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TABLE OF CONTENTS

Note from the Editor-in-Chief

The CINEC Academic Journal is proud to complete its third volume of publication which presents a selection of stimulating research papers from staff and students of CINEC. Once again, I would like to reiterate that the success of the Journal is due to the enthusiasm shown by the contributors and the dedication and talent of the editorial board.

Publishing is an important outlet to share and exchange ideas which lead to developing valuable contributions with other researchers in the field. Research in any field progresses when people make advancement in their field, publishing is one such outlet to share those novel ideas so others can utilize and improve them for the greater good of everyone.

CINEC has now been granted approval by the Ministry of Higher Education to award undergraduate degrees in several disciplines including Engineering, Management, Education, English Language, and Health Sciences. This will increase the topic area coverage and will further improve the standard of our Journal.

We hope that you find the Journal valuable, that you will help inform other utilizers about the journal and will consider submitting your own work. We welcome your comments so that we may improve the journal in future volumes.

Prof. N. Rajkumar

Survey of Condition Monitoring Techniques for Induction Motors

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***Abstract* – Induction motors have been identified as one of the most common and useful type of motors. Thus, these motors are commonly used in domestic applications as well as industrial applications due to their distinctive features. However, it has been determined that these motors tend to fail with the time of operation which can be minimized through proper techniques of monitoring the condition and diagnosing the fault of the induction motor. The following paper will investigate extensively, the faults which could occur in an induction motor as well as the techniques of diagnosing these faults which can provide a better lifetime whilst increasing the reliability in an induction motor subsequently.**

***Keywords* – Condition monitoring, Induction Motor, Motors, Vibration.**

I. INTRODUCTION

The cost of maintenance and the risk of unexpected, catastrophic failures in an induction motor can be determined by condition monitoring techniques. Within the mechanism of condition monitoring the previous records of the motor or statistical estimations of the motor failure is not being considered. Instead, it uses real-time data which is being obtained through experimental procedures in order to determine the fault of the motor. Thereby, this shall be considered as the key parameter for the success of condition based maintenance [1].

Usually induction motors are considered to be less maintenance, high efficient and low cost motors. However, induction motors can be subjected to several faults during operation, though they are considered to be reliable motors compared to other type of motors.

These faults which occur in induction motors can be classified under three main categories [2].

- Electrical faults
- Mechanical faults
- Environmental faults

Throughout the time there have been plentiful researches carried out in determining which parts of the induction motors are widely subjected to failures. According to Krmakar, Chattopadhyay, Mita and Sengupta most common component which is to be failed is bearings. Then comes the stator and rotor respectively [2].

Another similar research was carried out by Sin, Song and Ertugul. As per the research they have carried out it had been determined that 40% of the faults in an induction motor occurs due to bearing failures. 38% of the faults due to stator failure and 10% of the faults due to rotor [1].

Considering the faults which have been obtained by these researches an average chart of faults which could possibly occur in an induction motor shall be illustrated as follows.

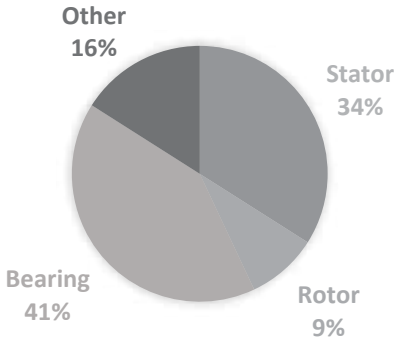

Fig. 1 Common faults in an induction motor

II. FAULTS IN AN INDUCTION MOTOR

A. Bearing Faults

The bearing of an induction motor is manufactured to be placed at the rear end and front end of the rotating shaft or the rotor. The main objective of manufacturers to equip bearings in induction motors is to make the rotor rotate smoothly reducing the friction. Considering about the parts of the bearing, these consist of an inner race, which have been attached to the rotor, outer race, which have been attached to the housing of the motor and set of balls which are in between the inner race and outer race of the bearing. Moreover, by applying grease or oil between the races can reduce the friction which is being transmitted to balls subsequently. Fatigue failure, lubrication failure, contamination and misalignment can be depicted as major causes to fail a bearing [2].

B. Stator Faults

Almost 35% of faults in an induction motor are caused due to failure of the stator. Thus, it is clear that this component is also a component which fails more often.

The stator can be also considered as a component within the induction motor which shall be subjected to numerous

stresses during the time of operation. These stresses which develops while the motor is under operation can be minimized in an effective manner if proper care was taken [2].

Moreover, Sin, Soong and Ertugul highlighted that the stator fault in an induction motor could lead to producing imbalanced magnetic fields depending on the heat which is being generated by the induction motor. Thereby, this fault can lead the motor to create large scale vibrations causing damage to other internal components within the induction motor. If the failure was not identified and fixed it shall further damage the stator windings of the motor [1].

These faults which occur in the stator shall be classified into two categories,

- Faults in the winding of the stator
- Faults in the frame and lamination of the stator.

Out of these faults the most common and crucial fault which could occur in an induction motor due to stator failure is the faults in the winding of the stator.

C. Rotor Faults

Rotor faults are comparatively less significant when it is being compared to bearing failures and stator failures. As per Fig. 1, it illustrates only 9% of rotor faults in an induction motor. Rotor faults can also be categorized further as broken rotor bar fault and Rotor mass unbalance [1, 2].

D. Other Faults

Apart from these major faults which could occur in an induction motor there are less significant faults which still could occur damaging the internal components of the induction motors.

1) Single Phasing Fault

The single phasing fault in an induction motor shall be considered to be one of the electrical fault occurs. This type of fault is present only in three phase induction motors. Thus, when one phase of an induction motor is not functioning properly the motor will still keep on functioning from the rest two phases. The common signs of an induction motor are having the single phase can be identified when the motor starts functioning below the speed which has been named on the name late of the motor whilst producing high level vibrations. Blown fuses, incorrect setting of protection devices provided along with the motor and broken relay contacts or damaged relay contacts are main causes of an induction motor to fail due to the single phasing fault [3].

2) Crawling

The fault which is considered to be crawling is an electromechanical fault which occurs only in induction motors which are manufactured with a squirrel cage [2]. First signs of identification of this fault is that the induction motor tends to produce high vibrations as well as noise, while operating at lower speeds than it have been named on the name plate. Moreover, the speed can be considered as low as one seventh of the average synchronous speed of the motor. The reason to a motor to crawl is because there are odd harmonics in the sine wave. In a healthy motor the sine wave which produce is an absolute perfect sine wave [4].

3) Over Voltage and Under Voltage

Over voltage fault and under voltage fault occurs when the voltage level which has been supplied through the supplier keeps on fluctuating. Over voltage fault causes the insulations to be stressed and under voltage fault causes an unexpected rise of temperature through the windings of the stator due to excessive line current [2].

4) Overload

Overload occurs when a greater load has been provided to an induction motor than the load which has been specified in the name plate. The following fault in an induction motor can be easily determined by reduction in torque and comparatively lower torque than it has been mentioned in the name plate. Overloading in an induction motor can cause great damage to other components which are located inside of the motor including bearings, oil seals, rotor, etc.

III. CONDITION MONITORING AND ITS IMPORTANCE

Induction motors are commonly used in industrial applications due to its distinctive features such as low maintenance, low cost, high efficiency, etc. However, these types of motors have limitations as well as the other motors which are available in the market. Henceforth, in an instance where the induction motor exceeds the limitations which have been mentioned in the name plate the motor can damage the internal components. Thus, the condition of the motor should be monitored accordingly to minimize these failures [2].

As per Krmakar, Chattopadhyay, Mita and Sengupta there are three key maintenance strategies in conducting maintenance activities in these types of motors.

A. Breakdown Maintenance

Within this mechanism the motor is being fixed after it breaks down, which could take a longer period of time to fix the issue. It has been identified that this mechanism is a costly mechanism compared to other two strategies of maintenance. Thus, the following strategy of maintenance shall be considered to be an inefficient strategy.

B. Fixed Time Maintenance

In order to perform the following strategy highly skilled technicians will be required. Thereby, this method is considered to be costly as well as the downtime is considerably higher than in the other two strategies.

C. Condition Based Maintenance

This strategy of monitoring the condition of induction motors was considered as the most successful strategy out of all three strategies. The reason behind this is that the condition of the motor has been determined while the motor is under operation. Preventive maintenance strategies will be carried out by the technicians if a fault has been identified.

By practicing the following strategy, the reliability of the motor can be increased whilst reducing the downtime effectively. Furthermore, the maintenance cost can be cut down accordingly.

IV. STRATEGIES OF CONDITION MONITORING

Within the modern context in identifying the faults in an induction motor numerous strategies related to condition monitoring are used such as vibration analysis, acoustic emission, thermal imaging, motor current analysis, surge test etc.

A. Vibration Analysis

Vibration analysis is considered to be one of the oldest strategies still in use, which is considered to be the first type of analysis. An induction motor consists of no faults tends to operate under less vibrations. However, when a fault is gradually developing the vibration starts to increase. Accelerometers and piezo electric sensors are widely used in order to capture these vibrations in the induction motors [1]. Moreover, this strategy is considered as a best strategy to perform predictive maintenance [5].

Performing the condition monitoring strategy of vibration analysis highlights several benefits,

- Life span of the motor can be increased.
- Component damage risk can be reduced.
- Reduction in production downtime.
- Increasing the efficiency of maintenance.
- Prevention of sudden failures.

Software such as MATLAB and LabView been used to analyze the signals further which has been obtained by the transducers. Thus, by analyzing the frequency spectrum it can be determined the faulty component in the induction motor. Thereby, vibration analysis is one of the most useful strategies in condition monitoring.

B. Thermal Imaging

The strategy of thermal imaging is associated with the temperature of the induction motor and the heat it produces. Usually an induction motor produces heat when it is under operation. The phenomena behind this is that the windings of the stator are shorted. Thus, it tends to produce very high current [6]. To capture the heat, IR (Infrared) cameras are used and then converted to videography for further analysis.

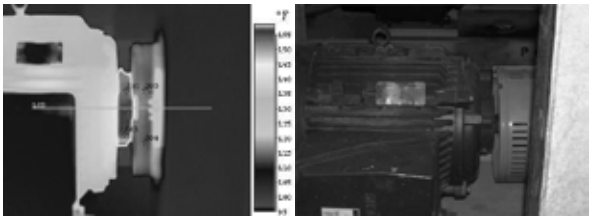

Fig. 2 - An induction motor with faulty bearing [7]

As it has been illustrated in Fig. 2 the following motor is having a faulty bearing. This can be easily determined due to infrared image obtained. However, through naked eye it is not possible to obtain an IR image. Thus, thermal imaging is considered to be one of the most used strategies when monitoring the condition of machinery.

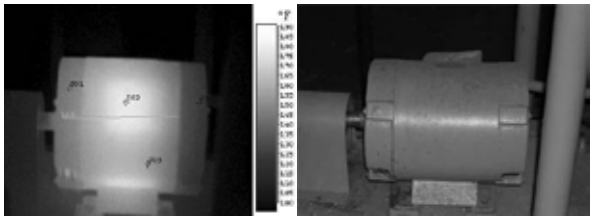

Fig. 3 - A motor which is been heated [7]

Another similar example is illustrated upon figure 3 of a motor which has been heated up during the time of operation through an infrared camera and through naked eyes.

C. Acoustic Emission Testing

Strategy of acoustic emission is another commonly used strategy in order to determine the faults in an induction motor. Usually when performing this type of condition monitoring technique the sensors are placed on the surface of the motor. When the motor starts operating if there is any defect the motor tends to activate the fault. Thereby the faulty spectrum shall be obtained through the sensors which are mounted on the surface of the motor. This strategy does not cause any physical damage to the motor and also it provides real-time process information. However, there are several limitations within this mechanism such as, these sensors are susceptible to attenuations and background noises which are really high [8, 9].

D. Noise Monitoring

Faults in an induction motor can also be determined by monitoring the noise it produces. Using the specially designed equipment the spectrum of the noise can be obtained. However, this strategy is not an accurate strategy of monitoring the condition of the induction motors .The phenomena behind this is background noise cannot be eliminated while obtaining the readings of the induction motor. Thus, this technique is not commonly used within the industry [6].

E. Motor Current Signature Analysis

This technique is widely used within the industry to detect the bearing damages and broken rotor bars in an induction motor. Within the following mechanism the stator current shall be used to obtain the power spectrum. However, if the rotor bars are broken the current is not supplied through those bars making the rotor bas asymmetric. This phenomena can cause reduction in harmonics related to stator winding currents [6, 10].

