AN ASSESSMENT OF THE IMPACTS OF CLEANER PRODUCTION IMPLEMENTATION IN MANUFACTURING INDUSTRIES IN NAIROBI KENYA

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Abstract

The purpose of this research was to assess the impacts cleaner production has had on manufacturing industries in Nairobi, Kenya. It involved fifteen industries that have incorporated cleaner production practices in their operations. The researcher conducted a census since the population was small and used questionnaires to collect data. Findings were that cleaner production had resulted in a number of positive impacts. For instance, 70% of the industries had noted improvement in water consumption trends since adoption of cleaner production. Other impacts included reduced costs of; raw materials, occupational safety expenses, energy consumption and waste discharge; improved corporate image and staff morale. Only 10% practiced rainwater harvesting while only 20% utilized solar energy; thus the study recommends provision of incentives by government to industries for them to implement cleaner production practices. There's also a need to have a cleaner production policy that would make its adoption mandatory for industries.

Key words: Cleaner Production, Resource efficiency, Sustainable development, Triple bottom line, Manufacturing

1. Introduction

Recently, environmental issues have become a matter of concern for all sectors and pressure has been mounting on all industrial sectors to improve their environmental performance. Companies are becoming more informed and are taking up resource efficient measures (UNEP, 2014). The World Commission on Environment and Development (WCED, 1987), recommended industrial operations that are more efficient in resource use, generate less wastes and pollution, and that minimize irreversible impacts on human health and environment. The Commission's report, Our Common Future, became the drive of the concept of Cleaner Production (CP) in the 1980's whose ultimate goal is sustainable development. Several current global trends are causing cleaner production to grow in relevance and importance as more and more companies become aware of low inefficiency with which they use their material and energy resources. Inefficiency results into higher production costs which affect competitiveness and profitability, reduction in populations' life quality and rapid environmental degradation in terms of resource constraints, climate change, waste management and food shortages (Schaltegger *et al.*, 2008; Thatcher, 2014). The United Nations Environment Program (UNEP) has since 2011 partnered with the European Union to prioritize regional approach on mainstreaming Sustainable Consumption and Production (SCP) and resource efficiency to enable countries to make shift and decouple environmental degradation from economic growth (UNEP, 2015).

Policies and regulations have been found to play a critical role in implementation of CP. Kenya, however, lacks a national cleaner production policy. Some policy statements on CP and environmental conservation addressed in the national industrialization policy framework draft are: promotion of investment in local manufacturing of CP equipment along with other emerging technology, mainstreaming operation of the Kenya National Cleaner Production Center (KNCPC) into the ministry responsible for industrialization and development of a national CP policy (GoK, 2010). A public policy is needed in order to scale up efforts to green the manufacturing sector in terms of eco-labeling, recycling and re-use, production of eco-friendly materials and support of RECP processes (UNEP, 2014). In Kenya, the government compliance and enforcement regime that encourages pollution prevention is the Environmental Management and Coordination (Amendment) Act (2015), an amendment of EMCA, 1999 which is the National Environmental Policy. The policy emphasizes the 'Polluter Pays Principle' and the 'Precautionary Principle'. Legal articles within the Act that are used for CP implementation are environmental audits, Environmental Impact

Assessment (EIA), environmental quality, environmental monitoring and the various licenses for waste handling (KNCPC, 2004).

According to KNCPC, enterprises are required to quantify and characterize their wastes and understand their production processes and services, ultimately developing their environmental policies. The activities of NCPCs have clearly proven the economic and environmental impacts of applying CP in businesses and in some areas have facilitated the integration of CP in national policy frameworks (UNIDO-UNEP, 2010). The potential for CP to benefit businesses is well demonstrated, but it's not yet as widely adopted as might be expected. According to Schaltegger *et al.* (2008), this could be because of lack of adequate information, the notion that CP is only relevant to manufacturing, institutional frameworks which don't encourage the adoption of CP and lack of a one-to-one relationship between organizational change (such as CP adoption) and acting change. Babilas *et al.* (2007) attributed successful application of CP in companies to technological, training, institutional and government capacities. These capacities are lacking especially in developing countries and efforts still need to be done to encourage CP adoption.

