

An Analysis of Industrial Sector Greenhouse Gas Effects towards Sustainable Economic Development by Enhancing Organic Rubber Cultivation in Sri-Lanka

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Abstract. This paper focuses on the Sri Lankan rubber manufacturing & plantation sector in reviewing its influence towards the decrease of CO₂. The objective of this study is to initiate a new strategy - “Agro-Industrial Revolution” through which the Sri Lankan apparel sector merges with Rubber sector to negate the effects of emissions originated from apparel industry. The ultimate objective of this study is to review the Apparel sector organizations in Sri Lanka to determine the extent of fossil fuel burning and pragmatic carbon offsetting steps. Rubber falls under “Cash crop-forest cover” category contributing directly to reducing CO₂. Therefore encouraging Sri Lanka’s biggest export earner, apparel industry, to utilize our own agri - base of rubber to reduce global warming can be a “win- win” situation, enhancing economic benefits to Sri Lanka in the process of reducing global warming. Such a strategic decision truly creates a Revolution by more smallholder land owners wanting to grow rubber and rubber product manufacturers increasing exports. This truly is sustainable development. Currently there are around 270 apparel factories in Sri Lanka and 50 apparel companies were selected for the present study.

Keywords: Global warming, Carbon off setting, fossil fuel, Agro industrial revolution

1. Introduction

After 1777 there was a new era, we called as Industrial revolution. More than 100 years ago, people around the world burnt large amounts of coal, oil, and natural gas to power homes, factories, and vehicles. Today the world relies on fossil fuels for energy needs. Burning fossil fuels releases carbon dioxide, a heat-trapping gas, into the atmosphere, which is the main reason for climate change. If climate change happens naturally why isn’t the current global warming considered as a natural cycle? Heat-trapping gases are also called greenhouse gases. They exist naturally in the atmosphere, where they help keep the Earth warm enough for plants and animals to live. But the concern is that people are adding extra greenhouse gases to the atmosphere. These extra gases are causing the Earth to get warmer and warmer. This is not a natural warming; we can call it a man-made climate change. We made it and therefore we are all responsible for finding solutions. If we stop all greenhouse gas emissions, will global climate change stop? No, Sorry for the future generations. Industrial activity has already pumped billions of tons of greenhouse gases into the atmosphere, and we have yet to see the full effect of warming from those gases. If all human greenhouse gas emissions stopped tomorrow, the Earth would still warm for at least a half-century. Now also we are experiencing the bad effect of man- made climate change. Researcher strongly believes that the whole world will change to a new era by 2100 which will be the Global climate revolution. After 200 years from industrial revolution bad effects of climate change is already been experienced and one does not have to wait for another 200 years for the revolution as it is all happening so fast. World consist not only humans. There are millions of living specie our responsibility is to protect them all now and the future generations, without waiting for the global climate revolution to happen. Global Agro Industrial Revolution is a good strategy to

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explore, a new thinking, as a solution without compromising valuable agricultural exports to industrial exports. If every industry sector organization can support and go hand in hand with an agricultural cash crop like rubber it will offset the ill effects generated by industry. Such synergy between the two sectors can be considered as true Green initiative in enhancing human ecological sustainable development in the world. Businesses are always under competitive pressure catering to a changing market place. The market is global thus competition is also global. In present day manufacturing context where all businesses are facing equal competition only the most efficient will survive. It is encouraging to note that, today most businesses have begun to focus their attention on Global warming, climate change and energy consumption because these are the focal points in ecologically sustainable businesses. In early years of human existence there has always been a strong bond between human life and earth and its environs. With the industrial revolution this balance of mankind and environment started to crack showing disrespect to long term damage caused by our own selfish acts. Sri Lanka being predominantly an agriculture based country has three traditional cash crops in Tea, Rubber & Coconut. With increasing population their needs and wants incrementally rises and rubber industry will play a big role in future not as a source of food but by facilitating transport, health related and house hold items. In the future whole world depend on the speed of moving towards economic development. Transportation is a key factor for future development and therefore encouraging rubber as a cash crop derives economic benefits whilst helping to reduce global warming