F. Air Gap Torque Monitoring

When an induction motor is under operation between the flux and current linkages the air gap torque is produced. However, the harmonics contain zero conditions when an induction motor is operating under its normal conditions. If there is an unbalanced power supply to the motor these harmonics can deviate from zero condition to non-zero condition. Thus, rotor faults and unbalanced stator windings can be determined by the following technique [6, 8].

G. Surge Test

The faults in the windings of the stator can be effectively determined by the following mechanism. Moreover, if a motor is about to fail electrically the failure in the stator winding can be considered to be one of the first signs. Reduction of windings in the stator of the motor is the reason it fails in following manner [11]. Identical high voltage pulses and high frequencies shall be provided to two phases of the motor while the other remaining phase is being grounded. Therefore, through the pulses which are reflected, the winding and insulation faults can be detected [8].

H. Instantaneous Angular Speed

Determining the issues related to non – symmetric stator cores can be identified using the following technique. This technique is defined as "variation of the angular speed within one revolution of the motor shaft". As well as to determine the faults in stator core this technique is also used in order to determine faults in the rotor. However, when determining the faults in the rotor of the induction motor the speed of the rotor is considered to be uniform which illustrates the difficulties in determining the faults in the rotor [1].

V. CONCLUSIONS

Reliability can be improved, and maintenance cost can be reduced effectively through accurate means of monitoring the condition of the induction motors. The techniques of condition monitoring are based on sampling the signals which were obtained through the specially designed transducers and processing the signals through various software such as Matlab and LabView to analyze the fault. Hence, deciding which component is faulty and repairing or replacing would be convenient. The following paper provides in detail survey related to condition monitoring and fault diagnosis of induction motors.

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Effects of Global Factors on Sustainable Ship Recycling

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***Abstract* -This paper examines the factors influencing ship recycling industry and their effect on the sustainability of the industry. It focuses on operations, which include current working practices of ship breaking facilities in global locations and regulations that govern these procedures. The objective of this study is to analyse how far the ship recycling operations stay within the existing regulations and whether any gaps exist, how best the future regulations and operational procedures can be improved in order to narrow down the existing gaps so that the sustainability of industry can be achieved. Major ship recycling yards in Asia are reviewed in this paper since they contribute to almost all the ship recycling currently take place globally.**

Keywords – Ship recycling, Basel convention, Hong Kong convention, Ship recycling yards.

I. INTRODUCTION

The ship is a mobile structure consisting mainly of steel and has a definite life cycle. At the end of its productive life span it needs to be responsibly broken up so that the steel scrap could be reused in new steel production, or the broken up parts could be reused in a different industry. It is essential for the renewal of the shipping fleet [1]. Amongst the different alternatives for the disposing of a vessel at the end of its operational life, recycling, which ensures the reuse of its components such as steel, is considered the most environmentally friendly way of disposing of an old ship, as compared to its sinking or abandonment. [2]

In different global locations, ship recycling is being carried out, involving different methods, using best available resources in that particular country, contributing immensely to local economies and providing a sustainable solution to world's aging ships [3].

There are many external factors which influence the sustainability of ship recycling and much can be done globally to steer it towards the sustainable industry. Amongst them, recycling operations, international and local regulations which govern those operations, pollution resulting from a particular operation, health and safety issues in the process are the leading factors for consideration.

In the following section operations and regulations pertaining to ship recycling are reviewed and analysed. Pollution, created by the ship recycling industry is briefly introduced in this paper, due to its immense impact on global well-being. It will require a study on its own in the future.

II. LITERATURE REVIEW

A. Regulations

An attempt to regulate ship recycling has been a result of the struggle between the shipping industry and civil society [4]. The first international regulation which addressed the disposal of hazardous waste from ships was adopted in 1989 as Basel convention and came into force in 1992 [5]. It applies to all types of ships when they are waste and the transboundary movement of ships that are waste. The regulation does not clearly define how the provisions in the Basel Convention could be practically applied once the dismantling process has commenced [6]. The standards, code of practices and guidelines of the International Labour Organization (ILO) for ship recycling were adopted in Thailand in 2003 and approved by the governing body of the ILO in 2004 [7]. These guidelines place responsibilities, duties and guidance upon the national legal framework and the integrity of the competent authority of the country where recycling takes place. [7].

Due to the pressing need of a comprehensive set of regulations to control the complete process of ship recycling, the International Maritime Organization (IMO) with inputs from its member states, and in corporation with the ILO and the parties to the Basel Convention subsequently developed the text of the Hong Kong Convention. (2009). Though it was adopted by IMO in 2009, it is yet to be ratified. This Convention specifies the planning of vessel's recycling at the building stage itself. Ships will be required to have an initial survey to verify the inventory of hazardous materials, additional surveys during the life of the ship, and a final survey prior to recycling [8]. This convention defines the duties of flag state which is the country whose flag the ship is entitled to fly and the recycling state, which is the country where the identified ship recycling facility is located [9]. However, in the absence of proper incentives and support mechanisms provided by the Convention to upgrade recycling facilities, it is unlikely that major recycling states would be enthusiastic to sign the Convention [10].

The Council of the European Union (EU) adopted ship recycling regulations in 2013. The objective of these Regulations is to reduce the negative impacts linked to the recycling of ships flying the flag of Member States of the Union. This regulation, comes into effect in 2018, bringing forward the requirements of the Hong Kong Convention, bringing its global entry into force. Seagoing vessels flying the flag of an EU Member State can be recycled only in a facility included in the European List of ship recycling facilities [11]. List of EU approved yard are attached in annex 1 of the appendices. However, it is interesting to note that some vessels owned by EU member states change their flag state to a less responsible flag at the time of handing over the vessel for recycling in order to avoid restrictions enforced by the original flag state [2]. Ways to plug this loophole are suggested in the recommendations of this paper.

National regulations of principal ship recycling states concentrate on workers' rights, but not specifically in recycling procedure [12], so unable to make a fair review on it.

B. Operation

One of the main factors that can influence sustainability in ship recycling is the operational procedure of recycling. There are three ship recycling methods in practice in different recycling locations. Beaching referred to breaking up a vessel at beach facility. This method is used in tidal plain countries of India, Bangladesh and Pakistan where three quarters of total recycled tonnage had been carried out in 2015 (2). (Annex II of appendices) Two major environmental impacts associated with beaching are, firstly, the use of a larger area for dismantling, affects both the local surrounding, environment and the society. Secondly, discharges and emissions to sea, ground and air cause pollution. The lack of containment to prevent toxins from entering the environment is a major concern [13]. However, it provides employment to a large unskilled population, while getting rid of end of life tonnage economically [14].

The second method, modified slipway recycling, is used in areas with lower tidal ranges. It involves dragging a ship onto a concrete slipway, which extends into the sea [15]. This form of recycling takes place in Turkey. Vessels are pulled ashore before they are cut at the bow and 600–800 tonne sections, are pulled onto an onshore cutting area. Smaller sections and equipment are later removed by cranes. As the shore ground contains densely packed soil, vehicles and cranes can operate close to the vessel [16]. Since the recycling yards are manned with skilled labour, health and safety hazards are reduced, however solid and liquid waste generation and air pollution exist in these yards [16].

The third method, is to carry out breaking up of a ship in a dry dock or specialized sail-in berth, as practiced in Chinese facilities of Pearl River Delta and Yangtze River Delta [17]. or dismantling by the quay and subsequent scrapping on impermeable floors with effective drainage systems as in Denmark Rolshøjvej facility [18].

Turkish yards, which practice modified slipway method of ship breaking stands out over the beaching method as its process reduces sea and ground pollution, further it employs a skilled workforce and heavy lift equipment thereby improving the quality of work [15].

Chinese facilities, after having invested in expensive green recycling yards, hoping to attract demand from all over the world once international environmental regulations were enforced are closer to breaking point [19]. Overcapacity in Chinese shipbreaking yards and anticipation of the strict regulatory framework, have placed China in this unfavourable situation [19].

Global steel price saw a regular decline for last eight years, from 750 United States Dollars (USD) /Tonne to 395 USD/Tonne, [20] which has a bearing on the price of scrap steel, as scrap steel is used in the production of steel. When Indian subcontinent offers a ship owner 380 USD/Tonne of scrap steel China could offer 210USD/Tonne due to their higher overheads and surplus steel production [17].

For the last several years the Chinese government paid an additional 200 USD per light displacement tonne (LDT) incentive to Chinese ship owners who choose to recycle their vessels in Chinese yards [19]. The results show this model has been effective in reducing Chinese vessels beaching for recycling.

C. Pollution

Ship breaking yard originated pollution can adversely impact air, water and the soil. [7]. Dangerously high air pollution in the vicinity of ship breaking yards has been detected by a recent study, where the concentrations of toxic chemicals and persistent organic pollutants (POP) in the air were found to be above carcinogenic risk limits as set by the World Health Organization. [21]. Ship breaking is also a known asbestos exposure hazard, the results, obtained from shipbreakers in Taiwan, have shown higher rates of cancer overall, especially lung cancers [22]. There are numerous cases of water and ground pollution have been documented near shipbreaking yards of beaching and modified slipway locations [22]. Since pollution is a serious threat to the sustainable ship recycling operation, the author intends to research the subject in subsequent studies.

D. Planning

My intention of this paper was to first identify the factors that influence the sustainable ship recycling operation, then separate out the factors that will be reviewed in detail within the scope of this report. Factors such as pollution are only briefly introduced here since the topic needs comprehensive research, and will be reviewed in subsequent publications as a separate subject. Operational procedure of ship recycling in major global locations and the regulations which govern these procedures are reviewed in this paper. Data pertaining to the regulations were gathered from IMO conventions as they were enacted according to their timeline. Operational data were gathered from peer reviewed journal articles and websites, which analyse procedure of particular recycling location.

Results were tabulated as they occur in recycling locations and compared against the existing regulations. Ways to narrow down the existing gaps in the present operational procedures and regulations are detailed in the conclusions chapter.

E. Method

This study was conducted to analyse the factors influencing the sustainable shipbreaking operation and what future developments require to steer it towards sustainability. The methodology used in this study is more of qualitative nature supported by statistical data collected from Clarkson Research Services Limited, United Kingdom and Kable Intelligence Ltd, United Kingdom, which provide maritime market statistics through "Ship Technology.com". The operational aspect of shipbreaking industry was analysed from the data collected from peer reviewed articles and journals of Institute of Marine Engineering, Science and Technology library and also from various other web journals and articles referred at the references.
Shipbreaking operations at the following locations were analysed from the data collected.

- Alang Sosiya ship recycling yard, Gujarat, India. [23].
- Mabiya shipbreaking yard, Chittagong, Bangladesh. [24].
- Gadani shipbreaking yard, Karachi, Pakistan. [25].
- Changjiang shipbreaking yard, Jiangyin City, China. [27].
- Isiksan shipbreaking Yard and trading Co. Ltd, Izmir, Turkey. [26].

Data pertaining to the regulations were accessed from publications and websites of the International Maritime Organization, International Labour Organization, Secretariat of the Basel Convention.
Operational data collected from the above locations were analysed against their conformity with existing maritime and labour conventions and regulations, gaps were analyses and recommendations were proposed to fill in the gaps.

E. Results

In order to evaluate the influence of external factors in sustainable ship breaking industry, ship breaking operations in different locations and existing regulations that governs this operation were studied.
Existing regulations do not have provision to regulate ship breaking procedure available globally, neither do they dictate shipowners choice in picking up a particular yard.

Basel Convention (Annex 3 of appendices)
Date adopted - 22nd March 1989
Date ratified - 5th May 1992, Number of Signatories - 116 nations at present.
Summary of the convention - Control of Transboundary Movements of Hazardous Wastes and Their Disposal.

European Commission regulation.
Date adopted - 20th Nov 2013,
Date expected to be ratified - 31st Dec 2018.
Summary of the regulation - European ship owners and flag states' obligations in ship recycling, approved list of ship recycling facilities and waste shipment regulations.

Hong Kong Convention
Date adopted – 15th May 2009
Nations ratified the Convention at present are the Democratic Republic of Congo, France, Panama, Norway and Belgium.
The results gathered from Clarkson Research Services Limited [28]., Ship Technology.com [29]. and Brussels based NGO Platform on Shipbreaking the following results were tabulated.

