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Characterization of Production Technologies Employed by Selected Small and Medium Scale Enterprises in Food Industry in Southwestern Nigeria

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ABSTRACT

The study examined the production technologies used by selected small and medium enterprises (SMEs) in the food industry in Southwestern Nigeria. This is with a view to determining the extent to which production of quality foods is done with adopted technologies. The study was carried out in Lagos, Ogun and Oyo States in Southwestern Nigeria where there is high concentration of food processing firms (FPFs). Multi-stage sampling technique was used to select the local governments and towns with high concentration of FPFs in each state. Two hundred and fifty small and medium scale FPFs were selected using purposive sampling. Primary data were collected with two sets of questionnaire. The first set elicited information on the type and nature of production technologies and was administered on production managers of the firms. The second set elicited information on effectiveness of production technologies and was administered on one randomly selected production employee from each firm. Data collected were analyzed using mean and frequency distribution. The results showed that 48% of the production technologies of the firms were for baking, 31% were for filtration and 14.4% were used for pasteurization. Furthermore, 39.2% and 41.6% of the firms used automated and a mixture of automated and manual machines respectively. A total of 42% used imported machines, while 41.6% used a mixture of imported and local machines. Majority (74%) used batch production system. The study concluded that the reliance of firms on imported technologies, which they have poorly maintained, cannot help to achieve sustainable development in Nigeria.

Keywords: Production, Technology, Food Processing

INTRODUCTION

Technology is a critical factor in any production system (Ilori *et al.*, 2002; Dussange *et al.*, 1992). Small scale firms in Nigeria are characterized by use of craft or traditional technologies in their production activities Taiwo *et al.* (1997) and Aworh (2010) have opined that small and medium scale enterprises (SMEs) are usually hampered by the adoption of inefficient or inappropriate technologies. Taiwo *et al.* (2002) have equally claimed that SMEs in the food industry rely on locally fabricated machines and equipment in their operations. In recent times however, individual and institutional efforts are being made to upgrade and improve the processing technologies of SMEs, Taiwo *et al.* (1997) and Aworh (2010) corroborated this claim citing the of mechanization of *gari* processing, instant yam flour, *soy-ogi*, industrial production of *dawadawa* and upgrading of *kilishi* processing among others. The SMEs, including firms in the food industry, have been indicted for their lukewarm attitude and little or no investment in research and development (R&D) capable of upgrading their production technologies. Many SMEs have continuously been relying on traditional methods for production. Very little has been documented about the extent to which the traditional technologies employed by SMEs in the food industry have brought about effective operations. This study therefore has the objective of assessing the features of production technologies adopted by SMEs in the food industry in Southwestern Nigeria with a view to discovering the possibility of the technologies sustaining and growing the operations of the firms. The study is particularly focused on firms producing biscuit and bakery products, soft drinks, carbonated water, and sachet and bottled water. These are leading subsectors in the food industry in Nigeria.

The foreign food processing firms, which constitute a major segment of food industry in Nigeria, are the overseas branches of multinational food companies (MFCs) based in developed countries (Aworh, 2010). These firms have therefore found it easier to import modern technologies from their parent companies overseas. These companies have been known to dominate the food industry by virtue of their application of modern technologies in their production (Taiwo *et al.*, 2002). The medium-scale food firms have been producing products with simple and modified technologies. The production technologies of these medium-sized firms have been based on batch production system (Aworh, 2010). For the fact that some of these firms are able to mobilize reasonable capital and foreign support, they have been able to adopt some modern technologies in their operations. They have also upgraded some traditional local technologies (Aworh, 2012; Taiwo *et al.*, 1997). However, many small scale FPFs have been consistent in their use of traditional food processing methods. The traditional technologies are those that were passed from one generation to another until the emergence of modern technologies (Hall, 1989). Floros *et al.* (2010) and Okwelle (2008) gave examples of traditional food processing unit operations to include cooking, fermentation, roasting, smoking, threshing, dry and wet milling, dehulling, peeling and so on.