A part of the Industry sector in Kenya has embraced CP technology through technical assistance by KNCPC in order to enhance efficiency in the use of natural resources and energy with the aim of reducing waste generation at source (NEMA, 2012). CP is seen as an important tool in promoting green economy in Kenya because it promotes activities that reduce carbon emissions, enhance efficient use of resources and improves industrial production while at the same time creating green jobs and alleviating poverty. KNCPC has been implementing programmes to promote cleaner production in industries since 2001. An example of a KNCPC program that is ongoing is the Lake Victoria Environmental Management Programme (LVEMP II) which is designed to address pollution and inefficient resource utilization through supporting the use of cleaner technologies by industries located in the Lake Victoria Basin. KNCPC is the regional coordinator of the program, which started in August 2010, and is meant to address industrial pollution challenges and unsustainable resource consumption patterns within the lake basin through CP technologies. KNCPC works together with Uganda Cleaner Production Center, Tanzania Cleaner Production Center, Rwanda RECP Center and the Department of Industry of Burundi. The program involves 40 companies on the Kenyan side and has proved to be effective as the companies have managed to recycle their waste water reduce resource consumption-mainly raw materials, water and energy-by up to 50% (KNCPC, 2014). For example, Kitumbe tea factory implemented rainwater harvesting,

solar drying and LED lighting and as a result achieved 60% reduction in water use and 20% reduction in energy consumption (UNIDO, 2015).

This study focused on manufacturing industries because they are likely to contribute to higher pollution levels in form of end-of-pipe approaches compared to other categories of industries. Moreover, the researcher studied industries within Nairobi because this is the region with the highest concentration of manufacturing industries countrywide. Historically, the usual (and apparently reasonable) assumption amongst many managers has been that improving environmental performance represents only extra costs for a firm whereas the alternative hypothesis is that wastes and pollution are signs of low efficiency (Schaltegger *et al.*, 2008). Thus this study will offer good understanding to manufacturers not to view cleaner production as just expenditure hence contribute to more adoption of the concept with one of the outcomes being improved economic performance of the manufacturing sector which is already declining.

2. Literature Review

Pollution can be considered as an indicator of inefficiency which is always characterized by resource wastage, poor working conditions, economic losses, environmental pollution, among other negative effects (Schaltegger *et al.*, 2008). In order to decouple growth from its environmental impact, manufacturing industries need to apply life cycle thinking; through adopting closed-cycle manufacturing process, extending the lifespan of manufactured goods, improving resource recovery and applying along product value chains (UNEP, 2012). Cleaner production is a sign of more efficient production; which in turn is more innovative and competitive, and in principle more economically superior (Schaltegger *et al.*, 2008). By implementing sustainability measures like cleaner production, the manufacturing sector can boost economic and environmental performance through reduction of emissions, integration of by-products into the production value chain, substantial returns of investment and positive implications for jobs through opportunities in secondary production (UNEP, 2012). Implementation of cleaner production strategies aim at increasing competitiveness and efficiency of firms as they assist in energy saving, water conservation, pollution control, safety of machines and workers and also enhances the image of the firm in both national and international arenas (GoK, 2010).

