
COMPARATIVE ANALYSIS OF GREEN MANUFACTURING PRACTICES AMONG MANUFACTURING FIRMS IN SOUTH-EAST NIGERIA AND MOGADISHU SOMALIA

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ABSTRACT

The study is a comparative analysis of green manufacturing practices (GMP) of firms in South East Nigeria and Mogadishu Somalia, using RECE model. The study used a qualitative research design to ascertain GMP (recycling energy efficiency initiative, choosing green materials and eco-innovation) among manufacturing firms in South East Nigeria and Mogadishu Somalia. It was found that both countries (Nigeria in West Africa and Somalia in East Africa) are conscious/aware of GMPs. The study concluded that green manufacturing is a benchmark for the future of African manufacturing firms and recommends that the RECE model developed here should be used by manufacturing firms in Nigeria and Somalia to access and implement GMP.

Keywords: Eco-innovation, energy efficiency, green manufacturing practices, green materials, RECE model

INTRODUCTION

It is recognized all over the world, that manufacturing activities pose challenges to the ecosystem. There has thus been determined efforts to address these challenges to ensure that environmental concerns are properly incorporated into socio-economic development efforts. It is critical that necessary conditions are established at the global and national levels to enable developing countries move towards green manufacturing. Green manufacturing practices that incorporate eco-friendly manufacturing processes of goods. It involves efficiently transforming raw materials into finished goods in ways that leave less environmental (Van Berkel et al., 1997; Hui et al., 2001). Green manufacturing consider waste reduction or prevention, recycling and green product designs (Porter & Linde, 1995).

Sivapirakasam et al. (2011) identify green manufacturing as a transformation process that maximises consumption of resource with high reliability and less ecological hazards. This is accomplished through innovative product and process designs that promote process changes, re-use of wastes and better housekeeping (Dornfeld, 2009).

Green manufacturing adopt strategies that minimize pollution and wastage. It gives many chances for reducing costs, meeting environmental principles, improved corporate image and minimizes health risks. The aim of green manufacturing is to reduce, control, avoid and prevent wastes during production. It is a strategy that protects the environment, consumers, and workers; and improve efficiency, profitability and competitiveness.

The vision of green manufacturing is to create harmonious conditions between businesses and the environment. The mission is value creation by producing more with fewer resources (Sivapirakasam et al., 2011). The outcomes includes reduced pollution, defects, downtime and inventories (Dangayach & Deshmukh, 2001); all of which tend to satisfy the expectations of various critical stakeholders (Miller & Ross, 2003).

Companies in Africa perform below global regulatory mechanisms aimed at enabling better functionality and performance. Though some manufacturing companies focus on green manufacturing practices, the financial and environmental performance of these companies remain generally low (Khan et al., 2021; Gandhi & Vasudevan, 2019). The manufacturing sector in African present opportunities for financial performance and environmental wellness despite the presence of financial constraints and environmental degradation which has generally affected performance of companies in countries such as Somalia, Nigeria etc.

In recent times, humanity has faced existential threats from the effects of climate change. These threats manifest through extreme weather condition such as floods, droughts and famine as well as changing patterns of disease occurrence and spread. The contribution to climate change by human economic activity is among the important discussions in recent times. According to Elizabeth and Helen (2015), this results from the realization that climate change, if unchecked, has potential to wipe out life on earth through depletion of life supporting systems such as clean water and air, destruction of habitats and increased natural disaster occurrence including disease outbreaks.

In this study therefore, we attempt to compare green manufacturing practices of companies in Nigeria and Somalia, with a view to identifying and proposing viable green manufacturing strategies that could lead to improved performance of manufacturing sector operations in both countries.

