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AN ANALYSIS OF BARRIERS OF MINIMIZING CARBON FOOTPRINT IN SMALL AND MEDIUM SCALE RUBBER ENTERPRISES IN WESTERN PROVINCE IN SRI LANKA

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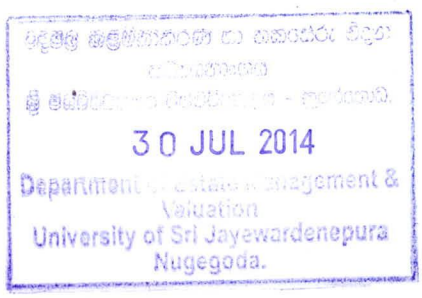

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Student's Declaration

The work described in this dissertation was carried out under the supervision of Professor Kennedy D. Gunawardana and any report on this has not been submitted in whole or in part to any university or any other institute for another degree /examination or any other purpose.

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Supervisor's Declaration

Hereby, I certify that Mr. Sampath Prasanna Dayaratne (Registration No: 5501/FM2010/0007) duly completed the research titled "An Analysis of Barriers of Minimizing Carbon Footprint in Small and Medium Scale Rubber Enterprises in Western Province In Sri Lanka" under my supervision and recommend to submit for the evaluation. Also it is declared that, this final report has been completed according to the instructions and suggestions made by the board of examiners.

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Abbreviation

ACF	Australian Conservation Foundation
ANOVA	Analysis of Variance
APO	Asian Productivity Organization
CDM	Clean Development Mechanism
CFP	Carbon Footprint of a Product
CH_4	Methane
CO_2	Carbon dioxide
CEB	Ceylon Electricity Board
CER	Certified Emissions Reductions
CFL	Compact Fluorescent Lamps
CE	Clean energy
CERES	Coalition for Environmentally Responsible Economies
CIMA	Chartered Institute of Management Accountants
COP	Conference of Parties
CP	Cleaner production
CREP	Charter on Corporate Responsibility for Environmental Protection
CSR	Corporate social responsibility
DfE	Design for environment
EC	European Commission
E^3ST	Energy Efficiency and Environmental Sound Technology
EMS	Environmental Management Systems
EU	European Union
GEF	Global Environmental Facility
GRI	Global Reporting Initiative
GRP	Glass reinforced plastic
GHG	Green House Gas
GSCM	Green supply chain management
GWP	Global Warming Potential
HFCs	Hydro fluorocarbons
HSBC	Hong Kong and Shanghai Banking Corporation
ILO	International Labour Organization
IPCC	Intergovernmental Panel on Climate Change
IPP	Integrated Product Policies

Abstract

Rapid advances in science and technology in the 21st century has strengthened the Small and Medium Scale Enterprises (SMEs) to exert themselves as engines in economy. In the sphere of production as well as increase of production and competition in the market, this situation is augmented as a result of consumer demand. Its impact is such that we discern a rapid increase of population, urbanization, social mobility and transition with vigorous competition. Looking at opportunities to maximize production to satisfy customer needs, SMEs do not consider the factors that affect environment during manufacturing, selling and distribution and consumption stages. Considering the magnitude of the excessive toxic effect on the bio-sphere and in order to protect the natural environment for the sustenance and conservation of organisms, it is imperative for all the parties concerned to take up responsibility to include carbon footprint mitigating measures during industrial processes. Available literature revealed that different types of systems have been set up to minimize carbon footprint by the industry at both national and international levels, but still there are issues on identifying carbon footprint emission levels along with implementation systems/methodologies introduced. Researcher identified energy consumption being largely associated at the rubber mills and emissions are extraordinarily connected to productivity of kW/H of energy consumption. In order to carry out research goal of challenges and barriers in implementing energy-efficient carbon footprint minimization measures, responses to one hundred questionnaires were collected from rubber product manufacturing SMEs registered under the Ministry of Industry and Commerce, Sri Lanka. Twenty five unstructured interviews were conducted with relevant professionals in order to ascertain their opinion. There are vital findings in this research. In order to identify the CO_2 emission level, the researcher examined the calculation model developed from the results to quantify carbon emission level from three selected rubber-band manufacturing factories as case-studies. Case-studies revealed the overall emissions from the production of rubber band amounting to 1.16, 1.53 and 1.23 ton CO_2-eq per ton of product respectively. Mainly the there is a difference among the enterprise owners attitude towards minimizing energy efficient carbon footprint effects which will phase-in obliging emphasis on policy makers to rethink their planning. This was proved by using the fishbone model. Major challenges and barriers were identified by using content analysis of respondents. The calculation model identified can be used to quantify the carbon emission level. These findings could directly benefit any country where rubber production is being put into practice; in order to identify factors that would minimize global warming potentials of rubber manufacturing SMEs, by the application of cleaner manufacturing model to achieve sustainable production.

Key words: Energy-efficient Carbon Footprint Minimizing, Global Warming Potentials, Small and Medium Scale Enterprises, Sri Lankan Rubber Industry

CHAPTER ONE

1. INTRODUCTION

The scientists have identified the increasing climate change impacts and in 1990 World Meteorological Organization (WMO) and United Nations Environmental Program (UNEP) formed Intergovernmental Panel on Climate Change (IPCC) to identify further issues and increase awareness. This organization includes 4000 scientists and they publish reports on global warming.