Organically derived Natural Latex is a unique gift from Mother Nature, harvested entirely by hand. The liquid material is tapped and collected as an environmental friendly raw material. Organic rubber plantation also directly contributes to emission reductions as it emits less N₂O from nitrogen application less N₂O and CH₄ from biomass waste burning and requires less energy, mainly due to zero chemical fertilizer use. For the last four years Latex Green has been seeking to take the leadership position in discussing green as that term applies to organic rubber latex mattresses and bedding component. The Sri-Lanka based company has leveraged its direct link to rubber tree plantation and the company's expertise in latex rubber Research and Development embarked upon a mission to introduce the world's first certified latex sleep products as a solution to emission reduction. Latex Green introduced the world's first bedding products to the US market by greening the entire global bedding market. The company has been working together for many years to promote naturally-grown raw materials in an environment-friendly way. This also entailed converting existing soil into a living organism which could bring forth plants without any artificial fertilizers. These types of eco-friendly yet economically viable, sustainable projects have to be encouraged as a solution to current global warming issue. The project aims at utilizing the land in an environment-friendly and economical way. Free land-to-rubber plantation conversion is an important land-use change in the world, for which the impacts on soil carbon stocks have hardly been studied. Deforestation and forest degradation in the tropics have been estimated to contribute 12–15% of the global anthropogenic CO₂ emissions [1]. The majority of land-use induced CO₂ emissions arise from the loss of above-ground biomass and to a lesser extent from decomposition of soil organic carbon [2], [3]. For over a decade, evidence has been growing that accumulation of greenhouse gases in the upper atmosphere is leading to changes in climate, particularly in temperature. The average global surface temperature increased by 0.6 ± 0.20 C° over the 20th century and is projected to rise by $0.3 - 2.50$ C° in the next 50 years and $1.4 - 5.80$ C° in the next century Rubber tree crops, as in the case of forest trees are known to function as natural Sponges for absorbing carbon dioxide from the atmosphere. Carbon sequestration is achieved through the uptake of carbon dioxide from the atmosphere and its conversion into cellulose and organic matter. The rubber tree *Hevea Brasiliensis* was first introduced as a crop for plantation agriculture many years ago from the wilderness of the Amazon Jungles. Hence, one can expect *Hevea* to behave as a typical tropical rain forest tree that would at least function as efficient as forest trees in C sequestration. Slow down soil C oxidation and Increase C fixation and storage. Such strategies include improved soil and water conservation practices such as leguminous cover cropping, application of organic manure, which helped in the increased enrichment of soil organic C by about 30 to 50% from about 1.9% C to 2.39% C in the lower depth of soils and 2.9 % C in the top soil. A large number of studies exist on the impact of tropical land-use changes on soil carbon stocks, especially on the conversion from forest to pasture, pasture to secondary forest, and forest to cropland [4]. Our present study focuses on the land-use change from free lands to rubber plantations in Sri-Lanka as an Organic crop to promote naturally grown raw

material in an environmentally friendly way. Carbon sequestrations from rubber leaves 95%, carbon sequestration from rubber trunk 2% and roots also 2% and there are many significant environmental credits of NR such as ability to lock carbon both in biomass and rubber and functioning as self-sustaining ecosystem, annual leaf fall, branches, fruits, twigs, root hairs. Its main potential lies in its significant capacity to sequester CO₂ in soils, and in its synergies between mitigation and adaptation. This potential is best utilized employing sustainable agricultural practices. 'Green credentials' for natural rubber over its synthetic rivals. Some may be confused it has some hidden energy in transportation and other processing stages. But the reality is in solar power other than fossil fuel burning. When comparing Material Energy consumption, GJ/tonne, Natural rubber 16, Polychloroprene 120, SBR 130 Polybutadiene 108, EPDM 142, Polyurethane 174, Butyl rubber 174, Polypropylene 110. The data indicate the amount of energy required for manufacturing of raw natural versus Synthetic latex. It is happy to say that natural rubber enjoys a very considerable competitive edge in energy terms as compared with synthetics. Very thin rubber products, such as balloons and condoms, and open cells structured natural foam products will degrade naturally especially if they are subjected to natural sunlight. Natural rubber products show the bio-degradability under the natural conditions. Like other green plants, *Hevea brasiliensis* is carbon sink by virtue of the process of photosynthesis. The rate of photosynthesis differs between clones. It would appear that a rubber plantation is almost as effective during photosynthesis as a virgin forest in consuming the products of fossil fuel burning, as well as producing life sustaining oxygen. Understanding of global warming and corporate sector -attitude towards offsetting through Sustainable economic development is essential for a business to predict the future of the Organization. Today the pressure to -reduce energy consumption will come from the twin drivers of reducing fossil fuel burn that helps to reduce carbon emission and also to be cost competitiveness. Global warming has become familiar to many people as one of the most important environmental issues of our times. The accumulation of carbon emission in the environment is recognized as a major contributor to the problem of Global warming caused by greenhouse gas effect. Adaptation of green management practices and carbon initiatives required for off-setting as part of an Organization policy that helps to develop major strategies is likely to carry on well into the 21st century. The objective of this study is to answer the following Questions, what is the corporate sector awareness towards energy reduction for minimizing fossil fuel burning? , Researcher selected Apparel sector to find answers to the question because Apparel Organization covers the half of the Industrial exports of Sri Lanka and the most energy intensive sector. By now it should be clear that our environment is becoming ever less capable of sustaining the growing impact of our economic activities.