Various studies have recommended CP practices in manufacturing/processing activities. Bach and Gheewala (2010), did a study at a coal preparation facility in Vietnam where they noted various

problems like old technology, management of environmental issues, coal slurry (4.5 m ton/year), high amounts of solid waste (6 m ton per year) and fresh water consumption. They suggested CP options to address issues of run of mine coal treatment, storm water, dust treatment and improving quality of fine coal product. CP techniques suggested were: improving process control, recycling, process modification, input substitution, redesigning technology and product modification but noted that not all techniques are applicable in every case. Mwithalii (2009) studied the role of cleaner production in enhancing water use efficiency of two manufacturing firms in Kasarani, Nairobi: Central Glass Industries and East African Breweries Ltd. He observed that annual water use declined in Central Glass Industries between 2004-2007 and noted practices such as re-using water at the cullet and sand plants and the use of closed system cooling as contributing factors. In East African Breweries Limited, he noted the re-use of hot condensed steam as one of the practices behind reduction in energy needs in the brewing process by 30%. In both industries, there was re-using and recycling thus saving the use of fresh natural resources. M'ribu (2006) studied waste management approaches in small-holder tea processing factories in Kenya and observed that although factories largely managed their wastes sustainably, there was no comprehensive and uniform approach to waste management. He therefore recommended CP strategy adoption in waste management with a view to having tea processing procedures that are environmentally friendly. Ondieki (2013) assessed the adoption and level of implementation of CP by star-rated hotels in Nairobi County. He studied efforts to deal with energy conservation, solid waste management and OHS measures and noted that some of the leading benefits of CP to the hotel industry are: enhanced compliance to environmental safety, enhanced safety and health for staff, reduced operating, waste collection and disposal, energy, water and food preparation costs. Environmental programs have also proved to be an effective means of generating enthusiasm and motivating staff to work as a team. Ondieki noted that incorporation of CP practices leads to greater employee involvement in, and commitment to, the production process which often leads to higher quality products. UNEP established CP in order to promote changes that will help achieve sustainable development. Cleaner production in enterprises results in sustainable development by addressing three sustainability dimensions: Production efficiency through improved use of natural resources; Environmental Management through minimization of impacts on nature; and Human Development through reduction of risks to people and communities (UNIDO/UNEP, 2010)

2.1 Theoretical Framework

2.1.1 The Triple Bottom Line Model

This study was based on the Triple Bottom Line (TBL) model. TBL is an accounting framework that incorporates three dimensions of performance; social, environmental and financial (Furnish *et al.*, 2013). The concept originated from a business and corporate setting. It was coined by John Elkington in 1994 who felt that it had become increasingly clear that business must play a central role in achieving SD goals, that is, companies needed to become more responsive to what he saw as competitive and strategic challenges of growing concern over environmental and social justice by consumers. TBL concept of sustainability is a premise that growth and development should take economic, social and environmental impacts into consideration. TBL of sustainability calls for a balance between the three aspects (Thatcher, 2014). Its dimensions are also called the 3P's: People, Planet and Profits. It differs from traditional reporting frameworks, which measure profits; return on investment and shareholder value, in that it includes ecological and social measures. However, these measures can be difficult to assign appropriate means of measurement (Slaper & Hall, 2011). This means that measuring the degree to which an organization is being sustainable or is pursuing sustainable growth can be difficult.

According to Furnish *et al.* (2013), prominence of the TBL concept of sustainability in international development efforts has been noted in the Brundtland Report of 1987, Our Common Future, as well as the UN's Agenda 21. The World Commission on Environment and Development (WCED) report strongly argued that a single focus on environmental issues would be a 'grave mistake' and that the environment does not exist separately from human actions and needs; it's inseparable from development and poverty alleviation. The Agenda 21 is an international framework for sustainable development that offers a practical approach for the three levels. The 27 principles underlying it promote the centrality of social equity and environmental protection to development for current and future generations.

TBL and its core value of sustainability have become compelling in the business world due to evidence of greater long-term profitability (Slaper & Hall, 2011). For example, reducing waste from packaging can reduce costs. In addition, the role of community involvement is a necessary component of TBL and SD strategies should favor shared responsibilities which involve bottom-up rather than top-down approaches (Furnish *et al.*, 2013). This is particularly important in

implementation of CP which becomes successful when a committed top management of an organization involves the workers in decision making. UNIDO based its corporate social responsibility programme on the TBL approach which is used as framework for measuring and reporting corporate performance against economic, social and environmental performance. According to UNIDO (2015), TBL approach has proven to be as successful tool for SMEs in developing countries to assist them in meeting social and environmental standards without compromising their competitiveness. It's an attempt to align enterprises to the goal of sustainable global development by providing them with a more comprehensive set of working objectives than just profit alone.