Production and Manufacturing

Singh (2006) defines production as an act of converting raw materials into finished goods or services through the use of different types of machines and processes. Production is generally used to refer to the process of creating physical goods and services. On the other hand, Heizer and Render (1999) argued that manufacturing refers only to the creation of physical goods through the transformation of inputs. Manufacturing is also viewed as techniques and methods by which inputs are physically transformed into outputs (Ilori *et al.*, 2002). Manufacturing creates value with the use of technology, and physical and mental labour in the process of changing or transforming raw materials or semi-finished materials into finished goods. Technology, in particular, is a critical factor in manufacturing. It is the totality of knowledge, techniques, procedures, processes and skills that culminate in the production of goods (Ilori *et al.*, 2002).

Any production or manufacturing activity must involve a process by which inputs will be converted into outputs (Olaposi, 2010). Hoyle (2000) argued that the process of transforming inputs into outputs involves materials, machines, the environment, personnel, documentation and techniques. Evans *et al.* (1987) also posited that process technologies consist of methods and equipment used to manufacture products or deliver services. In this study, production technology is viewed as methods, processes, facilities, machines or equipment used to produce or manufacture a product. The importance of

production technology has been explained by Prajogo and Sohal (2006) when they submitted that technology is an appropriate resource that could be used to enhance organizational performance; particularly production.

RESEARCH METHODOLOGY

The study was carried out in Lagos, Ogun and Oyo States in Southwestern Nigeria. These states host more than 50% of FPFs in (Taiwo *et al.*, 2002). Multi-stage sampling technique was used to select local governments and towns with high concentration of FPFs in each state. Two hundred and fifty small and medium FPFs were thereafter selected using a purposive sampling technique. Primary data were collected with the aid of two sets of questionnaire. The first set, which elicited information on the character of production technologies, was administered on production managers of the firms. The second set, which elicited information on the character and effectiveness of the production technologies, was administered on one randomly selected production employee in each firm. Interviews were also conducted to complement the questionnaire. Data collected were analyzed using means and frequency distribution.

RESULTS AND DISCUSSION

Table 1 reveals that majority (73.6%) of the firms used batch production system in which units of the products are produced in small lots. This agrees with Aworh's (2010) study who claimed that SMEs in food processing mainly used batch production techniques. Stevenson (1999) had also opined that production in small lots is a feature of small-scale firms. This feature might not be unconnected with little capital and limited market scope of many small-scale food firms. Table 1 also showed that 25.2% used continuous processing method. Only 1.3% of the firms used mass production methods. The low percentage of firms using continuous and mass production methods may be as a result of the inability of the small firms to afford purchase of needed specialised machines. This is coupled with SMEs limited operational scope. Cole (1986) had opined that mass production systems involvethe use of costly specialised machines. Moreover, 39.2% used fully automated machines, 41.6% used a mixture of fully automated and manual machines. These may actually be firms producing soft drinks and carbonated, sachet and bottled water. These are production areas where there are limited locally fabricated machines.

Majority of the firms (94.8% and 60.8%) had neither International Standard Organization ISO 9000 certificate nor Nigerian Industrial Standard (NIS) certificate (respectively) as indicated in Table 1. This could mean that majority of the firms cannot meet the quality standards of these agencies, probably because of their use of traditional technologies which may have resulted in sub-standard products. This is in addition to the informal operation of the firms which may not allow for such regulation of quality. Ibanga (2007) also reported that lack of modern technology in processing shea butter in Kainji area of Niger State in Nigeria was a barrier in the of quality shea butter produced. The lack of technology to produce the needed machines and equipment by Nigerian firms, including FPFs, should therefore be seen as a setback to sustainable development in Nigeria.

Importation of machines and equipment by industries cannot be sustained, especially in the face of dwindling foreign exchange earnings of government. Moreover, only 14% of the employees in Table 3 claimed that they had no machine breakdown in 2016, while majority (82%) claimed that their firms experienced between one and nine breakdowns in facilities and machines in 2016. This situation may have arisen as a result of poor maintenance culture of the firms and probably lack of understanding of the technological contents of the machines. Frequency of breakdown of facilities is capable of disrupting operations, bringing low productivity, wastages, low workers' morale and probably low quality of production.

