

## Analysis of Green Warehouse Practices in Sri Lanka

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**Abstract**—This research has been conducted to analyse the green warehouse practices in both public and private sectors in Sri Lanka. The study has been carried out based on research questions, where the main question could be presented as "What are the existing green warehouse practices in modern day warehouses in Sri Lanka", followed by a subsidiary question including, "The importance of those green applications to match with the international standards". Main objective of this research was, "to identify the prevailing green applications in Sri Lankan stores and thus to achieve other objectives which were identified as "to find the extent that each green practices are used in the both public and private logistics sectors" and "to categorize green warehouse practices according to the way of their practices" and yet "to make suggestions to each warehouses to improve their applications of green strategies to achieve the international standards or practices". Primary data was collected through a questionnaire survey targeting thousand two hundred responses from executive level members in selected companies fettered on stratified random sampling method and 83.3 percent of valid responses received including both thirty eight private organizations and two governmental organizations. The factor analysis of the research consists of frequency analysis, reliability test and KMO and Bartlett's test. Eleven factors have been identified as significant factors in analyses chapter and those were used to develop the factor model and hence to measure the validity. Conclusively it could be identified that, most of the private organizations are using both green energy systems and green waste water systems in their operations. Further they are practicing the green HR methods with green equipment practices. Also the green practices related to the areas of distribution, reverse logistics, purchasing, packing and wastage are highly practiced by the private sectors than the government sectors. The industry of Home appliance, Home care and Apparel in Sri Lanka are mostly practicing the green warehouse applications. Also when comparing them with the government sector, they do practice their warehouses' activities traditionally. Thus the government should motivate to accept the green practices to their warehouses.

**Keywords**— Green warehouse, Green applications, Warehouse

### I. INTRODUCTION

Warehouse and distribution strategies have been used by logistics sector in Sri Lanka to achieve smooth flow of supply chain. Those operational activities are negatively impact to the environment as it has been consumed energy and generated pollution in warehouse network. Practices of the green warehouse applications are pledged to reduce carbon emissions in warehouses' operational activities for better future prospects and it includes all warehouses' activities of forward and reverse flows of products, Information and services.

Global warming and environmental pollution are considered as the most top stories in present business sector. Also there is a growing trend in governments which implement regulations to consider about environmental protection. As a result of that, scientists and environmentalists have introduced go green concepts, in order to reduce both carbon footprint and greenhouse gas emission.

In identifying the value of the available natural resources with standing the stage of developing classification and prevailing environmental problems, this research has been carried out to analyse Green Warehouse Practices in Sri Lanka, in order to have an idea about the green warehouse practices and its level of usage in Sri Lanka. Thus the outcome of the research could be used develop the applications of green strategies and sustainable company value using a balance of economic and environmental efficiency. At the end it would be led to achieve long term sustainability in modern logistics industry.

#### A. Objectives of the Research

- To identify the prevailing green applications in Sri Lankan stores.
- To find the extent that each green practices are used in the both public and private logistics sector.

*B. Research Problems*

- What are the existing green warehouse practices in modern day warehouses in Sri Lanka?
- The importance of those green applications to match with the international standards.

*C. Significance of the Research*

This study would be significant in several ways namely, economically, socially, environmentally and practically.

Today with the growth of the logistics industry warehouse functions is also been expanded and has become complex more coit can be seen that the growth of logistics industry is increasing along with the increasing demand. With the implementations of green warehouse practices, the costs involved in warehouse operations can be reduced and ultimate which will lead to reduce the unit cost of a product. As a result of that companies are able to increase their profit margin which will finally affect the country's economic status by contributing to increase the Gross Domestic production. Therefore green warehouse practices will be economically significant to a country.

The economic significance should be subjected to the development of public transportation has a direct impact on macroeconomic level. Enhanced quality transport system and mobility it creates are linked to the level of output, employment, and the income of a country.

With the aid of the green warehouse practices; warehouse sustainability can be achieved. Three Rs, Reduce, Reuse and Recycle, the warehouse is the perfect place to start reducing, reusing and recycling. According to the general practices of green strategies are commonly applicable for almost all industries and it's not limited to the logistics industry. Thus green strategies will be socially significant to a country.

By implementing the environmentally friendly practices in the warehouse directly helps to minimize the carbon footprint percentage and wastage while minimizing the costs and increasing social responsibility. So this research is environmentally significant as it provides a general guidance towards the environmental pollution.