3. Methodology

The study adopted a descriptive survey research design; its purpose is to depict an accurate representation of individuals, events or situations (Robson, 2002). The researcher aimed to provide a description for issues in CP adoption and characteristics of particular industries especially those related to production processes. The study population consisted of 15 manufacturing industries in Nairobi that have already implemented CP and have been working with Kenya National Cleaner Production Center. This is according to a list obtained from the center, in January 2015, of all companies they have been working with countrywide whereby the researcher selected the manufacturing industries in Nairobi. The industries fall in processing, paper conversion, chemicals, tanning, plastics and rubber sub-sectors. The researcher conducted a census whereby the entire population was used for the study due to its small size hence no sampling was done.

Data was collected from both primary and secondary sources. Primary data was obtained using questionnaires which were administered to respondents who had complete understanding of the industrial operations. Questionnaires were used to extract information from technical officers, operations managers or HR representatives in the respective industries. Each industry to be studied had one questionnaire to fill; therefore the researcher had fifteen questionnaires to be administered. Descriptive statistics like percentages were used to analyze and make meaning out of the data. Bar graphs and pie-charts were then used to present the data.

4. Results and Discussion

CP implementation had had a very high impact on 70% on the industries as far as energy conservation is concerned; 10% had realised a high impact while 20% had experienced a moderate

impact on energy conservation. Regarding energy consumption, 100% of the industries are connected to the national grid and utilize energy from Kenya Power and Lighting Company; 90% of them also have diesel generators while only 20% utilized solar power as an energy source. However, 90% of the industries reported to have experienced considerable energy savings since CP adoption. Only 10% had realized increased energy consumption accompanied by increased costs. The industries had adopted various energy conservation measures: 20% of the industries use recycled water as a way of conserving energy; 30% of the industries ensure that their staff is well sensitized on proper usage of energy; 40% of the industries have adopted efficient energy conservation machinery and energy saving bulbs; while 10% have adopted metering of the energy flow system in order to track the production output.

CP had a very high impact on 60% of the industries, a high impact on 20% and a moderate impact on 20% of the industries in terms of water conservation. The researcher sought to find out about the water consumption trends since the Industry adopted CP. Regarding this, 30% of the industries had no noticeable change, 50% of the industries had noted a reduction in consumption, 10% of the industries had maintained controlled consumption through record keeping and another 10% had noted minimized water wastage (Fig. 1)