Theoretical Framework

This study is anchored on stakeholders' theory (Freeman, 1984) and institutional theory (Hirsch, 1975). Freeman (1984) defines stakeholders as interested parties in the operation of an organization. They are individuals, groups, institutions, etc. who are either affected by the firm or affects the way the firm operates. Stakeholders' theory describes how genuine issues of relevant stakeholders are included in operational decisions to achieve the goals and strategic direction of a firm (Donaldson & Preston, 1995). According to Hart (1995), developing and implementing strategic environmental commitment means understanding stakeholder's needs based on historical environmental performance, organizational structure and competitive position of the firm. Stakeholders scrutinize short and long-term risks and opportunities in relation to green manufacturing adoption (Donaldson & Preston, 1995). It is strategically beneficial and innovative to incorporate and manage stakeholders concerns in a way that guarantee strategic success and competitive advantage (Freeman, Martin, & Parmar, 2007).

Institutional theory on the other hand, examines how company operations are influenced by external pressures (Hirsch, 1975). Organizations operate within a social network and a strong motivating force behind their behaviour is socially based, and is embedded within institutions and interconnected organizational networks (Iacobucci & Hopkins, 1992). These social pressures force organizations to adopt green manufacturing practices (Scott, 1992). DiMaggio and Powell (1983) explain three forms of isomorphic drivers (mimetic, coercive and normative) that influence management decisions. Coercive isomorphic forces are driven by those in authority like the government and its agencies (Rivera, 2004).

Normative isomorphic forces are important in ensuring conformity to perceived legitimacy in relation to green manufacturing and environmental management practices by firms (Ball & Craig, 2010). Mimetic isomorphic forces are in control if companies copy successful strategies (Aerts et al., 2006). New cement plants are trying to adopt green manufacturing technologies to deal with challenges existing company's face. Cement firms are under pressure to become eco-friendly, lest rapidly changing global competitive economy will make them vulnerable to stringent public policies or consumer laws that would affect their operational performance.

Green Manufacturing Practices

Green Manufacturing Practices (GMP), refers to the system that incorporates product and product design issues with issues of manufacturing, planning and control in such a way to identify, quantify, access and manage the flow of environmental waste with the aim of reducing and ultimately minimizing environmental impact while also maximizing resource efficiency (Testa & Iraldo, 2010). Wisner and

Stanley (2007) see green manufacturing as production process which use inputs with relatively low environmental impacts, which are highly efficient and which generate little or no waste or no pollution.

GMP lead to lower raw material costs, production efficiency gains, reduced environmental and occupational safety expenses and improved corporate image. Green technology and Fico- innovation is one the green manufacturing practices. It is the driver in the move towards green and low carbon economy. Many organizations view the application of green manufacturing technologies as the cornerstone for their policies on economic growth. The evolution of sustainability gave rise to GMP from the application of technology for the treatment of pollution at the end of the pipe to more integrated systems of production which support collaboration across functional areas within a firm as well as inter-organizational level such as closed-loop production and industrial symbiosis (OECD, 2010).

Generally, GMP develop at three levels, i.e. product, process and system, (Jayal et al., 2010). At the product level, the traditional 3R concept (reduce, reuse, recycle) has been transformed to a greener 6R approach (reduce, reuse, recycle, recover, redesign, remanufacture), changing paradigm from single life cycle to multiple life cycles (Jayal et al., 2010). Numerous efforts have been made to optimize technological improvements and process planning for reducing resource consumption; waste generation and occupational hazards as well as improving product life (Jayal et al., 2010; Jawahir & Dillon, 2007).

In this context, GMP is defined as intra- and inter-organizational practices that integrate environmental, economic and social aspects into operational business activities. Differentiated based on the orientation of green thinking, there are two types of GMP namely internal GMP and external GMP. While internal GMP focuses on green practices within a firm, external GMP refers to inter-organizational practices within the value system and beyond the chain of production to improve economic, environmental and social sustainability simultaneously.

Previous studies reports on the status of green manufacturing adoption and operational performance. Many of these studies investigate successes made in the area of green production and the sacrifices that needs to be made to realize environmental sustainability. Inman (2002) did literature review on operations management in the context of green ecology explaining how industries are influenced to formulate strategic changes in manufacturing, with key focus on challenges of rolling out green manufacturing projects among electronics manufacturers.