Further the significance of this study can be extended as significance for trade. Here the trade implies the imports, exports and domestic purchases and sellings. The logistics industries which are following green strategies can be gained additional benefits than the others leading them to be prominent in the industry. And this causes to attract more business-to-business customers creating more trade benefits. The application of green warehouse

and logistics strategies are considered as timely important area due to the prevailing environmental conditions. Therefore, the purpose of the research is to analyze the Green Warehouse practices by using both public and private sectors in Sri Lanka

## II. METHODOLOGY

*A. Data Collection*

Primary data collection for this research was done by using a structured questionnaire survey by sending the questionnaire to the professionals, those who engage with the warehouse operational activities in selected companies manually. The professionals were included the employees currently who work in warehouse related functions such as purchasing, manufacturing, storing, transporting and distribution for targeting thousand responses in selected companies of both public and private logistics sectors. The gathered data was collected from both Sri Lankan and multinational companies in logistics industry. - The research data were collected during eight weeks time period.

In sample selection process, the researcher has divided the business areas into several categories titled as pharmaceutical, food and beverage, home appliances, home care, personal care and apparel.

Population selected for this research was Western Province from which was fettered on stratified random sampling method as; the sample units are selected based on the easy accessibility and convenience with including both thirty eight private organizations and two governmental organizations.

*B. Variable for the Analysis*

The research questionnaire was enclosed with the two parts. The part A was contained with the demographic data such as the both business category and type of the company, practices of the environmental protection certificate, employment department, total number of workers in each departments and the years of experience in each business category.

Based on the literature review the following green warehouse practices were identified. Those are known as green purchasing, manufacturing, building, storing, transportation, packaging, distribution, energy practices, IT practices, equipment uses, reverse logistics plans, and also recycling with proper waste management. By focusing on the above areas part B of the questionnaire was designed.

In part B questions were designed based on the Likert scale including five scales as; No Practices, Planning to

practices, lower Practices, Medium Practices and Strong Practices.

*C. Data Analysis*

One thousand and two hundred questionnaires were distributed among the identified companies and out of that 83.3% of valid responses were received.

Analysis of the data is consisted of frequency analysis test [Hasking and Wallis (1955)], reliability statistics test with Cronbach’s alpha value [Lee Cronbach (1951)], Kaiser-Meyer-Olkin (KMO), Bartlett’s test [Snedecor and Conchran (1989)] and factor analysis.

Frequency analyses test is a form of basic analysis. It identifies the possible responses and percentages of respondents when a large number of response options are available.

Reliability test explains the Cronbach’s Alpha value was used to notify in the reliability statistics value (where  $0.8 \geq \alpha \geq 0.7$ ) of the Survey. Further it is indicated the correlation in between variables of the research paper.

KMO and Bartlett’s test is an essential requirement for the primary data as it is demonstrated the validity of the factor analyses where  $p < 0.05$ , which was used to develop the extraction the number of interpretable latent variables.

Rotated Components Matrix was used to identify the number of factor components and the idea of rotation is to reduce the number factors on which the variables under investigation have high loadings.

III. RESULTS

According to the frequency analysis; business sectors of the sample are categorized as; pharmaceutical - 7.3%, Food and beverage - 33.6%, Home appliance - 73.6%, Home care - 85%, Personal care - 5.6% Apparel - 4% and Other - 1.5% respectively.

And also 42.9% respondents of the valid responses received were are from the multinational companies and 57.1% are from the local companies.

With reference to the functional areas of collected data; the respondents are from different departments such as; supply chain department-20.8%, logistics department-15.6%, procurement department-11.3% Transportation department-19.7%, warehouse-15.9%, distribution-10.5% and production-6.2% were provided in respectively.

In reliability test, Cronbach's Alpha value was 0.712 showing a high level of internal consistency and

correlation between the variables of the study. Kaiser-Meyer-Olkin Measure of Sampling Adequacy is .824 indicating that component or factor analysis will be useful for these variables.

Eleven factors were identified from the factor analysis as mention below in summary.

Table 1. List of the identified factors

Factor Number	Identified factors
01	Green Heat Reduction Methods, Reverse Logistics practices
02	Green Distribution, Delivery Methods, Water Recycle Practices
03	Green HR practices, Green Purchasing Practices
04	Possible Recycle Methods
05	Green Packaging Methods Available
06	Green Lighting Techniques
07	Green Building Practices
08	Green IT Practices
09	Green Energy Practices
10	Available Re-Usage Practicing Methods
11	Practices of Energy Efficient Vehicle Usage

Factor 1 is a function of Green Heat reduction Methods and Reverse Logistics Practices.

Green Heat Reduction Methods are referred as using ceiling mounted fans, roof ventilator, solar power thermal and so on. Reverse Logistics Practices are referred as re-process/direct delivery, re-distribution, combine inspection, selection/sorting, Disposal and so on.

Factor 2 is a function of Green Distribution, Delivery Methods and Water Recycle Practices.

Locations are networked to each other, established supplier’s partnerships to share warehouse fleet and utilization the regional warehouses are identified as green distribution function.

Green delivery method is explained as practices of off-peak/off-time transportation activities.