TABLE I.
GLOBAL RECYCLING DESTINATIONS AGAINST TONNAGE RECYCLED IN 2015

DESTINATION	GROSS TONNAGE
Bangladesh	6,759,633
India	4,523,347
China	4,148,851
Pakistan	3,731,532
Turkey	1,083,104
Rest of the World	134,496

Source: PLATFORM annual report, 2015

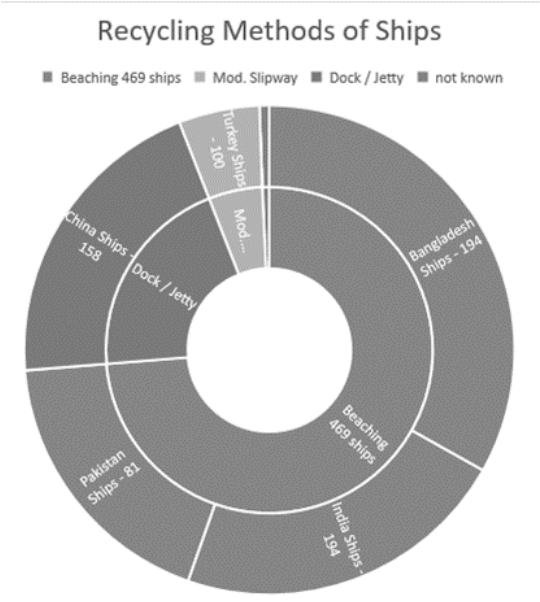

Fig. 1 Analysis of Main Shipbreaking destinations and recycling method. Source - PLATFORM annual report, 2015

Above results show during the year ending 2015, almost three quarters of recycled vessels (73%) were sold to south Asian beaching yards. Annex II of appendices provides a detailed result.
The following chart shows who sold those vessels to beaching yards.

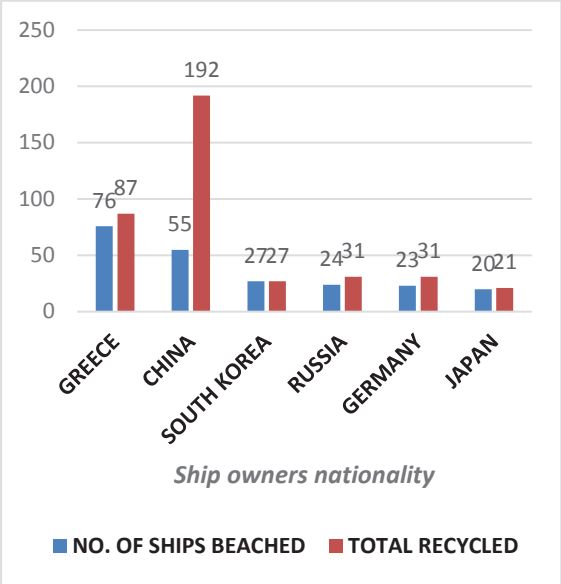

Fig. 2 Owners of recycled ships in 2015, Source - PLATFORM annual report, 2015

In spite of USD 200 / Tonne subside for Chinese ship owners, China sold 28.6% of their end of life tonnage to Asian beaching yards. (USD- United States Dollars)
Results show more ship owners prefer beaching to greener methods.

TABLE II.

YEAR	2012	2013	2014	2015	2016	2017
USD/TONNE STEEL	663.3	624.6	570	413	365	395

Global steel price, Source - Steel price forecast, 2017

TABLE III.

Destination	India	Ban'desh	Pakistan	China	Turkey
USD/LDT Tonne	380	370	370	205	245

Source - Ship technology.com

Above shows price in USD for a light displacement tonne (LDT) offered to ship-owner at the end 2015. (Ship technology.com)

Since scrap steel is used in steel manufacturing process price offered per light displacement tonne of steel to shipowners has a correlation with global steel price. China offers lowest for LDT due to their high overheads in building greener yards and overcapacity of yards [17].
Results obtained studying regulatory framework guiding ship breaking process are included in the appendices.

F. Discussion

Out of the factors influencing the sustainability of the ship recycling industry, existing regulations governing the operation and how operational procedure is being carried out in major ship breaking yards are analysed here.

Basel Convention refers the ship, a waste on its way to recycling yard, and convention controls or in some cases prohibits the transboundary movement of waste. A vessel which was sold for recycling away from recycle state, which still carries cargo, sails on its own power could hardly be called waste. Further, vessel's light displacement consists major portion of steel, that could be productively recycled, hardly would be wasted. Under the pretext of continued operational use most shipowners do not declare the intent to recycle their vessels, neither documents required by the Basel Convention and thus escape from law enforcement. This ambiguity of calling a ship waste on her final voyage needs to be rectified in future regulations in order to plug these loopholes.

Basel Convention fails to place any obligations to recycling yard or the state where the ship is recycled, but place heavy burdens on flag state and shipowners or owning state. This drives shipowner to change the flag state to a more lenient flag at the time of handing over for recycling, further there is no prohibition to change the flag state either in Basel Convention or in EU regulation.

EU regulations bring forward Hong Kong convention, which is yet to be ratified. The EU convention, which will come into effect from Dec 2018, has an approved list of recycling yards, but has not approved any intertidal zone beaching yards (Annex 1). EU shipowners will have to recycle their vessels in these approved yards. Since EU contributes to the major part of beached recycling, this will create a higher demand in scrap steel in Asia, prices will rise, recycling yards can offer further higher prices for LDT. The result will be the ship owners will somehow find a way to increase their profitability by selling their ships to beaching yards. However, EU regulation so far seems to be the only way out since it sets a global standard for sustainable ship recycling at least for European ship owners. With regards to operational procedure, results show yards in intertidal zone can offer a higher price for LDT due to their cheap labour and underdeveloped infrastructure. Cutting down a vessel on a beach does not allow for safe working conditions and the full containment of pollutants, leak into the water and soil. Most of hazardous material is not disposed of safely and are either illegally dumped or resold on the local markets since no documented procedure available in international or national regulations.

Most of the leading ship owning states taking advantage of this beaching model to improve their profits. This process does not improve the sustainability of recycling unless national regulations governing recycling procedure are geared to enforce yard owners to improve the quality.

Out of major ship recycling yards Turkey has a higher possibility of getting into the EU white list of ship breaking, further it is in a better position of offering a higher rate per LDT since it is a major steel producing country in Europe. (Annex 4 of Appendices). Underlying fact the above results indicate is, the majority of shipowners, whatever their nationality, would prefer beaching in the intertidal zone to greener recycling in order

to maximise their profitability which seem to be their main intention.

II. CONCLUSION

In order to achieve sustainability in beaching yards, where a ship is broken down directly on the sand, in the intertidal zone, regulations governing the operation has to be tight and fool proof. A ship arriving at the beaching yard should be completely free of hazardous material to make it a sustainable operation. All internal mountings should be so fitted that they can be dismantled at a transit station before she arrives at the beach. Tanks should be emptied, clean and gasfreed. This is a difficult task to achieve unless vessel's recycling has been planned at the building stage. Recycling survey has to be mandatory and it should be a part of the renewal survey where the inventory of hazardous material and readiness for recycling is demonstrated and confirmed.

The regulations should have a mechanism to provide level playing fields to all global recycling yards.

As it is shown in the results of this report China has marked improvement in reducing in beaching, they have achieved it by offering additional 200 USD for a LDT to Chinese shipowners. This model can be used in EU, Japan and South Korea since they are bigger ship owning nations, and all of them they have sustainable ship recycling yards. Maximising the profit of the shipowners is the main driver of the industry. Beaching yards offer a higher price since their overheads are low due to poor infrastructure and unskilled lowly paid workforce. As shown in the results, Chinese yards pay 205 USD per LDT while all beaching yards pay around 375 USD per LDT. With an incentive of 200 USD/LDT, China has managed to divert shipowners to more sustainable yards. This appears to be the only way to get beaching yards to improve their recycling methods. Since the local regulations in beaching locations are geared to maximise national profits, and ship recycling plays a major role in their income generation and employment, transformational changes in beach recycling cannot be expected in the near future. Hong Kong convention even if it comes into force will not have any effect in reflagging the vessel prior to its last voyage, neither does it controls the downstream waste management at the recycling yard. Ship dismantling is an industrial activity that needs industrial methods, equipment and standards. Recycling is a global necessity to phase out end of the life vessels in a sustainable manner, so it requires global attention and funding. A beach is not an appropriate place for a high-risk heavy industry involving hazardous waste management. Beach locations and intertidal zone operations cannot close all the gaps to ensure safe recycling operations and full containment of pollutants.

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Appendices. Annex 1

Country	Name of the facility	Method of recycling
Belgium	NV Galloo recycling ghent	Alongside (wet berth), slope
Denmark	Fornaes ApS	Dismantling by quay
	Smedegaarden A/S	Dismantling by quay
France	GARDET & DE BEZENAC Recycling/Groupe BAUDELET ENVIRONNEMENT GIE MUG	Floating & slipway
France	Grand Port Maritime de Bordeaux	Alongside, drydock
France	Les Recycleurs bretons	Alongside, drydock
Latvia	A/S,, Tosmares kugubuvetava	Ship dismantling (wet berth and dry dock)
Lithuania	UAB APK	Alongside (wet berth)
Lithuania	UAB Armar	Alongside (wet berth)
Lithuania	UAB Vakaru Refonda	Alongside (wet berth)
The Netherlands	Keppel Verolme	Shipbreaking
The Netherlands	Scheepsrecycling Nederland B.V.	Shipbreaking
Poland	Almex Sp. Z o.o.	Piers and recycling plots on land-sea interface
Portugal	Navalria – Docas, Construcoes e Reparacoes Navais	Dry dock dismantling
Spain	DDR VESSELS XXI, S.L.	Dismantling ramp
United Kingdom	Able UK limited	Ship dismantling and associated treatment authorizes with dry dock and wet berth

European list of recycling facilities.

Annex 2

DESTINATION	NO OF SHIPS RECYCLED	RECYCLING METHOD	GROSS TONNAGE
Bangladesh	194	Beaching	6,759,633
India	194	Beaching	4,523,347
China	158	Dock / Jetty	4,148,851
Pakistan	81	Beaching	3,731,532
Turkey	100	Mod. Slipway	1,083,104
Rest of the World	41	not known	134,496

Analysis of ship recycling at major global destinations.

Source - PLATFORM annual report, 2015

OWNER	NO. OF SHIPS BEACHED	SLIPWAY / DOCK	% Beached
GREECE	76	11	87.4
CHINA	55	137	28.6
SOUTH KOREA	27	0	100
RUSSIA	24	7	77.4
GERMANY	23	8	74.2
JAPAN	20	1	95.2

Annex 3

Parties to the Basel Convention

Annex 4

Top 20 Steel producing countries

Exploring Relationship between Freight Forwarder Selection and Size of the Organization: Multinomial Regression Analysis

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***Abstract*- Global economy tends to focus on more imports and exports, where businesses needs more and more support from 3PL providers to smooth their complicated business processes. When it comes to international business, there are a lot of regulations and steps to be followed. Starting from making a booking with the carrier, reserving space, negotiating better rates, equipment reservations, fumigation, obtaining certificates, clearing, and border regulations are few events involved. As a solution to the complicated processes freight forwarders came in to industry so that the business can focus on their core activities while forwarders involve in the transport and logistics processes. Hence the purpose of this study is to explore the relationship between freight forwarder selection and size of the organization and help to improve the service quality of the freight forwarding industry and identify whether there is a relationship between the frequencies of using forwarders with the size of organization. In order to carry out the research a questionnaire survey was developed using prior research, articles and distributed among the sample of 250 shippers which was selected out of the 1557 exporting companies in 23 industries in Sri Lanka. Multinomial Regression analysis was used to analyse data and Pseudo R-Square method was use to further confirm the relationship in between the dependent and independent variables. Findings identified a relationship between factors with organization size and the frequency of using freight forwarders. It is recommended to the policy makers of freight forwarding companies to consider the relationship and focus more on large scale organizations to enhance their profit and build relationships with the flourishing companies.**

***Keywords*- Freight Forwarder, shipper, International Business, Multinomial Logistic Regression**

I. INTRODUCTION

With Globalisation imports and exports play a vital role in every economy. When considering the Sri Lankan economy, revenue of $10.5 billion was indicated from exports in 2015 with a 5% of industrial production growth rate. Out of the $ 223 billion GDP in 2015, 20.5% were from exports. Processing of rubber, tea, coconuts, tobacco and other agricultural commodities, clothing, textiles; cement, petroleum refining, information technology services and construction can be considered the industries in the country. From these textiles and apparel, tea and spices; rubber manufactures; precious stones; coconut products, fish play a major role in the export industry. Sri Lankan export partners are considered to be US, India and Germany.