Udomleartprasert (2004) concluded that processes, materials, work environments, packaging, and waste management systems are some of the critical issues that determine the success of green manufacturing adoption. Rusinko (2007) studied the relationship between green manufacturing operations and competitive advantages of manufacturing firms and results were positive. Perrow (2011) examined China's policy of producing now and clean up later, and realized that public opinion is changing in China.

China's environmental problems are not from the lack of related laws but from the lack of law enforcement. DiPietro et al. (2013) studied green practices in upscale food service operations, and reported that consumers have green products awareness but that, there is still need for more campaign. Smith and Perks (2010) studied perception of consumers concerning greening the manufacturing industry using quantitative research design. The finding showed that manufacturers are the main sources of pollutants that cause global warming and it's important for them to recognise the consequences of their operations. Procedures have been put in place to facilitate green manufacturing adoption in various manufacturing industries.

Conceptual Framework: RECE Model

The RECE model has its foundation on green manufacturing as a driver for sustainable manufacturing. Its purpose was to provide a platform for green manufacturing practices across manufacturing firms. RECE provides a basis for a growing body of research that relates to green manufacturing. This model is proposed by the researcher for developing countries.

Extant literature shows that most developed countries where green manufacturing practices exist have among other factors, used RECE scale: (i) Recycling - the process of recovering material from waste and turning it into new products, (ii) Energy efficiency initiative - the process of minimizing the volume of energy used during manufacturing process, (iii) Choosing green materials - choosing production materials that conserve natural resources, save water and energy, minimize toxic emission and contribute to safe healthy indoor environment and (iv) Eco-innovation - adopting technologies, design and innovative ideas that are eco-efficient (Hua, 2009, Jamie et al., 2011, Javier et al., 2016).

This is a descriptive study based on literature review and semi-structured interview with management and staff of manufacturing firms in South-East, Nigeria and staffs of Somali plastic factory, Ajia mineral water in Mogadishu Somalia. The study hypothesizes that green manufacturing practices vary among manufacturing firm in South East Nigeria and Somalia.

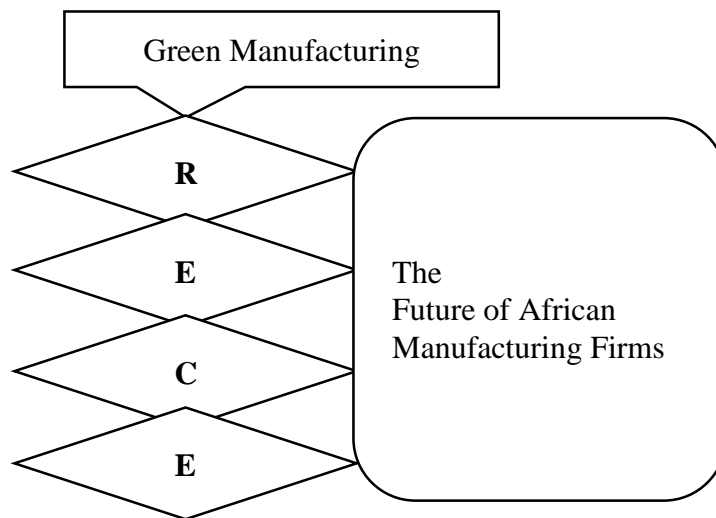


Fig. 1: Researcher Model

Fig. 1 shows the application of the RECE model on green manufacturing practices and how it is pivotal to the future of African Manufacturing firms. The application of this model was considered suitable for this study because it highlights the various parameter that should be considered by African manufacturing firms to practice green manufacturing towards a sustainable future.

METHODOLOGY

This study attempts a comparative analyses of GMP of firms in South-East Nigeria and Mogadishu Somalia. The choice of the manufacturing sector was predicted on the fact that firms in the sector generate vast volume of waste that pollute the environment. The target population of the study consists 1254 staff of the manufacturing firms. The focus was on management level employees (top, middle and lower level management staff) from the manufacturing firms in South-East, Nigeria and Mogadishu Somalia. A sample size 257 was drawn from the population. The study thus administered 257 copies of semi-structured interview schedules on the respondents. However, 240 were returned and used in the analyses of the study. Literature was reviewed based on their relevance to the study. Secondary data collected from reports, articles, research studies and reviews were also used for this research.