Attitudes of the people changed after the Earth Summit held in Rio de Janeiro in 1992, all the countries have met and understood the common need of the world and then set up United Nations Framework Convention on Climate Change (UNFCCC) with a vision to control Greenhouse Gas (GHG) in the atmosphere.

GHG emissions mainly consist of Carbon Dioxide (CO_2), Methane (CH_4), Nitrous Oxide (N_2O), hydro and per fluorocarbons (HFCs, PFCs) and Sulphur Hexafluoride (SF_6) emissions from manufacturing process reactions, distributions and treatment processes (Verfaillie and Bidwell, 2000). Approximately eight billion tons per year of carbon in the form of carbon dioxide are emitted globally through the burning of fossil fuels for transportation, heat and electricity worldwide. This is about five billion tons more than the absorptive capacity of the biosphere (IPCC, 2007; Senge, 2008 cited by Shi et.al, 2012; Röös et.al, 2012).

Main effect of greenhouse gases is the global warming. The climate change issue related to increasing concentrations of GHG is a global concern (Verfaillie and Bidwell, 2000 cited by Shi et.al 2012). According to Hraskey (2012), footprint-related disclosure rates are increasing and disclosure is being signaled more prominently. However, while carbon-intensive sectors appear to be pursuing a moral legitimating strategy underpinned by substantive action, the less intensive sectors are relying more heavily on symbolic disclosure. In order to minimize the carbon footprint, the definition of the cleaner production (CP) model introduced by the United Nations Environment Programme (UNEP) is given as follows.

> *"Cleaner Production is the continuous application of an integrated preventive environmental strategy to processes, products, and services to increase overall efficiency, and reduce risks to humans and the environment".*

Also, Fore and Mbohwa, (2010) stated as follows,

> *"Cleaner production (CP) is useful in addressing pollution during industrial production"*

For example, it was noted that the combination of environmental and economic pressures has led firms in Naroda Industrial Estate, India to make process improvements so as to increase their resource efficiency and hence their profitability. They have achieved this mainly through a cleaner production approach that has helped them to enhance individual environmental performance too (Visvanathan and Tenzin, 2006). Environmental friendly manufacturing costs are associated with capital expenditure for implementing cleaner production (Senge, 2008). Companies can burn millions of dollars on pollution control equipments which consume managerial time and fines for mismanagement of environmental issues. Instead if firms adopted waste management will benefit from financial savings in the long run (Esty and Winston, 2009 cited by Shi et.al, 2012).

According to Thiruchelvam et.al, (2003), in comparison with service industries, manufacturing industries generate obvious environmental impact resulting from the nature of their operations (Wee and Quazi, 2005; Chang, 2008 cited by Jalaludin et.al, 2011). There were several efforts were taken towards identifying barriers in implementing of reduction measures of carbon footprint in SME. The establishment of National Cleaner Production center (NCPC) is one of the examples that we can observe in Sri Lanka. The organizations project themselves, using self-congratulatory rhetoric, as green, sustainable, and socially responsible yet continue to operate as per usual (Warren-Myers, 2012). Cleaner Production (CP) is useful in addressing pollution during industrial production. CP is not against industrial development and expansion, but emphasizes that development and expansion be sustainable.

To reduce carbon emission, legal binding of countries was advocated through the establishment of Conference of Parties (CoP) of UNFCCC in 1997 and established the Kyoto Protocol which phased out in 2012. Agreement was, countries combining to reduce the GHG by 5.2 percent from 1990 level during 2008-2012 periods. In the agreement they have three mechanisms established. Those were: Emission Trading, Joint Implementation and Clean Development Mechanism. Clean Development Mechanism (CDM) was divided in to two sub section in sequence (i) first and second are limited to industrialized countries (ii) introduce projects in developing countries to introduce sustainable development.

Further setting up of The GHG Protocol which is a multi-stakeholder partnership of businesses, non-governmental organizations (NGOs), governments, and others convened by the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD) also has taken place as a result of the increasing GHG emissions. This was launched in 1998; the mission of the GHG Protocol is to develop internationally accepted GHG accounting and reporting standards and tools, and to promote their adoption in order to achieve a low emissions economy worldwide. For business entities, it has placed GHG Protocol Corporate Accounting and Reporting Standard (2004): A standardized methodology for companies to quantify and report their corporate GHG emissions which also referred to as the Corporate Standard and GHG Protocol Corporate Value Chain (Scope 3) Accounting and Reporting Standard (2011): A standardized methodology for companies to quantify and report their corporate value chain (scope 3) GHG emissions, to be used in conjunction with the Corporate Standard which also referred to as the Scope 3 Standard (www.ghgprotocol.org accessed on 27 March, 2013).

Also setting up of GHG protocol, product life cycle accounting and reporting standard which provides, the GHG protocol product life cycle accounting and reporting standard (referred to as the Product Standard) provides requirements and guidance for companies and other organizations to quantify and publicly report an inventory of GHG emissions and removals associated with a specific product. The primary goal of this standard is to provide a general framework for companies to make informed choices to reduce greenhouse gas emissions from the products (goods or services)