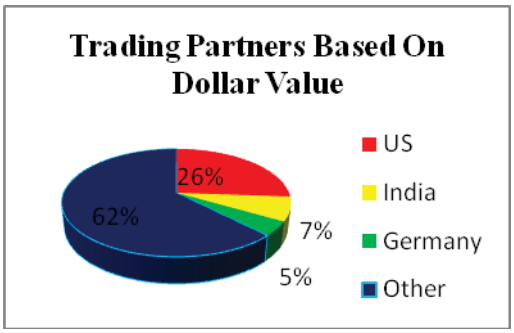

Figure 1.1; Trading Partners Based On Dollar Value

Source: World Fact Book 2015 [1]

Though it creates lot of opportunities for the business owners, the process they have to handle is a bit complicated since they have to deal with different parties like shipping lines, container yards, cross border regulations, customs, local transporters and especially with documentation.

Negotiating better rates with shipping lines and reserving space is not an easy task to do on their own especially for the small scale business operators. As a result freight forwarders or logistics specialists came on stage to smooth the process of imports and exports. As per the shippers requirement they provide an end to end solution to deliver cargo to its destination [1]. For professionalising the forwarding industry Sri Lanka Freight Forwarding Association (SLAFA) was established in 1981.Being the apex body for the 108 members SLAFA is a member of regional freight forwarding body Federation of Asia Pacific

Air cargo Associations (FAPAA) and the international freight forwarding body FIATA [2].

Consequently it is essential to have a better understanding in between shipper and freight forwarder (as well as a good partnership). Forwarder need to understand the flow of the customer and customer should be willing to provide required information to forwarder to maintain the partnership, Hence both parties can go for win win situations[3].

In addition this study helps to identify the frequency of using a freight forwarder with the size of organization with considered factors by shippers when selecting a freight forwarder .

II. METHODOLOGY

Multinomial Logistic Regression

Multinomial regression is the linear regression analysis used when the dependent variables are considered to be nominal. This model is a simple extension of binomial logistic regression model. This is used to describe the relationship between the nominal dependent variable and one or more continuous (interval or ratio) independent variable[25]. Further this method is only used when there are more than two nominal dependent variables.

In this model dummy coding is given to all variables and for having M categories in dependent variable will have M-1 dummy variables. Generally reference category is coded as "0".

In order to carry out a multinomial logistic regression model following assumptions are need to be made.

1. Observations Yi are statistically independent of each other
2. Observations Yi are a random sample from a population where Yi has a multinomial distribution with probability parameters:$\pi_i^{(0)}, \pi_i^{(1)} \dots \dots, \pi_i^{(c-1)}$
3. As with binomial logistic regression, we have to set aside one category for a base category (hence the C - 1 parameters π)

The logit for non-referential category j= 1, 2, …., (C-1) against the reference category 0 depends on the values of the explanatory variables as per the below equation [1].

$$log\frac{\pi_i^{(j)}}{\pi_i^{(0)}} = \alpha^{(j)} + \beta_1{}^j x_{1i} + \beta_k{}^j x_{ki} \quad (1)$$

For each j= 1, 2, …, (C-1) $\alpha^j, \beta_1{}^j, \beta_k{}^j$ are unknown population parameters.[5]

III. ANALYSIS

Multiple regression model was developed to identify the relationship between the frequency of freight forwarders being used and the size of the organisation. Table III-A shows the summery of the case.

III-A Case Processing Summary

		N	Marginal Percentage
Frequency of freight forwarders are being used	high	107	48.6%
	medium	94	42.7%
	low	19	8.6%
number of employees	large	95	43.2%
	medium	90	40.9%
	small	35	15.9%
Valid		220	100.0%
Missing		1	
Total		221	
Subpopulation		3	

As per the table III-A, 48.6% responses are from high users of freight forwarding service while 8.6% is from low frequency users. Out of 221 responses 95 are from large scale organisations and 90 are from medium size organisations.

III-B Model Fitting Information

Model	Model Fitting Criteria	Likelihood Ratio Tests		
	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	53.593			
Final	23.590	30.003	4	.000

Table III-B shows whether the coefficients of the model are zero or whether the coefficients are statistically significant. P value is shown as .000 in the table III-B which is less than 0.005.Hence it can be known as full

model statistically significant and predict the dependent variables.

III-C Likelihood Ratio Tests

Intercept Only	53.593			
Final	23.590	30.003	4	.000

The chi-square statistic is the difference in -2 log-likelihoods between the final model and a reduced model. The reduced model is formed by omitting an effect from the final model. The null hypothesis is that all parameters of that effect are 0.

This reduced model is equivalent to the final model because omitting the effect does not increase the degrees of freedom.

Table III-C shows the statistically significance of the independent variable. Having a 0.000 value for the sizes of the organisation which is less than 0.005 indicate independent variable is statistically significant.

III-D Parameter Estimation

Frequency of freight forwarders are being used[a]		B	Std. Error	Wald	df	Sig.	Exp(B)	95% Confidence Interval for Exp(B)	
								Lower Bound	Upper Bound
high	Intercept	.799	.401	3.958	1	.047			
	[size=1.00]	1.245	.568	4.803	1	.028	3.471	1.141	10.565
	[size=2.00]	1.599	.724	4.875	1	.027	4.950	1.197	20.474
	[size=3.00]	0[b]	.	.	0	.	.	.	.
medium	Intercept	-.405	.527	.592	1	.442			
	[size=1.00]	1.986	.671	8.763	1	.003	7.286	1.956	27.133
	[size=2.00]	3.296	.793	17.252	1	.000	27.000	5.701	127.875
	[size=3.00]	0[b]	.	.	0	.	.	.	.

a. The reference category is: low.

Frequency of freight forwarders are being used[a]		B	Std. Error	Wald	df	Sig.	Exp(B)	95% Confidence Interval for Exp(B)	
								Lower Bound	Upper Bound
high	Intercept	.799	.401	3.958	1	.047			
	[size=1.00]	1.245	.568	4.803	1	.028	3.471	1.141	10.565
	[size=2.00]	1.599	.724	4.875	1	.027	4.950	1.197	20.474
	[size=3.00]	0[b]	.	.	0	.	.	.	.
medium	Intercept	-.405	.527	.592	1	.442			
	[size=1.00]	1.986	.671	8.763	1	.003	7.286	1.956	27.133
	[size=2.00]	3.296	.793	17.252	1	.000	27.000	5.701	127.875
	[size=3.00]	0[b]	.	.	0	.	.	.	.

a. The reference category is: low.

Interpreting $\hat{\beta}$ for Continuous X

Holding the small size of organisations constant, large size organisations multiply the odds of using high frequency of freight forwarders rather than low frequency by 3.471.

Holding the small size of organisations constant, medium size organisations multiplies the odds of using high frequency of freight forwarders rather than low frequency by 4.950.

Holding the small size of organisations constant, large size organisations multiplies the odds of using medium frequency of freight forwarders rather than low frequency by 7.286.

Holding the small size of organisations constant, medium size organisations multiplies the odds of using medium frequency of freight forwarders rather than low frequency by 27.000.

Interpreting $\hat{\beta}$ Between Non Reference Categories of X

The odds for large size organisations using high frequency of freight forwarders rather than low frequency are 0.701 times [exp (1.245- 1.599) = exp (-0.354) or 3.471/4.950] than the odds of medium size organisations.

The odds for large size organisations using medium frequency of freight forwarders rather than low frequency are 0.269 times [exp (1.986- 3.296) = exp (-1.31) or 7.286/27.000] than the odds of medium size organisations.

Interpreting $\hat{\beta}$ Between Non Reference Categories of Y

The odds for large size organisations using high frequency of freight forwarders rather than medium frequency are 2.099 times [exp (1.986- 1.245) = exp (0.741) or 7.286/3.471] the odds of small size organisations.

Computing Fitted Probability

Equations are needed to be developed to compute the fitted values.

Response Variable: Frequency of using freight forwarders

- Low frequency : reference category, j= 0
- High frequency : j=1 category
- Medium frequency: j=2 category

Explanatory Variables: Size of the organisation

- Small scale = Omitted reference category
- Large scale = X_1
- Medium scale = X_2

Model for the log odds of using high frequency vs. low frequency of freight forwarders

$$\log\left(\frac{\pi_i^1}{\pi_i^0}\right) = \alpha^{(1)} + \beta_1{}^1 x_{1i} + \beta_2{}^1 x_{2i}$$

Model for the log odds of using medium frequency vs. low frequency of freight forwarders

$$\log\left(\frac{\pi_i^2}{\pi_i^0}\right) = \alpha^{(2)} + \beta_1{}^2 x_{1i} + \beta_2{}^2 x_{2i}$$

When fit a logit model for each non-reference category j:

$$L_j = \log\left(\frac{\pi_{ij}}{p_{i(0)}}\right)$$ .....[log odds of a response in category j rather than the reference category 0]

Probability of response in category j can be calculated by:

$$\pi^j = \frac{\exp(L^j)}{1 + \exp(L^1) + \cdots . + \exp(L^{(c-1)})}$$

Probability of response in category 0 can be calculated by:

$$\pi^0 = \frac{1}{1 + \exp(L^1) + \cdots . + \exp(L^{(c-1)})}$$

Logit (Logistic regression coefficient) for using high frequency of freight forwarders rather than the low frequency of freight forwarders can be defined as:

$$L^{(HF)} = \log\frac{\pi_i^{(HF)}}{\pi_i^{(LF)}}$$

$L^{(HF)}$ = 0.799 + 1.245* large scale organisation + 1.599* medium scale organisation

Logit for using medium frequency of freight forwarders rather than the low frequency of freight forwarders can be defined as:

$$L^{(MF)} = \log\frac{\pi_i^{(MF)}}{\pi_i^{(LF)}}$$

$L^{(MF)}$ = -0.405 + 1.986* large scale organisation + 3.296* medium scale organisation

Probability of using high frequency can be found by the below equation

$$\frac{0.799 + 1.245 * \text{large scale organisation} + 1.599 * \text{medium scale organisation}}{0.799 + 1.245 * \text{large scale organisation} + 1.599 * \text{medium scale organisation} - 0.405 + 1.986 * \text{large scale organisation} + 3.296 * \text{medium scale organisation}}$$

Probability of using medium frequency can be found by the below equation

$$\frac{-0.405 + 1.986 * \text{large scale organisation} + 3.296 * \text{medium scale organisation}}{0.799 + 1.245 * \text{large scale organisation} + 1.599 * \text{medium scale organisation} - 0.405 + 1.986 * \text{large scale organisation} + 3.296 * \text{medium scale organisation}}$$

III-E Pseudo R-Square

Cox and Snell	.127
Nagelkerke	.151
McFadden	.074

R^2 or the coefficient of determination shows the proportion of variation in the dependent variables associated with the independent variables. As per the standard values of Cox and Snell, Nagelkerke, and McFadden need to be less than 1 to accept the R^2 value. Table III-E shows R^2 values less than 1 which means R^2 value can be accepted.

IV. Conclusions

When compared the company sizes large and medium with the high frequency of using freight forwarders significance values are .28 and .27 respectively. When compared the large company size and the medium company size with the medium frequency of using freight forwarders significance values are .03 and .000 respectively. Hence this can be concluded as frequency of using freight forwarders are depending on the company size.

V. ACKNOWLEDGMENT

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A Survey on Arrival Passenger Satisfaction Factors of Bandaranaike International Airport Services

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***Abstract*— Airport industry has been a vast area which has been growing each second to cater to the demand of the passengers who have been arriving and departing through worldwide distributed airports for various types of purposes. This research had carried out to find out the Arrival Passenger Satisfaction of Bandaranaike International Airport Services. The passenger has been the king in the airport industry who can make a business success or a failure. To provide quality services as required by the passengers, airports should be following up on the modified strategies and amended policies. Because of an airport has been the entrance to the country which has been needed to be attracting new investments towards the country to build up the economy. BIA has been like our heart and it needs to perform well to keep the body alive**

A questionnaire had designed with 41 variables and a questionnaire survey had conducted. The target sample has been Bandaranaike International Airport users, although the sample size had 300, there had only 263 valid responses. Simple random sampling had used in this study and SPSS had used to analyze the data.