2. Literature Review

Improved estimates of the effects of these important land-use changes on soil carbon stocks are essential to the national Greenhouse gas inventories from the Conference of Parties of the United Nations Framework of Climate Change. Although the Intergovernmental Panel on Climate Change (IPCC) provides guidelines for the estimations of the ecosystem carbon fluxes arising from land-use changes, the IPCC tier 1 method assumes soil carbon changes to be zero for the conversion from forests to rubber plantations because of limited scientific knowledge [5], [6]. Two out of the three studies focused on the conversion from primary forests to rubber plantations in Brazil [7], [8] and both reported declines in the soil carbon stocks in 17- and 22-year-old plantations. Whereas in another review 0–30% decrease in soil carbon stocks were reported for intensified rubber plantations compared to Sweden fields in Southeast Asia [9].

3. Methodology

A comprehensive literature review was carried to identify the factors that have given prominence for carbon emission. Detailed discussions and interviews were carried out with the experts in the industry to gather their views to identify and verify the factors identified. In the first step, questionnaires, interviews, emails, observational studies and literature were used as data sources. Questionnaires were filled by executives, managers and directors of apparel industries who were responsible for sustainability development projects and environmental related activities of their respective organizations. The feedback on the questionnaires was obtained through email or by visiting the company. The interviews were conducted when

the companies were visited and sometimes there were possibilities for observational study as well. The results from this methodology of study helped to gain an overall understanding about carbon emission and carbon off setting activities of the apparel industry. Currently there are around 270 apparel factories in Sri Lanka Therefore there is no reliable evidence on the current population size of the apparel factories in Sri Lanka. Among the ones in operation a sample of 50 apparel companies was selected representing various types of garments being manufactured and in different geographical areas. Collections of returns were completed in June 2013. Total 50 questioners were distributed among each industry out of which 40 valid questionnaires were returned.

4. Result and Discussion

In this Analysis a total of 40 usable samples were obtained. This sample consists of Extra Large, Large and Medium size Organizations with mix of Combination. This implies that the respondents represent the whole view of Apparel sector. Return from the research reveal that in Table 1 is arranged according to the Mean values from maxim to minimum questions asked on the subject of cooperate sector burning fossil fuels towards greenhouse emission. According to that arrangement, it clearly mentions that one factor which is Mean 4.6, Question was *Do you believe that Apparel Industry will face a “big challenge in future” due to carbon emission originating from the industry?* That’s indicate all respondents fluctuate closed to strongly agreed levels. Standard deviation of 0.632 is also clearly explained that all respondents’ ideas fluctuate within very close tolerance. According to above figure, that’s indicate that All

