded as one of the sources of market failure in food waste sub-sector needing policy actions. The positive externalities from the butcheries are seen as the benefits the butcheries generate to the owners through the profits estimated in Table 4. It is also seen in terms of its contribution as compost to be used in soil nutrient management by farmers who buy the wastes and other users of the butchery by-products.

Profitability and Efficiency of butchery firms in Port Harcourt Metropolis

The data presented in Table 4 shows that butchery firms in Port Harcourt metropolis recorded an average gross revenue of $32,260.90 (USD) and incurred an average operating expenses of $15,957.85 (USD) per annum. The respective and detailed cost items with their units, prices and total monetary values are listed in Table 4. The average Net Profit from a typical firm in the area as indicated in the table is $15,740.08.This profit estimate indicate that the that the butchery business is a profitable enterprise. However, there is a need to measure the level of profitability in order to be confident about the efficiency of the abattoirs and their relative performance to other firms in the industry. The Gross Margin Ratio estimated for butcheries in the study is 80.03, which is far greater than what Joseph-Palmer (2020) recommends for a profitable business plan of a butchery in Nigeria. This goes to confirm the viability of the butchery business in Port Harcourt. Table 4 also indicate that the Operating Expense Ratio estimated is 0.37 or 37%. According to The American Institute for Goat Research (2020), the Operating Expense Ratio reflects the extent to which gross farm revenues are expended on farm operating inputs, excluding depreciation and interest. The higher the value of this ratio, the larger the proportion of gross farm revenues that will be required to offset all of the operating expenses. Ratios in the 40 to 60 percent range indicate relative efficiency, with efficiency

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Table 4: Profitability of Butcheries in Port Harcourt Metropolis

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Lairage depreciation	1	95,000.00	512.13	95,000.00	513.51
Total Depreciation				795,086.00	4,297.76
Rent on land	1	266,000.00	1433.96	266,000.00	1,437.84
Tax and rates	12	60,000	323.45	720,000.00	3,891.89
Total Fixed Costs (=Total Depreciation + Rent + Taxes/Rates)				1,781,086.00	9,627.49
Total Cost (TC) = TVC + TFC) i.e. Total Operating Expenses				2,952,202.00	15,957.85
Net Profit				2,911,914.00	15,740.08

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Profitability Ratios		
(a) Gross Margin Ratio (GM/TR x 100/1)	80.03	80.03
(b) Operating Expenses Ratio (TC- Dep. /TR)	0.37	0.37
(c) Net Profit Ratio (Net profit/Gross Revenue x 100)	50	50

Source: Field Data, 2014 NB: The exchange rate for Naira (₦) to 1 US dollar at this time was ₦185 to 1 USD

Influence of Cost of Disposal of Solid Butchery Wastes and Socio-Economic Variables on the Profitability Levels of Butcheries

The multiple regression analysis results for determining the influence cost of solid slaughterhouse wastes disposal and socio-economic variables on the profitability levels of abattoirs are presented in Table 5. The performance of the four models estimated were evaluated using the standard economic criteria such as R^2, F ratio and the presence of multicollinearity, heteroscedasticity, autocorrelation, and normality test. Among the four models, the linear model had the highest R^2 and F ratio (4.1 significant at $p < 0.01$). The estimated R^2 of the linear model (0.61) suggested that 61 percent of the profitability level of the abattoir firms can be explained by the covariates included in the model. The significant F ratio at the 1 percent level implies rejecting the null hypothesis of a non-significant joint effect of the covariates in the model. Since the Jarque-Bera statistics (16.92) estimated is not statistically significant at 5% (p estimated = 0.0002), it could be concluded that the residuals of the OLS model applied is normally distributed, leptokurtic in nature but not significantly skewed. The test for heteroscedasticity conducted indicated Breusch-Pagan-Godfrey coefficient, an F-ratio of 1.02, which has a p value of 0.455 (not significant at 5%). This indicates that there was no severe heteroscedasticity in the model. All thissupport the fact that the selected model has all the major required properties of a true OLS model and exhibited a much better fitting than the other counterpart models estimated.

In discussing the signs of the slope coefficients in the linear model, every unit change in the independent variable would lead to some unit change in the dependent variable. For instance, in the linear model, the marital status slope coefficient was a positive and significant at $p < 0.05$.

This implies that marital status of butchery operators has a positive influence on the profitability levels of these slaughterhouse firms. Also, the slope coefficient of household size of the butchery operators was 2047292 which is significant at $p < 0.05$, this implies that a unit increase in the household size ratio of butchery operators leads to an increase in the profitability levels of these butcheries. A larger household size implies more family labour which would lead to a decrease in the rate of hired labour used thereby reducing cost of labour and increasing profit margin. The number of years of experience coefficient was 156191.9, significant at $p < 0.05$, indicating that higher level of experience of butchery operators are associated with higher the levels of profitability of the butchery firms. An increased level of experience leads to increased

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knowledge and willingness to adopt new techniques for carrying out butchery operations.