The factors will be covered up as the independent variables and the dependent variable has been the passenger preference on BIA. Frequencies test will be run to all variables and for the demographic factors. A factor analysis had carried out to reduce the number of variables and grouping factors which have the same characteristics. Once this had completed the 41 variables had reduced to 9 variables. A hypothesis testing will determine the independent and dependents variables for the passenger satisfaction as well as a factor analysis model will be illustrated to identify the relationships between variables and demographic factors, correlations and reliability of the factors. Finally, the research findings had discussed, and recommendations had made. The basis of recommendations had to focus on customer service and comfortability to have an efficient and effective BIA service system.

***Keywords*—BIA terminal, Passenger satisfaction, Airport**.

I. INTRODUCTION

The main international airport serving as the gateway to Sri Lanka has been Bandaranaike International Airport famous as Katunayake International Airport. BIA assists as the heart for airline services such as Sri Lankan Airlines, Sri Lankan cargo, Millennium Airlines and Cinnamon Air. BIA has been the first international airport in Sri Lanka and has been controlled by Airport and Aviation Services Limited (AASL). Foundation begins in 1964 and had finished in 1967. BIA had the main point for the UK's Royal Air Force within World War II and had delivered to the Royal Ceylon Air Force in 1957. After it renamed as Katunayake International Airport. There have been 30 airlines serve the airport's more than 9 million passengers per year.

Bandaranaike international airport vision has been "To be the most efficient and friendliest premier aviation hub in the Asian region" and mission has been "We will strive to give competitive aviation facilities and services with best practices while ensuring stakeholder satisfaction" stated in Bandaranaike international airport annual report, 2015. In 2017 BIA recorded 9,805,045 passenger movements, 58,460 aircraft movement and 265,786 (MT) air freight movements. The Bandaranaike international airport has only one runway (04/22) runway length 3441m (11,290ft). The government has planned to invest on a second runway at BIA, can land A380 to the airport.

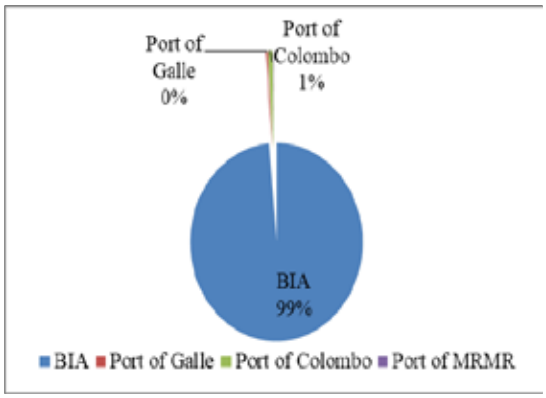

FIG. 1 TOURIST ARRIVALS BY TYPE OF GATEWAY

A. The Significance of the Study

Passenger satisfaction has become a significant factor in air travel which may affect the reputation and long-term profits of airports. BIA needs to respond quickly to the changes that take place in the air travel industry to meet their demands. This research will help Bandaranaike International Airport to identify the areas where their services have been good at and areas where they must improve.

B. The Objectives of the Research

The research has focused on understanding the customer satisfaction factors of Bandaranaike International Airport services to generate new business by meeting the requirements of potential customers. The following objectives have been contrasted through this research.

- Find out the factors that has an impact on customer satisfaction in BIA Service
- Categorize the factors that have the highest impact on Customer Satisfaction

C. Research Questions

Focused question has been what have been passenger satisfaction factors of BIA? According to the research question, responses will be gathered, and factors will be collected to find the answer to the research question.

II. Review Of Literature

According to [1] passenger satisfaction has been depending on the service and facilities that have been located at the BIA when they have been travelling at a time as arriving or departing. BIA Passengers have been showing least satisfaction level with the services and facilities which have been being offered by the immigration department. It defines a passenger as "a person who's travelling on a train, bus, airline, taxi, ferry, automobile, or other carriers" [2]. According to [1] travellers desire on-air terminal staff has been identified with the capacity to give solid and precise administrations and the readiness to help clients and give benefits fast reactions. Confirmation shows that staff with the expert learning of administrations and carries on kindly and benignant has been probably going to win the clients' trust and certainty. The study done by [5], declared that the services include the complete targeting factor has been readily manageable by the service provider that expedites customer behaviour during the service meet and improve their whole service quality perception. According to [4] baggage delivery has 3 types of problems. Facility and equipment related problem, Passenger related problems and Staff related problems. Facility and equipment related problems can also extend baggage access time. The high efficient equipment that has been used in baggage unloading and loading has been carousels, vehicles and trolleys, band conveyor, portable conveyor. The insufficient number of this machine can cause delays. According to [3] the significance of assurance wellbeing and security in an aeroplane terminal can't be over-underlined mainly in furnishing travellers with a protected and consistent experience. According to [1] prove there has been no any affect from the demographic factors to the satisfaction of the passengers. There has been no value concerning treating especially for any age group, gender biases, special attention for the travelling purpose, number of times travelled and time of using BIA.

III. METHODOLOGY

A. The Definition of the Research and the Design

The Methodology of this research had done to collect required data, to analyse that data and to understand the specific factors that affect to the customer satisfaction of Bandaranaike international airport services. A methodology has defined as "is a systematic way to solve a problem. It has been a science of studying how research has been to be carried out" [6].

The design concept for this research has been a conclusive Design. Using conclusive design, the relationship between the satisfaction factors and passenger can be easily assessed. By using the conclusive design, a convivial model could be designed to fulfil the ultimate objective of this research. Another reason conclusive design has been best suited for this research has been that of the large sample rate (300) and the fact that the primary data has been quantitative

B. Population and Sample

Research Sampling has been an act, a method of determining criteria or properties of the whole population. [7] Basic Tools of Research (Chapter 9) describes "A population distribution has been a statement of the regularity with which the units of analysis or cases that, together make up a population which have been observed or have been expected to be observed in the various classes or categories that make up a variable"

As per the [8], There have been 98.7% passengers arrives through Katunayake (BIA) to Sri Lanka. The target population of the research has been the passenger's departure from the BIA during the month of July to August. The annual statistical report 2016 of Tourism Research and Statistics indicates, 209,351 and 186,288 of passenger-arrivals during July and August of 2016. The random sampling method has been used in sample selection for departure passengers from BIA during the month of July and August.

C. The Questionnaire Design

The questionnaire used for this research has been designed on printed Forms; this had the main form of primary data used in this research. The questionnaire has been based on Multiple Choice methods where respondents would choose the most suitable answer. It had distributed among Bandaranaike international airport users using printed format to an identified sample size of 300. The questionnaire consisted of 2 parts which have been further discussed.

- Demographic
- Variables

D. Data Collection Method

Data originating from the researcher for the objective of addressing the research issue. It has been what the researcher originally collects from the target sample or population. In this specific study, primary data has been that collected from the sample/respondents through the deployment of questionnaires. The Secondary data has been the data that has been gathered and saved in databases, books or any other mode for some determination. In this study, secondary data has been collected from the registers of the companies used for the study and online articles and journals specifically relevant to the field of study, which has been customer satisfaction.

E. Data Analysis Tools and Methods

The process of analysing the collected data id adequately described beneath this division. The results of demographic data will be shown through multiple representation methods such as tables, bar charts and pie charts.

As the questionnaire has outlined on the printed form and Google forms This has included qualitative section, using a Liker weighting system. This qualitative data will be converted to quantitative data using a coding for a more accurate evaluation. Once the quantitative data has been

gathered, software i.e. Statistical Package for Social Science (SPSS) will be used to analyse the numerical data. The answers obtained from SPSS will ascertain the main variable and eliminate any highly correlated variable hence giving a more reliable picture of the collected data and rejecting any sort of reflection of data, which would a result in an inaccurate analysis. In data analysing by using statistical methods and the SPSS firstly Preparing data for entering to SPSS (Data coding), Defining the variables, Entering the collected data, Testing reliability using Cronbach alpha, Checking Bartlett's statistic and Kaiser-Meyer-Olkin, Data reduction using Factor analysis and Finally relationship with computed factors and demographic factors has been checked.

IV. ANALYSIS

A. Descriptive Analysis

According to the analysis the most number of Bandaranaike International Airport users have been Males which amount to 68.1% of the total usage. Females only count for 39.9% of the total users. From the study, the dominant usage has been of males whom satisfaction needs have been addressed by the study. According to the analysis the most number of Bandaranaike International Airport users have been Asian 78.3%. And European 9.1%, Oceania 8.7% and Others 3.8%. From the study, the main usage has been of Asian whom satisfaction needs have been addressed by the study

Due to the descriptive analysis of the research most of the Bandaranaike International Airport users have been young generation (around 16-25 yrs.). The age group of 25-40 stands next in usage. From the descriptive analysis, the most users have been annually users representing 42.6%, monthly users consist of 7.6% and other users on 49.8%. According to nominal data many of the Bandaranaike International Airport users have been largest amount has been 31.9% which have been between $300-$1000 incomes earners. Next largest amount has been 24.7% which have been between $75-$300 incomes earners. The data analysis indicates that the degree holders reside the highest in the sample analysis. Both A/L and Postgraduate share a similar proportion (14.4%) and others have been 17.5. Students (O/L's) indicate a lower representation of usage in Bandaranaike International Airport. The study could address the airport user needs by reaching out to the larger proportion users

Due to the sample data, private sector employees (11.8%) mostly use Bandaranaike International Airport services than public sector employees (55.5%).The sample data indicate that most of the Bandaranaike International Airport users have been people who travel for Pilgrimage (10%), Leisure (47%), Business (14%), Studies (14%) and other purposes (15%) whose requirements successfully addressed by the study users who travel for personal reasons also represent a large proportion in the selected population

By the sample data it has been evident that the Sri Lankan Airline (31%) has been the most used Airline service and Another Airline has been Second place (29%). both Singapore and Emirates have been got similar number of percentage (13%). Qatar and Malaysia Airlines have been low users in Bandaranaike international airport (8% and 6%).

B. Factor analysis

1) *Reliability Test: The reliability of the data set has tested, and the Cronbach alpha valve has occurred as .942, which has stated in the methodology as "Excellent". Therefore, the reliability of the data set has proved.*

2) *KMO Test and The Bartlett's test of Sphericity: "The Kaiser-Meyer-Olkin" value of the data has appeared as .905. This value lay KMO ≥ 0.9 and has termed as "Marvellous". This proved that the data set could use for the factor analysis. Bartlett's test of Sphericity has given the significance level as .000 (<.05). This has indicated that the variables used in the study have been unrelated. This provides that the variables of the study have been unsuitable for structure detection. The data set has accomplished the requirement of validation for conducting a factor analysis hence; the analysis has pursued the process of factor analysis*

3) *The Scree Plot: This scree plot analysis has plotted all the principal components. The components on the steep slope in the plot have been the best represents of the components. They describe the fundamental relationship among the variables of customer satisfaction identification process. This study has 9 first-rated principal components. The study has 41 components on the shallow slope, which has described as slight contribution towards selection process.*

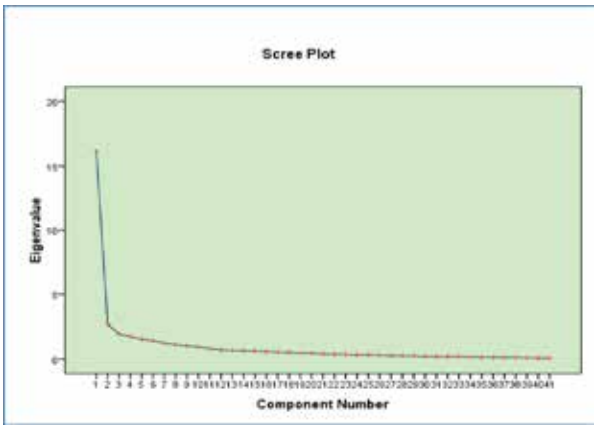

Fig.2 Scree Plot, Principal Component Analysis

4) *Principal Components Extracted from Factor Analysis: The analysis shows that the study has 9 principal components. The Cumulative percentage column has given that the percentage of variance has accounted 70.824 for the first 9 components of the study. The rotated component matrix helps in identifying which component belongs to which factor. It can be observed that although there are 41 factors, these factors can be grouped into 9 larger factors. The table below represent the categorized factors according to SPSS.*