RESULTS

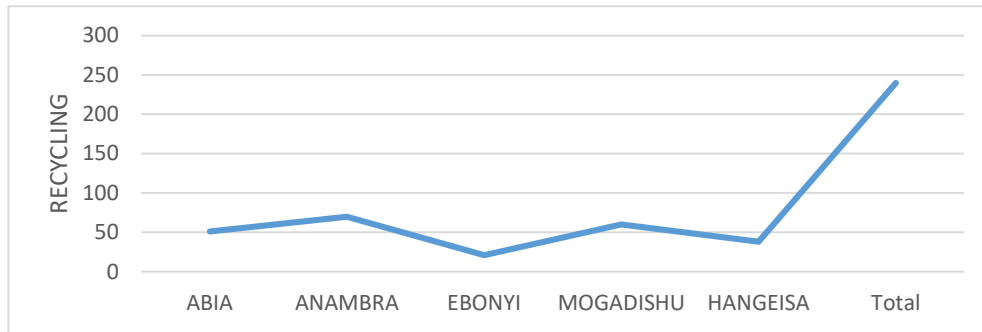


Fig. 2: Disparity in recycling practice among the five cities (Abia, Anambra, Ebnyi, Mogadishu and Hangeisa) in Nigeria and Somalia.

From fig. 2, recycling practice trend varies from state to state, where 51 respondents from Abia State confirm that their manufacturing firms practice recycling. 70 respondents from Anambra State confirm recycling practice, 21 from Ebonyi state, 60 from Mogadishu and 38 from Hangeisa. Thus Anambra State (Nigeria) carries the highest recycling practice.

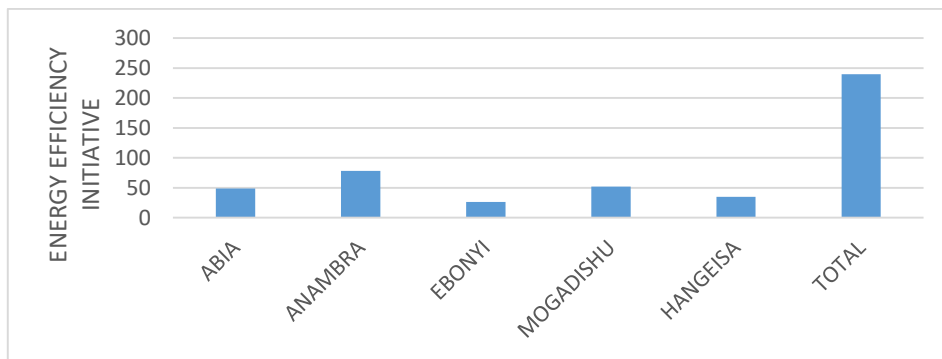


Fig 3: Extent of energy initiatives adopted by the two countries (Abia, Anambra, Mogadishu Hangeisa) in Nigeria and Somalia.

From fig. 3, responses on energy efficiency initiative varies from country to country with Abia 49, Anambra 78, Ebonyi 26, Mogadishu 52, and Hangeisa 35. Thus showing that Anambra (Nigeria) has the highest manufacturing firms with energy efficiency initiative.

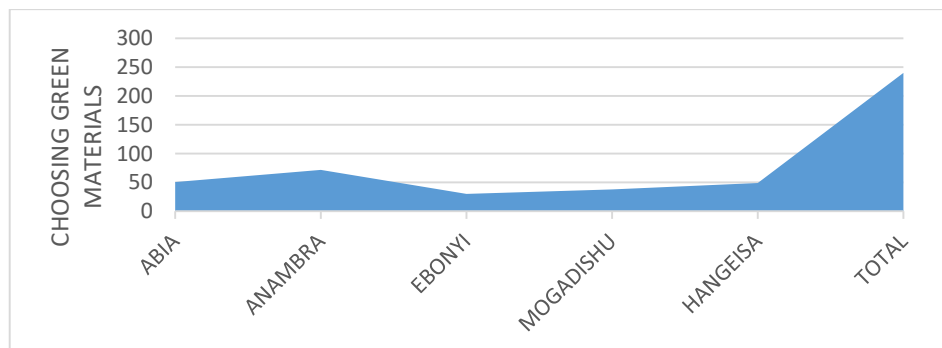


Fig. 4: Extent to which the country regions (Abia, Anambra, Ebonyi, Mogadishu and Hangeisa) in Somalia and Nigeria choose green materials for manufacturing