Also practices of recycle the grey water system and practices of recycle the rain water system are discussed under the practices of water recycle.

Factor 3 is functions of Green HR Practices and Purchasing Practices.

Green HR Practice is referred as Encouragement of Eco Friendly Suppliers etc.

Green Purchasing Practices is referred as Practices of Alternative Local materials etc.

Factor 4 is a function of Possible Recycle Methods. Possible Recycle methods are explained by recycling the plastic, paper, glass, hay and cardboard

Factor 5 is a function of Green Packaging Methods Available. Practices of downsize packaging, minimize the packaging materials usage and time to unpack with increase the warehouse space utilization are probably discussed by this function.

Factor 6 is a function which is explained as Green Lighting Techniques. This function is referred as uses of day lighting system, uses of LED lighting system, uses of silicon wafer cells and practices of solar power lighting system.

Factor 7 is a function of Green Building Practices. Green building practices are referred as uses of fiber concrete practice, uses of recycle roofing material such as galvanized steel and wood.

Factor 8 is a function which explained as Green IT Practices. Practices of order via email, uses of wireless communication system and practices of RFID technology are identified as green IT practices.

Factor 9 is a function of Green Energy Practices. Green energy practices are referred as uses of diesel power, solar power, wind power, fossil fuels, electricity power and so on.

Factor 10 is a function of Available Re-Usage Practicing Methods. This function is discussed by re-usage of pallets, returnable packaging materials with papers used for documentation.

Factor 11 is a function which is explained as Practices of Energy Efficient Vehicle Usage. Uses of electrical vehicles, compressed air powered vehicles and so on are explained in this function. The table of Communalities for this analysis shows almost all variables are explained and communalities for the variables are above 0.50 depicting this factor model can be concerned as good.

#### IV. DISCUSSION AND CONCLUTIONS

##### A. Discussion of Research Questions

The study mainly focuses on one main question with a sub question which were intended to address through the research findings.

1) *Research Question One:* "What are the existing green warehouse practices in modern day warehouses in Sri Lanka"?

In Sri Lankan logistics industry, sustainability is an important part of being a responsible corporate citizen. Many logistics organizations have been implemented award winning initiatives that reduce both their customers' and their own carbon footprint and best practice benchmark in sustainability, optimising business case driven logistics services – from transportation solutions to warehousing and distribution. Well reputed companies in Sri Lanka (Abans, Mas Holdings, BrandixSingar, Nestle, Atlas, Logiwiz, Fonterra, Lanka Milk Foods, CBL natural foods, Softlogic, Hemas Pharmaceutical, Samson rubber, Oviklo, Brandix etc. ) are implemented green skills from the inside and outside of their warehouses.

Greening up the existing warehouse with using sustainable practices which are used mostly by the Abans, Nestle, are able to be reduced the facility's carbon footprint; lessen consumption and lower energy costs. Also the practices of them have been created good environmental citizenship and positive public relations and customer goodwill due to the ethical environment perspectives of do the right thing in the right time. However, going green is not altruistic but it really can make rupees. Many green warehousing and building techniques are more expensive in terms of initial investment, but they quickly pay for themselves through energy cost savings.

According to the research output 89% of logistics organizations are replaced LED (light-emitting diode) or induction lighting for substantial energy savings. Though LED lights are more expensive, they produce less heat and are ideal for cold storage. Further some companies like Ceylon Beverages, Keels food products, DelmageForsth company have been highly practiced the method of skylights are an economical way to bring lots of natural daylight into modern warehouses and reduce the extra electricity usage.

Many logistics organizations are probably reused pallets, cardboard and other packing materials as well. According to the analysis of the research 96% have been implemented a returnable packaging system is a good solution help to reduce the environmental damage. Further it increases the life of the packaging and makes it easy for customers to return the packaging can be reused many times, reducing waste and saving money.

Currently many warehouses in private sectors (79%

positive responses) have invested in 'green' assets, including electrical vehicles for handling activities, usage of electrical power for the whole warehouse operations, Practices of recycle roofing materials and uses of roof ventilator to reduce the heat in the warehouse are completely harmless to the environment, 53% were responded as positively and as well as being 30% less expensive to operate than the fossil fuel material handling equipment.

Many environmental strategies are built on the optimal deployment of all current resources. (Practices of alternative local market materials, Encouragement of employees to follow eco ethical guide lines, purchase Orders via emails facilitating the centralized IT methods) all the factors identified in the study are contributed in different ways to reduce the environmental impacts of a logistics system and increase both company bottom line and reputation at the end. Researcher was able to identified 43% positive answers according to the analysis of the research further it have been proved that (39%) home appliance industry in Sri Lanka has been introduced the concept of 'extra distance' as a measure of uncertainty within the supply chain, various elements, including network modelling, elimination of 'dead kilometres' and other initiatives to reduce fuel consumption and limit waste.