TABLE 1
VARIABLES OF FACTORS IDENTIFIED

Factor 1: **Baggage Handling and Staff Professionalism**	User Friendly Environment Security Officer Behavior Standardized Baggage Handling Speed of Baggage Delivery Handling Baggage Misplacements Safety of Baggage Security Level of Baggage Staff Professionalism.
Factor 2**: Utility Related factors**	Parking Ticket Price Cleanliness at BIA Communication Hotel Booking Taxi Booking Comfortable Restroom Washroom Conditions Refund and Reverse Vending
Factor 3**: Display of information and Retailing**	Ease of Finding Way Displaying of Signage Flight Information Retailer.
Factor 4**: Safety and staff behaviour**	Safety of Passengers Passengers Security Level Waiting Area Condition Staff Behaviour
Factor 5**: Waiting area Facility**	Baggage Carts Condition Waiting Area Seat Capacity Boarding Area Seat Capacity Comfortable Seating.
Factor 6**: Personal Care Factors**	Medical and Healthcare firefighting Action Bank Service Transit Handling
Factor 7**: Queuing and Time related factors**	Counter Processing Time Queue Area Condition Wi-Fi Emergency Handling
Factor 8**: Parking Related Factors**	Comfortable Entrance Parking Area Condition Adequate Parking Areas
Factor 9**: Recreational Factors**	Restaurant Lounge Service Quality

Source: Researcher Output

C. Hypothesis test

TABLE 2

PEARSON CHI-SQUARE TEST OF BAGGAGE HANDLING AND STAFF PROFESSIONALISM

	Asymp. Sig. (2-sided) Nationality	Asymp. Sig. (2-sided) Travel Frequency	Asymp. Sig. (2-sided) Income	Asymp. Sig. (2-sided) Education	Asymp. Sig. (2-sided) Employment
Pearson Chi-square	**.001**	**.038**	**.024**	**.025**	**.139**
Likelihood Ratio	.003	.012	.006	.012	.055
Linear-by-Linear Association	.046	.240	.058	.211	.083
N of Valid Cases					

H_0: Baggage Handling and Staff Professionalism is independent from descriptive variables.

H_A: Baggage Handling and Staff Professionalism is dependent from descriptive variables.

- Baggage handling and staff professionalism has been significant with demographic variables such as nationality, travel frequency, income and education.
- Pearson chi-square test of a utility-related factor has indicated that it's highly significant with all the demographic variables.
- Pearson chi-square test of Display of information and retailing nationality has proved that income and education variables have been significant.
- Pearson chi-square test of safety and staff behaviour has explained that nationality and income variables have been significant.
- Chi-square test of waiting area facility gives that nationality, income, education and employment variables have a higher level of significance over it.
- Chi-square test of personal care factors has been significant with nationality, income and employment variables.
- Chi-square test of queuing and time-related factor has been insignificant with all the demographic variables.
- Chi-square test of parking-related factors has been vital with nationality and education variables.
- Chi-square test of recreational factors has been insignificant with all the demographic variables of the study.

V. CONCLUSION

A. Conclusion from the Analysis of the Study

The Descriptive analysis of the study has shown that most numbers of BIA users have been Asian male. The logical reason for this result has been that the researcher has used only the arrival terminal Bandaranaike international airport and most of Asians tend to come to the country through BIA. In the age, category 16-25 age group has been got the highest percentage of using BIA. Most of the respondents represent the average income level between $300-$1000 and indicated that they use to arrival terminal annually. For travel purposes, most of the respondents of the research have been Leisure travellers, because Sri Lanka has been a more attractive country in the tourism industry. The other respondents have shown a similar percentage in travel purpose i.e. business and study category. Majority of the BIA respondents of the survey have been degree holders and working in the privet sector. Sri Lankan airline has been the most used airline in Bandaranaike international airport as its national airline in Sri Lanka.

In the reliability test of the study, Cronbach alpha got 0.942 value and KMO value of the data has appeared as 0.905 proving that the dataset has acceptable to proceed in factor analysis. It has been the successful step to the research. A factor analysis had carried out to reduce the number of variables of the study. The analysis has generated nine factors out of the forty-one factors. The computer-generated factors have been baggage handling and staff professionalism, utility-related factors, display of

information and retailing, safety and staff behaviour, waiting area facility, personal care facility, queuing and time-related factors, parking-related factors, recreational factors. The principal component analysis extraction sums of squared loading of the analysis have explained that the first 9 components of the study have represented 70.824%. An equation has been formulated to express the relationship between observed variables and the generated component. The formulate equation has been the component score coefficient matrix of the variable multiple by affiliate variable of the component and get the summation.

Cross-tabulation analysis of the demographic variables and computed factors has been conveyed to examine the significance of each variable to the generated factors. Pearson chi-square test has revealed that baggage handling and staff professionalism has been significant with demographic variables such as nationality, travel frequency, income and education. Pearson chi-square test of a utility-related factor has indicated that it's highly significant with all the demographic variables. Pearson chi-square test of Display of information and retailing nationality has proved that income and education variables have been significant. Pearson chi-square test of safety and staff behaviour has explained that nationality and income variables have been significant. Chi-square test of waiting area facility gives that nationality, income, education and employment variables have a higher level of significance over it. Chi-square test of personal care factors has been significant with nationality, income and employment variables. Chi-square test of queuing and time-related factor has been insignificant with all the demographic variables. Chi-square test of parking-related factors has been vital with nationality and education variables. Chi-square test of recreational factors has been insignificant with all the demographic variables of the study.

B. Recommendation

The research has suggested that developing the parking facilities and improves the customer handling services by expanding the parking facilities for the BIA users by preparing the proper plan for the parking might enhance the satisfaction of the customer. Research has proposed that upgrades in communication, information technology and Wi-Fi facilities, and a vast range of retailer will heighten the attraction. Establishment of free Wi-Fi service has been required by most of the respondents.

BIA should introduce the modern facilities like other airports in the world to attract the foreign investments to develop Sri Lankan economy by giving better services to the passengers and need more caring about the passengers. BIA must facilitate with the separate immigration counters for the foreigners and local passengers. Otherwise, all the passengers have been standing on a queue until the right turn and the checking counter staff services must be improved by allocating more staff for the different requirements of the passengers.

C. Limitations of the Study

The scope of the study has limited to Bandaranaike International Airport services in Sri Lanka, but Sri Lanka has another airport to handle passengers. Factors that affect customer satisfaction in another Airport service could be different from the findings of this survey. In future studying & surveying on all the Airport services in Sri Lanka will help to overcome this limitation.

In future studies surveys done with other terminal and another airport, related respondents may give a solid result.

Affecting of more demographic factors will be enhancing the opportunity to measure the satisfaction of the passengers by doing future research on it. Developing of the research can be carried out by adding more variables other than mentioned in this research and according to that analysis the passenger preference on the BIA.

VI. ACKNOWLEDGMENT

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Judicial Intervention on Environmental Protection Through Judicial Review with Special Reference to Sri Lanka

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***Abstract* - The concept of solidarity as advanced by Durkheim in the 18th century concerns about the totality of a given society in which it tries to work together as a cohesive unit. Durkheim observed that at the initial stages, that is to say in the primitive societies people bonded together because of their similarities. As most of the people in a tribe or a clan in those periods were self-sufficient and their needs and wants being limited in nature, they were capable of surviving on their own and hence they formed alliances with one another out of their similarities. This was termed as mechanical solidarity. Durkheim observed that, during these periods laws were stringently applied and that any deviant behaviors were heavily condemned and retributive justice was considered to be the norm. However, as the societies grew in numbers, the similarities which existed among the people in a tribe or a clan soon started to disappear and more and dissimilarities and differences among them began to arise. With these latter developments, the unity of the society was protected by a different kind of solidarity, which is termed as organic solidarity. Under this particular system social unity is based on a division of labor that results in people depending on each other. As one person became dependent on another the relationships which existed prior to such change of circumstances were not able to provide for the rather complex relationships which started to develop with the division of labor, where each person was somehow, or the other produced a commodity which was to be exchanged with other commodities in which the exchange of ones capabilities with another became the norm of a society. Durkheim explained that, even with these differences people had to work together under an organic solidarity to make sure of their future existence. Durkheim observed that, during these periods, the laws are made not so with a retributive aim but with a rehabilitative aim, in which offenders or deviants are rehabilitated so that they can be re-released to a given society where once again they can become productive individuals. Using a black letter approach, this paper tries to evaluate the theory of solidarity as advanced by Durkheim in a conceptual manner with the prevalent realities of the modern society. In doing so this paper looks at the contemporary arguments which have been put forward both for and against the ides presented by Durkheim with regard to his idea of solidarity. From these contemporary writings it has been found that, though not in its entirety, the Durkheimian concept of solidarity still holds true with regard to the working of or keeping a society together admits all of its differences.**

***Keywords*- Sociology, Mechanical Solidarity, Organic Solidarity, Durkheim**

I. INTRODUCTION

Environment is a major concern for all the countries in the world whether rich or poor, developed or underdeveloped. It has turned from the common heritage of the mankind to the common concern of mankind [8]. Concerns lie in the destructions that are caused to the environment by the activities of people who are chasing the dreams of development at the cost of environment. It is axiomatic to point out that "mankind is the part of nature and life depends on the uninterrupted functioning of natural system which ensures the supply of energy and nutrients" which is essential for every life support system [10]. Environmental law was initially considered as a part of the broader conception of public international law and through the evolution of time and the concerns raised about the environmental issues grew in the domestic terrain and the domestic realm of environmental law was developed to both address and combat the environmental problems that were created and later faced by the countries all over the world. Environmental law consists of a body of complex interlocking rules, agreements and treaties that operate to regulate the interaction of humanity and the rest of the natural or physical environment. Its goal is to reduce the impact of human activity both on the natural environment and on humanity itself [9]. Giving an adequate definition for the term environment or environmental law is a very difficult one [4]. However, Einstein has once observed, 'The environment is everything that is not me'. The definition provided by Einstein is given from a biocentric perspective where the environment is valued for its own sake and not for the only value it has for the mankind.

The recognition of the environment or recognizing the fact that we have done so much harm to it and that we need to act now to protect it came about in the 1960s after most of the development projects were

shaping up to rebuild countries from the effects of the second world war. In particular, Rachel Carson's book 'the silent spring' arouse much interest and controversy with regard to the need of protecting the environment. With this arousal of interest, the global leaders had to come together and act in order to prevent further irrecoverable damages being caused to the environment. One of the major events that happened was the adaptation of the Stockholm declaration in 1972 which focused on the human environment, where for first time in history of human kind a universal declaration was created to address environmental issues that were prevalent in the globe at that time. Even in a context where United Nations declaration on human rights omitted to give a special emphasis on the environment in its Articles, Stockholm declaration directly address the environment and according to the Article 1 of the Stockholm declaration, it declared that 'man has the fundamental right to freedom, equality and adequate conditions of life, in an environment of a quality that permits a life of dignity and wellbeing, and he bears a solemn responsibility to protect and improve the environment for present and future generations'. The first principle itself entails the environmental principles of sustainable development and environmental protection.

The environmental protection from a Sri Lankan context has to be evaluated from its own laws and regulations. The first and foremost source of the law which is the Constitution of the country does recognize the importance of the environment in its state directive policy whereby according to Article 27 (14) which declares the duty owed by the state to protect and enhance the environment. The directive policy is a guide for the government to adopt when it is taking decisions and accordingly there is a duty on the government to take environmental considerations into account when it is going to develop the country. Under Article 28 (f) there is a corresponding duty on every citizen to protect nature and conserve its riches. But this is never put in to too much of a focus.

However, the fundamental rights chapter that gave the citizens of the country for the first time in its constitutional history what we call justiciable set of human rights in the form of fundamental rights under Chapter 3 of the constitution does not recognize a right to a clean and healthy environment. Therefore, when a person is trying to invoke the fundamental rights jurisdiction of the Supreme Court he or she cannot make a claim for a breach of fundamental rights if that violation only refers to an environmental aspect that does not have a necessary connection to any of the other fundamental rights that have been recognized under the constitution. This is a big lacuna in the system as not even the fundamental right to life was recognized in the constitution and it was only after a purposive interpretation given in the judgment of [11], by justice Bandaranayke that the right to life was fully established in a positive form where it was put in a negative form in the constitution by declaring that no one can take the life of another without a lawful authority under Article 13(4). This is of serious concern for a country like Sri Lanka because where the right to life is not recognized as a fundamental right would mean that unless the judiciary takes a very broad view or give an expansive interpretation to the existing set of fundamental rights, rights such as, right to a healthy and clean environment may never be realized.