From fig. 4, Abia State manufacturing firms choose green materials for manufacturing at the rate of 51, Anambra 72, Ebonyi 30, Mogadishu 38 and Hangeisa 49 with Anambra (Nigeria) still the highest state that practices green manufacturing.

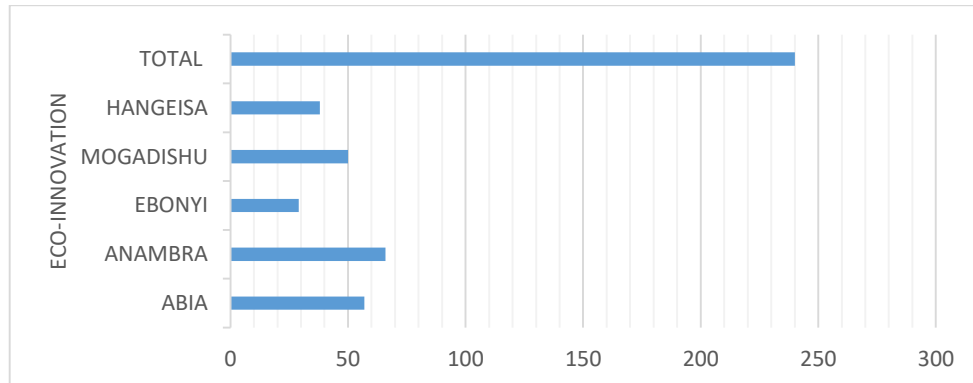


Figure 5: Trend of eco-innovation adopted by the two countries (Somalia and Nigeria)

From fig 5, based on the responses from the respondent, 57 respondents confirm that eco-innovation is practiced in Abia State, Anambra 66, Ebonyi 29, Mogadishu 50 and Hangeisa 38. Anambra (Nigeria) manufacturing firms practice eco-innovation.

DISCUSSION OF FINDINGS

GMP based on the RECE model is particularly practiced in Anambra state (Nigeria), followed by other cities including Hangeisa in Somalia. Green manufacturing is a paradigm that employ green strategies: recycling, energy efficiency initiative, choosing green materials and eco-innovation. It is a global believe that green manufacturing drives sustainability. Manufacturing firms are the major sector of the economy that emits vast volume of waste and pollution that adversely affects the eco-system. The study applied various parameters that manufacturing firms should consider to practice green manufacturing.

Results from the findings show that Anambra state, Nigeria Practice recycling, energy efficiency initiative, choose green material and practice eco-innovation as a drive towards practice green manufacturing. This therefore, shows that Anambra State (Nigeria) manufacturing firms are working towards a sustainable future compared with Somalia.

CONCLUSION AND RECOMMENDATIONS

Green manufacturing is system-wide and integrated approach towards the reduction of waste and pollution associated with manufacturing activities. The essence of green manufacturing is to secure the future of manufacturing firms. The role of green manufacturing in the 21st century is critical as it minimizes landfill waste and enhances pollution control. With the application of the RECE model it is concluded that amongst the South-East Nigerian manufacturing firms, Anambra state is more conscious of green manufacturing practice more than the East African counterpart, Somalia. Therefore, if the practice is consistent, they are most likely to secure sustainable manufacturing. Service delivery by the hospital phenomenally.

Based on the findings, the study recommends that RECE model should be adopted by manufacturing firms in Nigeria and Somalia to assess and implement Green manufacturing Practice; and that manufacturing firms in Anambra State, Nigeria should be used as yardstick to develop strategies that are applicable towards green manufacturing practice, and also East Africa, particularly in Somalia.

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