The study also found that the transport distance actually run does not add value to the end customer, follows networked locations systems for the distribution perspective, Established supplier's partnerships to share warehouses and fleet, Practices of off-peak/off-time transportation activities, Monitors reprocess and direct delivery Observes re-distribution increase both economic and environmental implications. Typical causes of these 'extra kilometres' included distribution centre failures (picking delays, queuing delays and other factors), short-notice volume increases, as well as errors in forecasting and transport planning.

2) *Research Question Two:* "The importance of those green applications to match with the international standards."

Sri Lanka is a developing country and common practices of developing countries, Sri Lankan business sector, environment and more importantly society are facing negative impacts. Due to that the companies mainly focus on cost reduction of the operations and do not consider the safety of products, safety of environment or consumer expectations. But in the present most of the general public become aware about the protection of the environment.

The current trend in modern consumption of the earth's resources is unsustainable and is creating major environment problems. Present use of the earth's finite resources cannot be maintained. Thus people need to move to sustainable development, which 'meets the needs of the present without compromising the ability of future generations to meet the human needs.

Sustainability is the ultimate target of green warehouse practices from which the available natural resources can be preserved for future use while utilizing the resources maximally in existing requirements. According to the final analysis of the research 75% positive answers were collected which have been utilized the resources by preserving natural resources. Green warehouse applications generally imply the eliminations of unnecessary use of natural resources with use of alternatives.

The study identifies 68% positive responds with regards to the eco-friendly systems which are mainly used in the modern day warehouses today. Lighting accounts for the biggest energy cost in a warehouse. By adopting modern technologies for lighting, company can reduce that extra energy usage. So in this way with the aid of the green warehouse practices; warehouse sustainability can be achieved. Three Rs, Reduce, Reuse and Recycle, the warehouse is the perfect place to start reducing, reusing and recycling which have been highly practiced by international logistics industry.

Today with the current situation it can be seen that the growth of logistics industry is increasing along with the increasing demand. With the implementations of international green warehouse practices, which has been found through the previous researches in that the main costs involve in warehouse operations can be reduced with the implementations of green warehouse practices ultimately which will lead to reduce the unit cost of a product.

As a result of that Sri Lankan companies are able to increase their profit margin which will finally affect the country's economic status by contributing to increase the Gross Domestic production. It has been also evident that the cost benefits the companies gain through the reduction of operational cost is passed to the ultimate customer by reducing the unit price. Therefore green warehouse practices will be economically significant to a country.

By implementing the environmentally friendly practices in the warehouse directly helps to minimize the carbon

footprint percentage and wastage while minimizing the costs and increasing social responsibility like as international Trade.

#### IV. RECOMMENDATIONS

Public warehousing practices as an industry, which provides a service to the customers, it is important to understand the development of the green warehouse practices. An improved green applications would leads to attract more customers where it brings more benefits to the operators and ultimately to the country.

Through this study it has been identified the factors that have influence on warehouses, and it could be used to improve the efficiency in public warehousing sector in our country. Facilitated warehouse with green applications encourage local and foreign people to use the final goods to fulfil their requirements which increase the demand of the public sector. This study is similarly important to the relevant authorities, that the findings could be used to develop and enforce new warehouse policy by securing the standard of the public sector.

The government should motivate the logistics industry by introducing environmental tax for each type of business industries. (For non-renewable energy usage, poor transportation activities, pollution for environment by company).

Facilitate the state-of-art knowledge and benefits to adopt green warehouse practices and uses the renewable and re-usage sources for energy consumption with reducing the tax price for the cost of needed equipment (Hybrid vehicles, Electric forklifts) can also be highly influenced to create positive image of green warehouse practices. Further government should develop a process to encourage the local raw material suppliers. (Ensure the long term cost reduction) and introduce new transportation policies to motivate the off-peak / off-time travel methods while practicing the resources more efficiently.

Moreover create byproducts, recycle and re-use to eliminate waste with use of green technology to remain competitive and increase productivity can be implemented to the warehouse operations to increase the green warehouse practices in Sri Lanka.

Furthermore use of green initiatives to attract new market opportunities, use only green packaging method for products wrappings with facilitating the warehouse or implement stroge facilities to reduce environmental impact can be highly impacted to increase the green

warehouse usage in the country. Further logistics companies should be advised to use biofuels in transportation fleet and limit the number of distribution trips to reduce the carbon footprint and should be implemented green human resource policies to cultivate a green business culture.

#### D. Limitations

Study has not included the all public and private logistics organizations and companies in Sri Lankan logistics industry. Further there were some restrictions of the time to collect the data as researcher was able to spent the limited time period to collect the practical information. Also there were lack in past studies regards to the green WH practices in the Sri Lankan Logistics industry. Additionally in accessing data for data collection method, some public organizations did not provide permission to gather data.

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