In comparison to this, the Indian constitution which recognizes the right to life under a positive form under Article 21 of the constitution, according to Rosencranz the boundaries of the fundamental right to life and personal liberty guaranteed in Article 21 were expanded to include environmental protection. The court recognized several unarticulated liberties that were implied by Article 21. It is by using this method that the Supreme Court interpreted the right to life and personal liberty to include the right to a wholesome environment [3]. Further, Abraham observes that the judiciary-led legal developments in India were achieved by resorting to the extraordinary powers of the higher courts [1]. However, in absence of such provisions in the Sri Lankan Constitution there has to be some other measures that has to be made available for protecting the environment. The process of judicial review is one such mechanism where even in the absence of constitutional provisions a court of law can intervene and aid in protecting of the environment when the jurisdiction of the court is invoked through the judicial review process. Judicial review is based on the premises of separation of power, rule of law and constitutionalism. Judicial review is thus not only an integral part of the constitution but also a basic structure of the constitution. The process of judicial review is one way of making public bodies accountable to the courts and ensuring that they only act within the powers given to them by Parliament. Accordingly, judicial review addresses the legality, and not the merits, of a decision [2]. Hence, when public bodies take decisions that have serious repercussions on the environment, the judicial review of those decisions that do not stay within the legitimate boundaries of the authority which has been granted to such authorities, such decisions can be invalidated by the court and the case can be referred back to the authority who took the decision to reconsider that particular decision. Article 140 of the Sri Lankan constitution sets out the provisions relating to judicial review. The provision states that, subject to the provisions of the Constitution, the Court of Appeal shall have full power and authority to inspect and examine the records of any Court of First Instance or tribunal or other institution and grant and issue, according to law, orders in the nature of writs of *certiorari, prohibition, procedendo, mandamus* and *quo warranto* against the judge of any Court of First Instance or tribunal or other institution or any other person. The court of appeal therefore has the power of judicial review over the decisions taken by

governmental bodies below that. Environmental judicial review on the other hand is somewhat of a recent phenomenon, and it has its roots in the United Kingdom where there is now plenty of literature that has been written on the subject [7]. Environmental judicial review specifically deals with its own procedures and methods of reviewing decisions of public bodies that has direct consequences on the environment.

II. RESEARCH QUESTION/OBJECTIVES

Sri Lanka as a developing country is making new strides towards development at a rapid speed and whether that development is sustainable or not remains to be questioned. While its constitution has given a set of fundamental rights for its citizens to enjoy and invoke when infringed or is in imminent threat of being infringed, the set of established fundamental rights lack the ability to bring in environmental concerns or to positively assert a right to environment. In this context this research endeavors to find answers to following questions, namely, what is the existing law regarding environmental protection, how does the constitutional provisions help to protect the environment, are the existing provisions sufficient to protect the environment, what is meant by environmental judicial review and whether it is a viable mechanism to protect the environment in the absence of positively obliging constitutional provisions to that effect. Therefore, this research has the main objectives of describing the existing law regarding environmental protection in Sri Lanka, examining the constitutional provisions relating to environmental protection, deducing the adequacy of the existing legal framework in protecting the environment, arguing for environmental judicial review as a method of protecting the environment and testing the viability of such a system in a Sri Lankan context as a mechanism for environmental protection.

III. METHODOLOGY

This research is conducted using a qualitative method. The research uses primary legal sources such as constitutional provisions, legislative enactments and decided case law from both the Sri Lankan and foreign jurisdiction in order to accommodate a comparative study of the research. As secondary legal sources the research uses writings of the highest authority in the field and other comments made on the subject by reputed scholars. Due to the constraint of available resources this research only uses quantitative techniques of research only in a complementary manner. This research is limited by the availability of empirical data on number of cases that are brought forward before the Court of Appeal and the Supreme Court referring to an environmental issue where the judicial review is invoked. Though, the research is done based on looking at the existing, constitutional, legislative provisions and judgments pronounced by both local and foreign jurisdictions, the existing legal discourse in the field of environmental judicial review itself would help to get rid of the disadvantage caused by the lack of empiricism in the article.

IV. DISCUSSION/RESULTS

The Sri Lankan Legal system which considers Roman-Dutch Law as its common law is now departing its roots from these traditions to more English Law based statutory laws to cope with the modern structures of the local and international communities. When one looks at the existing legal framework on environmental protection, Sri Lanka dose not certainly lack legislations, regulations or rules that are put in place for the protection of environment. In fact as with its legal system where due to a variety of common and personal laws which exist to make things complicate at times, environmental protection legislations which are many in numbers overlap and therefore create confusions as to the duties and responsibilities of relevant environmental departments and authorities hence creating a situation where the *ball is being passed* between these institutions without the work being getting done [6]. The earlier pieces of legislations such as Geological Survey and Mines Bureau Forest Ordinance No. 16 1907, Fauna and Flora Protection Ordinance No 2 of 1937, Ordinance for the Protection of Areas Subject to Damages from Floods No. 4 of 1924 and Land Development Ordinance No. 19 1935. All of these legislations and including many others shared the common goal of protecting the environment.

However, the main legislation relating to the environmental protection is the National Environmental Act No. 47 of 1980 (NEA) which has the main objectives of protection, management and enhancement of the environment, for the regulation, maintenance and control of the quality of the environment; for the prevention, abatement and control of pollution. The NEA uses the two-protective mechanism to safeguard the environment form developmental activities. Firstly, the environmental protections licenses issued under the provisions of the Act and the Gazette Notification No. 1533/16 dated 25.01.2008 prescribes certain activities which will require an environmental protections license in order for a person to carry on with such an activity legally. This is aimed at safeguarding the environmental from the excessive adverse impacts caused by small and medium scale activities. Secondly, the Environmental Impact Assessments or more commonly known EIA's are required to be carried out regarding major development projects in order to analyze the relative costs and benefits of a project.

In addition to these legislations there are several authorities and departments that are empowered to take necessary measures in protecting the environment and they include, department of wildlife conservation,

metrological department, national water supply and drainage board, marine pollution prevention authority and so many others. The Central Environmental Authority, commonly known as the CEA is the main body that is empowered with protecting the environment and its vision is to make a clean and green environment. The general overview of Sri Lanka 's legislation asserts that a comprehensive legal and institutional infrastructure has been developed, including laws for controlling land air and water pollution. However, it also acknowledges the widening gap between Sri Lanka 's environmental goals and its achievements. This is put down to inadequate management skills, ill-defined project planning, poor law enforcement, confusing procedures, inadequate training and poor facilities [12].

Sri Lankan Environmental Management and protection Policy originates from the country's supreme law which is the Constitution. The 1978 Constitution recognizes that the State shall protect, preserve and improve the environment for the benefit of the community according to Article 27(14) of the directive principles. However, it is clearly mentioned in chapter VI of the constitution which contains these directives that, 'the provisions of this Chapter [VI] do not confer or impose legal rights or obligations and are not enforceable in any court or tribunal. No question of inconsistency with such provisions shall be raised in any court or tribunal'. Hence, though the directives guide the governments in decision making it does not compel them to take these directives in to consideration. It is clear from this fact that the constitution has failed to make justiciable the right to a clean and healthy environment. However, the Supreme Court as the protector of fundamental rights has on some occasions realized the importance of environment and the need of protecting the same.

Unlike other South Asian jurisdictions, where the right to clean environment has been carved out of right to life, in Sri Lanka the same has been done through the invocation of right to equality. The Supreme Court by referring to Article 12 of the Constitutions, which is called as the non-discrimination clause in (*Wattegedera Wijebanda vs. Conservator general of forests and others*, 2009) held that, 'even if environmental rights are not specifically alluded to under the fundamental rights chapter of the Constitution, the right to clean environment and the principles of equity with respect to the protection and preservation of the environment are inherent in a meaningful reading of Article 12(1) of the Constitution'. The *Public Trust* doctrine has come in the discourse of environmental protection and is a pinnacle doctrine for enforcing the duty of the state to protect the environment declared under Article 27(14) of the Constitution. The origins of Public Trust doctrine can be traced to Justinien's Institutes where it recognizes three things common to mankind i.e. air, running water and sea, (including the shores of the sea). These common property resources were held by the rulers in trusteeship for the free and unimpeded use of the general public (*Environmental Foundation Limited and Others v Mahaweli Authority of Sri Lanka and others 2010*) The Public Doctrine asserts that, those who hold public office must act as trustees of people regarding the management of environmental resources and protection. It was observed in (*Wattegedera Wijebanda vs. Conservator general of forests and others*, 2009) that, recognition of the doctrine of 'public trust', accords a great responsibility upon the government to preserve and protect the environment and its resources.

However, even with these constitutional and legislative instruments the data regarding the status of Sri Lanka's environment are not satisfactory. Issues such as deforestation; soil erosion; wildlife populations threatened by poaching and urbanization; coastal degradation from mining activities and increased pollution; freshwater resources being polluted by industrial wastes and sewage runoff; waste disposal; air pollution in Colombo have significantly impacted the environment in an adverse manner. The forest area of the country has decreased from nearly 23000 in 1990 square kilometers to 20500 in 2015 according to officially recognized sources. Though Sri Lanka has better numbers when compared to other south Asian countries regarding air, soil, water and noise pollution, those numbers fall very short with that of the developed countries. Further, due to the politicized development projects that have taken place in the country such as the Colombo fort city project and the Uma-Oya project, environmental concerns have come second and the damage to the environment caused by these projects have been somewhat ignored by the public at large. Though there have been protest and hostilities towards these projects, nothing has put an end to them and all things have turned futile.

Judicial review is a facet of the judicial power of the People, which in terms of our Constitution is exercised ordinarily through the courts. The power of judicial review of administrative action is primarily vested in the Court of Appeal by Article 140 of the Constitution, which empowers that court to grant and issue "according to law" writs such as writs of *certiorari,* prohibition, *procedendo, mandamus* and *quo warranto* against the judge of any court of first instance or tribunal or other institution or any other person (Marsoof, 2010). The development of environmental judicial review is heavily influenced by considerations of political theory, such as the importance of economic access to justice, the value of public participation and transparency in public decision-making. the application of the familiar grounds for judicial review is therefore shaped by competing theories of environmental governance and justice, and it is necessary first to understand the context before considering the detail [7]. Recognition that environmental judicial review is distinctive

prompts a more general enquiry into the nature of judicial review and administrative law.

Judicial Review can easily be invoked in cases relating to issuance of Environmental Protection License (EPL) and Environmental Impact Assessments (EIA). It will be seen that the courts have distinguished between the environmental impact assessment regime, which places great emphasis on the public right to participate (militating strongly against the courts exercising a discretion to refuse relief) and, on the other hand, the habitats regime, which does not include a participatory role for the public at the stage of carrying out an appropriate assessment (which militates in favor of refusing relief) [7]. Further it can be used in a Sri Lankan context to add additional thrust to the protection of the environment as judicial review is a discretionary remedy and that discretion is capable of being used for good effect in protecting the environment.

The importance of judicial review lies in the fact that it is only an extraordinary remedy and that no one as of right has a right of or to judicial review. Claimants for judicial review must first exhaust alternative remedies, and thus other routes of redress are relevant to whether judicial review will actually be available. Therefore, as mentioned earlier, in situations where there is a political or other outside interference with the decision-making process that may have adverse impacts on the environment judicial review acts as a last bastion of hope. The judicial review process therefore should be based on a rationality that is both appealing to the political and democratic ideologies.

To understand the dynamics of environmental judicial review it is important to find out the various parties who may bring claims and to explore their motives for doing so. This is important because the identity of the parties to an environmental dispute influences judicial decisions on issues such as costs, standing and the award of discretionary remedies. Exploring the parties who are likely to bring an environmental judicial review claim also gives an insight into how effective the enforcement of environmental law actually is in practice [7]. Four major categories of environmental dispute may be identified: (i) disputes between the regulator and the regulated; (ii) disputes between a disappointed applicant and the decision maker; (iii) challenges by interest groups or individual members of the public; and (iv) challenges by commercial competitors.