Adegbite *et al.* (2006) have opined that the products of many SMEs in Nigeria are sub-standard when compared with that of large firms who use modern technologies in their production. Furthermore, in Table 1, most of the firms (98.3% and 92%) neither collaborated in research with universities and research institutes nor conduct internal research. Ilori *et al.* (1999) alluded to this when they claimed that most firms in the food industry in Nigeria were not active in R&D. This is perhaps why 88% of the firms had no invention/innovation in the last 5 years. This attribute of FPFs may be as a result of their informal

operational methods, limited capital and particularly a lack of understanding of the role of R & D in achieving sustainable development. Aworh (2010) attributed the negative attitude towards R&D by SMEs in food industry to poor financial background and informal operations.

Table 2 indicates that 48.4% of the firms used baking, 31.2% used filtration while 14.5% used pasteurization in production. Only 3.6% used extraction methods. The facilities, machines and equipment used by the firms were either fully automated (39.2%) or a mixture of automation and manual techniques (41.6%). The automated machines are mainly imported. This may only be afforded mainly by medium-sized firms which are common among firms producing biscuits, soft drinks and carbonated water. Table 2 further shows that only 1.2% used manual machines and equipment. These may have been small firms in bakery and perhaps sachet water production. These results could be a departure from Aworh (2010) who submitted that inappropriate and traditional technologies were being used by SMEs. Results in Table 2 also reveal that 42% of the firms used imported machines, while another 41.6% used a combination of imported and locally fabricated facilities and equipment. This result confirms the claim of Oyeku *et al.* (2005) that bakers in Nigeria fabricated their equipment locally especially ovens, mixers and milling machines and import others such as slicers, proofing chambers, and dough dividers among others. Only 16.4% of the firms used mainly locally fabricated facilities. This agrees with Oyedoyin *et al.* (2008) who discovered that fabricated equipment were used in the production of food such as pectinase enzymes and clarified juice. This small percentage of firms using locally fabricated facilities might be those that are really incapacitated by little capital and small operational scale, who cannot afford imported facilities. The dependence of many of the firms on imported technologies may have indicated that the technology to produce required machines is still lacking in Nigeria. This may be as a result of low emphasis on technological development which is a necessity for sustainable development.

Table 1: Characteristics of Selected Food Processing Firms in Southwestern Nigeria

	Variables	F	Percentage
i.	Nature of production system:		
	Batch	184	73.6
	Continuous	63	25.2
	Mass	03	1.3
ii.	Nature of Technology used in Production		
	Full Automation	98	39.2
	Semi Automation	45	18.0
	Manual	03	1.2
	Both full automation and manual	104	41.6
iii.	Type of machine used in production		
	Imported	105	42.0
	Locally fabricated	41	16.4
	Both imported and local	104	41.6
iv.	Possession of ISO 9000 Certificate		
	Yes	13	5.2
	No	237	94.8
v.	Possession of NIS Certificate		
	Yes	98	39.2
	No	152	60.8
vi.	Research collaboration with institutions		
	Yes	04	1.7
	No	246	98.3
vii.	Company internal research		
	Yes	20	8.0
	No	230	92.0
viii.	Invention/Innovations in last 5 years		
	Yes	30	12.0
	No	220	88.0

Table 2: Production Technologies used by Small and Medium Scale Food Processing Firms in Southwestern Nigeria