Table 1: Descriptive data analysis for Fossil Fuel burning

	N	Min	Max	Mean	Std.	
Electricity usage directly effects	40	1	5	4.20	1.067	3
Big challenge in the Future	40	3	5	4.60	.632	1
Initial cost converting existing to alternative	40	1	5	2.18	1.083	6
Cost Saving	40	1	5	3.10	1.257	5
Future sustainable practices	40	1	5	4.08	.944	4
Definite standard for emission reduction	40	1	5	4.23	1.165	2
Valid N (list wise)	40					

respondents attitudes towards “Big challenge” is a positive one, that’s mean all agreed Impact of Greenhouse gas emission will be a big problem in future. The second highest mean is 4.23 which indicate that, *is it better if a “Definite Standard” for emission reduction can be develop in the future for the Apparel industry?* Which also foaling within the Agreed and strongly agreed level. Stranded deviation 1.165 is also clearly explained that all respondents’ ideas fluctuate within close tolerance. Third highest is 4.20, it comes under the question of, *Do you strongly believe that electricity usage directly effect to the greenhouse gas emission?* This is foaling within the Agreed and strongly agreed level. Stranded deviation 1.067 is also clearly explained that all respondents’ ideas fluctuate within very close tolerance. The fourth highest mean is 4.08; the question related to that is, *do you believe that future sustainable practices should have to be initiated on emission reduction?* Which also fluctuating within the Agreed and strongly agreed level. Standard deviation 0.994 also clear that, all respondents are varies among narrow limits. With considering to above mention three questions, we can conclude that every leader in Apparel industry strongly believe that, greenhouse gas effect is big challenge for the industry due to High amount of Energy usage and All expecting for definite standard to control this issue in near future through sustainable economic developments. The fifth highest mean is “ Cost saving”, The question asked was *Do you believe that saving energy is one of our sustainability initiative, but the reality behind that is cost saving?*. This is foaling within the range of neutral. It is clear that All organizations focus to direction. Long term objective is cost saving, but ultimate objective may be cost saving. The sixth mean is 2.18, it can categorized under strongly disagree to disagree level. The asked Question was *“Do you not have any interest to convert present energy to alternative because initial investment is too high?* Standard deviation also cleared that all comments are falling in a narrow limits. The last two factors cleared that Apparel industry leaders like to go with new strategies and alternative souses instead of traditional fossil fuel burning. Further *F*-test revealed a significant effect of group, $F(8, 31) = 2.284, p = 0.047$ and it shows significant relation between fossil fuel burning and greenhouse gas emission.

5. Conclusion and Recommendations

Apparel sector depend heavily on imported raw material and the chances of it changing to more local material use is unlikely. Therefore supporting rubber plantation that provides rubber product manufacturers over 90% of its raw material usage will compensate apparel sector over dependence on imported raw material. Rubber other than being an eco-friendly plantation also plays a major role in the social structure of the country in numerous ways. Therefore any positive involvement with it can easily be a true CSR activity. Due to the pleasant & pleasing nature of plantations it creates a positive mind set in the apparel sector managers of “want to do” commitment. Apparel sector possesses high caliber professionals and their involvement in rubber plantations will certainly help add value to the plantations that otherwise find hard to draw such professional input. Apparel being the number one export revenue earner for the country joining with rubber that also earns considerable export revenue will stand to form a formidable economic bond for Sri Lanka. The present trend in apparel factories is to *go green* starting from the location of the factory.

As all facilities and infra-structure is already available within the country this amalgamation of these two valuable industries must be initiated as priority. Apparel sector must be given the liberty to pick and choose its plantation partners as forcing them to work with large RPC’s (Regional Plantation Companies) may hinder the objectives due to reasons like, large work force of RPC’s, Gratuity and EPF liabilities of RPC.s etc. Government must consider incentives like Tax reductions, Scholarships’ for higher education and training to private sector employees not limiting such to only government institutes like RRI,CRI & TRI to apparel companies who contribute to reduce carbon emissions through this link.

5.1. Further studies

The researcher is indeed happy to have had that the opportunity to involve in this topic and believe that no other researchers have undertaken such a study previously. This paper is based on a research carried out research for the apparel sector Organization in Sri-Lanka. Researcher strongly believe that research dedicated to a particular sector shall encourage further researchers to carry out similar research for other important sectors in determining the impact of greenhouse gas emissions of their respective operations. Would also like to place on record that to derive the fullest benefit out of my research this study must be extended to cover the apparel sector organization in the whole of Asian region.

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