From the findings in the result of regression analysis, it shows that the coefficient of the cost of waste disposal was -13.05 with t-values (-0.302) at $p > 0.10$, was insignificant at 10% statistical level.

Table 5: Parameter Estimates of influence of cost of disposal of solid butchery wastes and socio-economic variables on the profitability levels of butcheries OLS models

Dependent Variable = Net Profit	Linear Function		Semi-Log		Double Log		Exponential Log	
Variable	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
Intercept	-5052560	-0.904	13.734	15.223***	13.28888	4.578***	-6210626	-0.327
AGE	-1055971	-1.093	0.145366	0.932	0.419949	1.208	-1258919	-0.554
MARSTAT	3019229	2.114**	0.285826	1.240	0.335811	0.918	4194678	1.755**
EDUC	336410.5	0.498	-0.077064	-0.707	-0.158415	-0.522	1037785	0.523
HSHDSZ	2047292	2.679**	0.23565	1.910**	0.425364	1.430	3820687	1.966**
EXPR	156191.9	2.361**	0.016003	1.498	0.169012	1.109	1703855	1.711
WSTECST	-13.051	-0.302	-3.43E-06	-0.491	-0.059449	-0.303	-177026	-0.138
HOHDEXP	6.739	0.456	1.96E-06	0.823	0.126196	0.572	428807.2	0.298
GENDER	-638562.7	-0.155	-0.096425	-0.145	0.007767	0.098	53020.28	0.103
R-squared	0.61		0.59		0.496		0.46	
Adjusted R-squared	0.461		0.440		0.304		0.255	
F-statistic	4.099		3.845		2.585		2.240	
Prob(F-statistic)	0.004		0.006		0.039		0.066	
Akaike info criterion	33.25894		1.98076		2.19734		33.58254	

****, ** and * indicate statistical significance at 0.01, 0.05 and 0.10 level respectively. Source: Author's Estimates from Field Survey, (2014).*

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Therefore, the null hypothesis which implies that no significant relationship exists between the profitability levels of butcheries and the cost of solid waste disposed by the studied butcheries was accepted, indicating that cost of solid waste disposed in Port Harcourt butcheries were not the major determinants of their profitability levels.

The second hypothesis of this study stated that socio-economic factors have no significant influence on the profitability levels of studied butcheries. The regression analysis results revealed that marital status had a coefficient value of 3019229 with t-values at $p > 0.01$ which is significant at the 5 percent level. The null hypothesis was therefore rejected indicating that marital status of butchery operators was one of the important determinants of the profitability levels of the butchery firms. Similarly, the slope coefficient values of the household size and the level of experience of the butchery operators were 2047292 and 156191.9 respectively, which are both significant at $p < 0.05$, enabling us to reject the null hypothesis which also held that socio-economic attributes do not influence the profitability levels of butcheries within the study area. It was then concluded that household size and level of experience of these butchery operators were significant socio-economic attributes which strongly influenced or determined the profitability levels of the butcheries in Port Harcourt metropolis but not waste costs.

Conclusion

The study analyzed the status of solid waste management in butcheries and possible effects of waste disposal costs and socioeconomic attributes of butchery operators on agribusiness productivity. The disposal measures and the adequacy of the waste disposal systems in place in the butcheries were also reviewed. Three major disposal measures were used by the butcheries. These include burning, composting and paying waste authorities to dispose the wastes. The butcheries' average profit levels were high and the business ran efficiently. It was found that socioeconomic attributes of the butchery operators, especially marital status, household size and working experience that directly affect their profits. Based on the foregoing findings, the study recommends that authorities and stakeholders should promote the butchery business as a livelihood source, incentivizing the agribusiness owners with better infrastructure, building their capacities. Butchery operators should be trained to help supply farmers with recycled farm wastes to enhance sustainable development.

On the other side, this study also notes that the cost of wastes from butcheries is very insignificant to the butcheries owners while they reduce the availability of limited natural resources. The wastes they generate pose threat to the society at a time of increasing impact of climate change through decomposition of the landfills. This, researchers have warned, can increase the generation of methane – GHG emissions. It is a typical challenge of market failure which needs to be urgently addressed by policy makers in a rapidly growing global population and under a dilemma of difficulty in gathering information on the environmental costs to the society. It is therefore recommended that the state government should make attempts to correct this market failure by imposing higher tax or levies for a cleaner environmental management on butcheries in the state. Such revenues should be directed in providing more environmentally friendly projects in the state.

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