Technology items	Frequency	Percentage
1. Technology of Production Facilities		
Cooking	01	0.4
Pasteurization	36	14.5
Filtration	78	31.5
Evaporation	02	0.8
Extraction	09	3.6
Dry mixing	01	0.4
Freezing	01	0.4
Baking	120	48.4
2. Nature of Technology used in production		
Full automated	98	39.2
Semi automated	45	18.0
Manual	03	1.2
Both fully automated and manual	104	41.6
3. Type of facilities, machines and equipment for production		
Imported	105	42.0
Locally fabricated	41	16.4
Both imported and local	104	41.6
4. Change in Production technology in last 5 years		
Yes	222	88.8
No	28	11.2
5. Nature of Production System		
Batch	184	73.6
Continuous	63	25.2
Mass	03	1.3
6. Improvement in Production technology in last 5 years		
Yes	156	62.4
No	47	18.8
Can't say	47	18.8
7. Adequacy of Production Technology		
Very adequate	67	26.8
Adequate	169	67.6
Fairly adequate	06	2.4
Inadequate	12	3.2
8. Adequacy of facilities, machines and equipment for production		
Very adequate	58	19.7
Adequate	192	80.3
Fairly adequate	00	00.0
Inadequate	00	00.0
9. Impact of technology on quality		
No defect	101	40.4
Very few defects	115	46.0
Few defects	32	12.8
Many defects	02	0.8

Table 3: Employees Assessment of Number of Breakdowns in Facilities, Machines and Equipment in 2016

Number of times machine breakdown in 2016	F	Percentage
No breakdown	35	14.0
1 – 3 times	101	40.4
4 – 6 times	37	14.8
7 – 9 times	67	26.8
Above 10 times	10	4.0

Table 4 indicates that the production system of many of the firms is being effectively supervised and controlled, with a mean score of 3.28. This may probably be due to the personal involvement of the owner(s) of the business. However, many of the firms in table 4 slacked in the areas of regular maintenance of machines, constant addition of new machines and regular training of employees in machine handling with 1.59, 1.59 and 1.56 mean scores respectively. These weak features of FPFs may be attributed to many factors, such as informal operational methods, insufficient capital, low technical knowledge, and lack of knowledge of importance of workers among others. These may have created problems in their production system. This is perhaps why 50% of the firms could not meet their daily production targets as indicated in table 5. Moreover, irregular maintenance of machines and facilities might also have explained why majority (51.2%) of the firms (Table 5) viewed the state of their machines and facilities as unsatisfactory. All these are capable of hindering sustainable development of the firms, and consequently that of the country as a whole.

CONCLUSION

The findings of this study reveal that the technologies of the FPFs are characterised by dependence on importation of operational facilities and lack of regular maintenance of the imported machines. Majority of the firms still use batch production methods because of their low operational scale, lack of capital and limited scope of their market. Some of the firms are still relying on traditional technologies. All these features are a potential hindrance to sustainable development of the food industry and by implication, Nigeria.

Table 4: Continuous Improvement in Production Operations of FPFs

	Type of Improvements	Mean	Standard deviation
i.	Regular maintenance of machines and facilities	1.59	0.95
ii.	Constant addition of new facilities and machines	1.59	0.95
iii.	Regular training of employees on machine handling	1.56	1.66
iv.	Clear understanding of production system	2.35	1.41
v.	Constant updating of production policy work rules and procedure	2.07	1.20
vi.	Available opportunity for employees to introduce new ideas	1.56	1.66
vii.	Effectiveness of supervision and control of production system	3.28	1.41

Table 5: Effectiveness of Production Technologies of the Firms

	Variables	F	Percentage
i.	Attainment of daily production target		
	Yes	124	49.6
	No	105	42.0
	No response	21	8.4
ii.	Daily defects in production		
	No defect	72	28.8
	1 – 10 “	115	46.0
	11 – 20 “	31	12.4
	21 – 30 “	25	10.0
	31 – 40 “	6	2.4
	Above 40 “	1	0.4
iii.	Present state of facilities, machines and equipment		
	Very satisfactory	12	4.8
	Satisfactory	41	16.4
	Fairly satisfactory	53	21.2
	Unsatisfactory	128	51.2
	Undecided	16	6.4

POLICY RECOMMENDATIONS

- i. Government should give a deadline of about seven to ten years to firms relying on imported machines to stop importation of these machines and start developing local alternatives, probably in partnership with relevant technical agencies and institutions. This is capable of bringing about sustainable development in Nigeria.
- ii. There should also be strict enforcement of the use of locally produced products by government. This will create enlarged market for FPFs such that many of them could boost their production.

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