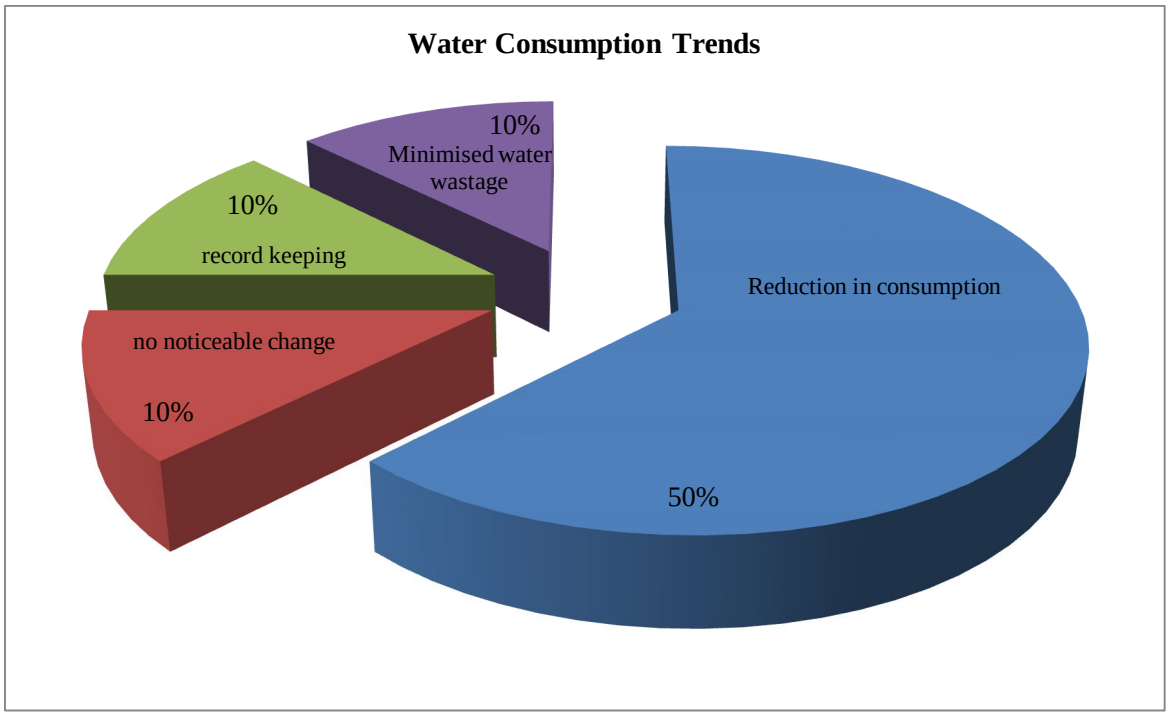

Fig. 1: Water consumption trends since adoption of CP

Majority of the industries use piped water for their day to day industrial activities (90%); 70% of them reported to utilize borehole water while only 10% harvest rainwater for industrial use. However, the industries had adopted various water conservation measures; 40% of the industries treat their waste water through an effluent treatment plant, 20% recycled their waste water, 10% conducted daily checks for leakages, 20% have avoided wastage in their usage of water while 10% reported to have improved on their water storage (Fig. 2).

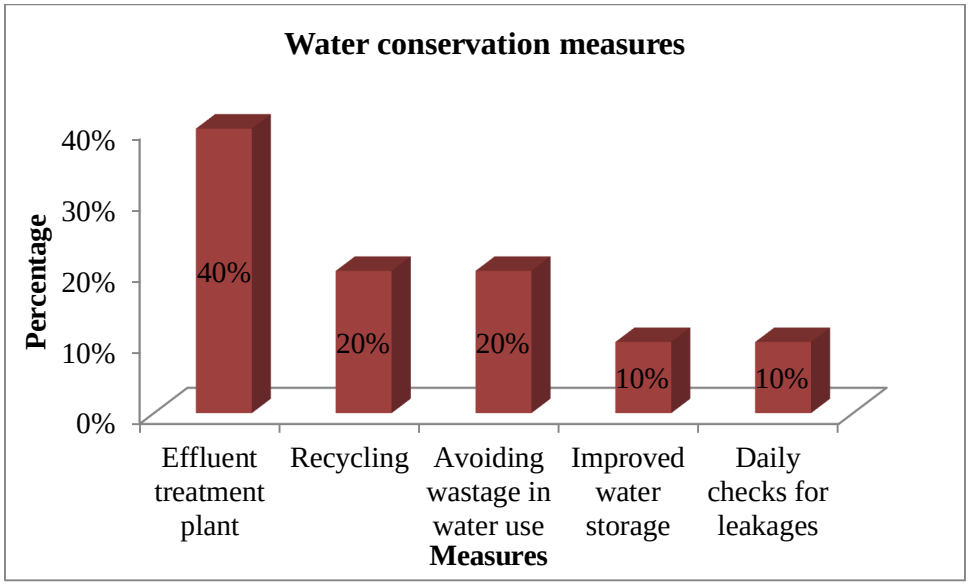

Fig. 2: Water conservation measures in the industries

Green product design had not been adopted in 40% of the industries since CP adoption; it had a low impact on 20% of the industries and a high impact on 40% of them. A small proportion of the industries (10%) had not experienced increased costs of purchasing environmentally friendly materials and equipment; 40% felt a low impact while 30% and 20% felt moderate and high impacts respectively. Few of the industries (10%) had not experienced increased investments while 30%, 20% and 40% reported to have experienced low, moderate and high impacts on the same respectively. A big percentage (80%) of the industries studied had realized increased profitability in relation to competitors to a high extent; but 10% of them had not experienced this at all while 10% had experienced a moderate impact.

Other impacts together with the percentage of industries in which they were realised included: reduced cost of raw materials (30%), reduced Occupational Safety expenses (80%), improved corporate image (40%), reduced costs of waste discharge (60%), reduced environmental accidents

(70%) and improved staff morale (50%). In addition, 40% of the industries had experienced improved external markets for products, 60% production efficiency gains and 30% improved quality of products. None of the industries surveyed reported to have experienced reduced penalty fee from NEMA; this might be attributed to the fact that cases of industries been subjected to penalties by the authority due to environmental pollution are rare and almost non-existent in the country.

Various studies have established the above impacts from CP implementation. For example, a study done by GDRC (2015) on a Lead Acid battery manufacturer in Tunisia who had implemented P2 options revealed benefits such as reduction of the costs of treating chemicals (by 33%), improved employee health, reduction in energy and water consumption, improvement of waste water quality and less lead was required in the process. Mwithalii (2009) in his study on EABL noted that the industry had experienced reduction in energy needs as a result of CP practices like recycling and reusing and process modification in terms of the use of hot condensed steam. Similar results on energy reduction were also noted by GDRC (2015) and Ondieki (2013). Bach and Gheewala (2010) in a study on a coal preparation facility in Vietnam noted problems in management of environmental issues and high amounts of solid waste and suggested CP practices as a solution. Thus CP implementation is meant to be a solution to environmental problems and should result in reduction of pollution.

5. Conclusions and policy recommendations

Cleaner production resulted in a number of positive impacts in the studied industries. Impacts that were experienced by over 40% of the industries included: reduced costs of raw materials, occupational safety expenses, energy consumption and waste discharge; improved corporate image and staff morale; reduced environmental accidents; production efficiency gains and improved quality of products. It was also noted that only 10% of the industries utilize rainwater in their day to day operations through harvesting. However, 70% of the industries had noted positive changes in water consumption trends since CP adoption. The major water conservation measures included effluent treatment plants (in 40% of the industries) and water recycling (20%). As far as energy consumption was concerned, only 20% utilized solar energy. However, all industries had adopted various energy conservation measures.

The fact that there is no CP policy in Kenya is a matter of concern and is an issue of significance according to this study. CP need not be a voluntary procedure in the country for maximum realization of positive social, economic and environmental impacts. There needs to be some rule guiding all manufacturing industries regarding this issue as adopted in China in the year 2003. KNCPC should partner with organizations such as UNEP, ADB, World Bank, etc, to source funding, technology and human capital required so that their operations can reach out to a higher number of industries bearing the fact that the researcher only had 15 manufacturing industries only that have worked with KNCPC in the whole of Nairobi region. In addition to this, the government needs to see to it that industries have been provided with the right incentives they need in order to comfortably adopt and implement CP processes. Majority of the industries pointed out lack of government incentives as a major challenge. The policy makers should collaborate with the Kenya Association of Manufacturers (KAM) because this body is in the best position to influence policy making on behalf of the industries. KAM should also find ways of influencing its members to adopt clean energy such as solar energy and also alternative sources of water like rainwater harvesting which this study found missing in most of the industries.

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