Firstly, most environmental judicial review claims are disputes between environmental regulators and the industries that they regulate. Most of the times the regulators will want to make sure that the industries are following the minimum standards that are set by the governments and on the other hand the industries would want to show that they are following these minimum standards. When disputes arise between these parties' judicial review can accommodate for a proportionate way to decide on the dispute and hence as its ultimate goal strive for environmental protection. Judicial review should not be thought as something which hinders development, instead judicial review should be considered as a sustainable development mechanism which can be used to both protect the environment and to advance the sustainable development of a country. In the case of (*Dissanayake and others v Geological survey and mines bureau and others* 2011), the petitioner invoked the writ jurisdiction of the Court of Appeal seeking a *mandamus*. The question that arose before the court was a failure on the part of the Conservator of Forests to gazette the EIAR under Section 23 BB [4] of the National Environmental Act 47 of 1980. The court held that, the Conservator of Forests - was in breach of a statutory duty amounting to unfairness and an abuse of power when he did not comply with gazetting the project approved by the Technical Evaluation Committee (TEC). This case clearly illustrate that judicial review is pro-sustainable developmental.

Secondly, a large number of environmental disputes arise due to the number of activities affecting the environment that require some form of license or permission, inevitably there are large numbers of judicial review decisions by disappointed applicants. However, the judiciary while respecting the individual rights must also consider about the public right to environment and hence be able to strike a fair balance between private and private rights. In the case of (*Vishvanath v Divisional secretary, Madhurawala and others* 2006) the question that arose before the Court was suspension of a trade permit to operate a stone quarry for 2002. The Court decided that the suspension was justified on the ground that, the refusal to extend the petitioner's authority was not arbitrary and was justified by the protests of (neighbors) affected parties and environmental considerations. However, it must be remembered that, even where disappointed applicants manage to persuade a court that the impugned decision was unlawful, judicial review does not guarantee a favorable decision. A successful judicial review claim can only result in the quashing of an unlawful decision which is resend to the decision-maker for redetermination on the correct legal basis. After redetermination, it is entirely possible for the decision-maker to affirm the decision given earlier [7].

Thirdly, an increasing number of environmental judicial review claims are brought by groups or individuals in the public interest. These claims are motivated by ideological concerns and are part of the wider phenomenon of green politics or environmentalism. Prominent and well-resourced pressure groups in the environmental field, such as, the Environmental Foundation Limited, Friends of the Earth Sri Lanka, Sri Lanka Wildlife Conservation Society and Center for Environmental Justice are some of the most well recognized ones. Many breaches of

environmental law do not harm any individual in particular, and there is little incentive for ordinary members of the public to enforce environmental duties. In many cases an environmental pressure group with a particular concern for a given species or habitat is likely to be the only potential challenger [7]. Through the development of the concept of Public Interest Litigation or commonly known as PIL applications, the judiciary facilitates the access to justice for those of whom who are incapable of protecting their environmental rights by themselves. Especially in the case of fundamental rights, public interest litigation have pave the way for parties to intervene with fundamental rights issues with the broadening of the scope of *locus standi* which is used to filter in the cases to the Courts. In the case of (*EPL v UDA Sri Lanka* 2009), where the issue was related to handing over of the management and control of the 14 acres - "the Galle Face Green", to E. A. P. Ltd and one of the questions that had to be decided was whether EPL had the *locus standi* for the case. The Court opined that, 'the word "persons" as appearing in Article 12(1) [of the constitution] should not be restricted to "natural" persons but extended to all entities having legal personality recognized by law. The Court further opined that, the Petitioner has acted in the public interest and exposed acts on the part of the UDA that are clearly *ultra vires*. In the case of (*Bulankulama* 2000), the Court held that, the individual petitioners have standing to pursue their rights in terms of Articles 17 and 126(l) of the Constitution. They are not disqualified on the alleged ground that it is a "public interest" litigation. The court is concerned with the rights of individual petitioners even though their rights are linked to the collective rights of the citizenry of Sri Lanka, rights they share with the people of Sri Lanka. [T]he modern trend is for the judiciary to facilitate access to justice by such pressure groups in order to promote the effective enforcement of environmental law [7].

Fourthly, in contrast to challenges brought by pressure groups and ideologically motivated individuals, challenges by commercial competitors are entirely self-interested. Such challenges are usually brought against the decision to grant a valuable permission or license to a commercial rival. The claimant typically argues that the decision to grant permission or license to the rival company was unlawful because of a breach of environmental law, and consequently the decision should be quashed [7]. However, in the Sri Lanka context such instances or examples are far and few in between.

From the above case law, it can be seen that the Courts of Law have made huge interventions when it comes to environmental protection through judicial review coupled with the fundamental rights. Thus, it seems viable that judicial review is an appropriate mechanism for the protection of environment in the absence of a coherent legal framework for environmental protection and justiciable obligations imposed upon by the Constitution on those who are responsible for the protection of the environment. Concepts developed by the Courts, such as the public trust enables the Courts to impose upon the individuals the responsibility of protecting the environment which is not made justiciable under the constitution. Further, the broadening of the *locus standi* allows the less-capable and the under privileged people to gain access to justice through the medium of pressure groups and environmental conscious private organizations who can accommodate for the collective individual rights of the people. Further, as mentioned above, since judicial review is a discretionary process, that discretion could be freely used by the Courts to protect the vital interest of the environment.

But there is a fundamental problem under the concept political legitimacy, whereas unelected members, the judiciary, through the process of judicial review is capable of overruling the democratic authority of the government decision and policy making. The general criticism leveled at general judicial review can be leveled at environmental judicial review as well. Therefore, a country thriving for a sustainable developmental approach much have in its Constitution, provisions for environmental protection and sustainable development. In 2017 the government of Sri Lanka introduced the Sustainable Development Act No 19 of 2017 which states in its preamble that, '[The Act] intends to design, develop and implement a National Policy and Strategy on Sustainable Development and facilitate all agencies responsible and to follow up and monitor the progress'.

Environmental judicial review claims are amongst the most factually complex judicial review proceedings. Frequently they involve voluminous factual, policy and technical material, often requiring a court to understand complicated scientific processes or modelling. There are significant practical and financial hurdles facing private persons contemplating civil litigation to enforce environmental law. A claimant will have to obtain funding for its own legal advice and representation, and in the event of defeat, it may face exposure to paying the legal costs of the victor. These costs are likely to be considerable and in many cases, will prove a prohibitive financial burden. The democratic deficit in environmental law is heightened by the fact that at the domestic level many environmental decisions are delegated to independent agencies with only indirect and weak links to the electoral process. Delegation of this kind is justified by the need for technical and scientific expertise in environmental decision-making. The setting of environmental standards requires a balance to be struck between environmental protection and other social and economic objectives. It also requires the prioritization of competing environmental interests [7]. Therefore, when one considers these constraints in the judicial review process, still having a constitutional

provision on environmental protection and sustainable development are of paramount importance and realizing this fact in the new draft constitutional committee report it was suggested that such right be recognised as a fundamental right.

V. CONCLUSION

The right to a healthy and a lean environment which is recognized through many international instruments is not recognised in a positive manner in the Constitution of Sri Lanka. It was further observed that other laws which exist regarding environmental protection overlaps due to the uncertainty of respective duties and obligations of the relevant authorities. Therefore, in the absence of a proper mechanism to protect the environment, judicial review has to be considered as a one important mechanism in protecting the environment.

Judicial review, as a discretionary remedy has the strength of being able to take each and every case upon their relevant merits. It enables to draw the line between development and environmental protection. When used in a proper manner it helps to resolve conflicts that gives rise to environmental pollution to be decided in favour of neither of the claimant/defendant nor the institution but the environment.

Judicial review through the development of concepts such as the public trust and public interest litigation made it and obligation on the policy and decision makers to take environmental considerations in to consideration in a situation where under the directive principles of the Constitution authorities are merely guided but not made obliged to take in to consideration the environmental aspects.

However, when one considers the political legitimacy of a Court in overruling the decisions made by a much more democratic institution than it, it becomes evident that judicial review in environmental protection can only be made available till necessary constitutional amendments are made to recognize the environment and protection thereof are both fundamental rights and duties made justiciable by the Constitution itself.

Therefore, it becomes paramount that, while having judicial review as the last bastion of hope where every other mechanism fails to adequately protect the environment, the protection and the maintenance of the environment should come from a supreme force of law, which in most of the instances is the Constitution. In considering this, judicial review itself should advocate for the Constitutional recognition of right to a clean and health environment.

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Study on Factors Influencing Waste Disposal Cost and Optimize in FMCG Industry in Sri Lanka

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Abstract - **Waste is one of the greatest difficulties confronted by people in any country where waste contaminates indigenous habitat with devastating results if the authorities fail to take care accurately. In any case, it appears to be practically unavoidable that our general public, manufactures, industrial businesses etc produces waste whereas only can be minimized hence the point of this rationale thesis has been to explore how to recover the material assets by rethinking waste as an asset.**

The study primarily focuses on two stakeholders, mainly FMCG companies in Sri Lanka who produces numerous waste per month and secondly the study focuses on professional recyclers who have ability to recycle under proper long-term agreements with unwavering trust.

This paper investigates a way of sustainably disposing product wastes of FMCG companies and also the determinants of waste disposal cost and ways of optimizing in fast moving goods industry in Sri Lanka. Thus, two questionnaires were distributed focusing on FMCG players and professional recyclers within Sri Lanka to measure determinants of waste disposal cost as well as to identify a strategy to aid generating profits instead of previously used cost generative process of direct disposing the FMCG wastage. Thus, factor analysis was conducted using two hundred and ten responses and the analysis extracts seven major factors as determinants to the waste disposal cost. This study concluded a successful waste disposal strategy as sorting and recycling where can change the current game play of the FMCG companies to a new direction.

Keywords - **Waste management, Fast Moving Goods Industry, Recycler**

I. INTRODUCTION

Throughout the history of mankind, the application of logistics and supply chain continue to emerge with the growing needs & wants of users where Fast Moving Consumer Goods plays a vital role by satisfying those requirements in daily lives where traditional trade gives customer/consumer the same experience in buying as in old times while modern trade makes a new experience by giving consumers the opportunity to select their requirements themselves under one roof. However, both inter as well as intra traders compete to fulfil the social needs and wants of

Accordingly, different ways of product wastages defined according to Basel Convention of 1989 as "substance or objects, which are disposed of or are intended to be disposed of or are required to be disposed of by the provisions of national law" [1]. Hence, the rate of disposal has been on the rise, more and more damaged & expired goods are thrown away by wasting money and effort while making threats to the environment, society, individual and industries as well as devastating results attributable to increasing population and developing of industries. As there is a twofold scenario where people can't totally eliminate this issue it needs urgent solutions by changing the existing tracks on how companies work on this crucial area of managing waste [2].

Hence in a time period where product handling process is labour intensive in Sri Lanka and industries still can't afford capital intensive processes, this study covers the possibilities where can identify key areas of waste and optimize. Further, FMCG companies do not devote any time or effort to treat their waste [3] in Sri Lanka because they think that selling new products is more effective than spending money and resources on treating discarded equipment for make it usable again, especially in developing countries which do not have many legal frameworks for waste management [4].

Therefore, the overall significance of this study is that it will serve as a working document for policy makers to make regulations where currently existing regulations are based only on pesticide items disposal. This study is also an exemplarily way of turning garbage into wealth (money). So, it is hoped that this document shall be useful to other countries particularly in the developing sector which helps to balance economic, social and environmental objectives which are frequently in conflict in reverse logistics processes.

II. METHODOLOGY

A. Identification of Variables

The major objective of the study is to determine the factors affecting the waste disposal cost in the Fast-Moving Goods Industry in Sri Lanka and to identify and propose a more sustainable and cost-effective waste disposal strategy. Hence the author has identified waste disposal cost of Fast Moving Goods Industry as the dependent variable of this research and the determinants of waste disposal cost is considered as the independent variables which was summarized from the literatures respectively. Hence, these characteristics further concluded that this research takes the nature of a casual research.

B. Questionnaire Design

Initially a web based assessment questionnaire was prepared to overcome geographical barriers using Nominal, Likert and Interval scaling method to collect the primary

data required for the study along with 21 factors as the factors affecting to waste disposal cost in FMCG industry in Sri Lanka. Besides, the questionnaire focused on the FMCG industry where FMCG waste is generated and consists of 3 segments for easy understanding of the questions.

C. Sample Design

In the view of all 65 companies including multinationals and locals who control the Sri Lankan FMCG business in small, medium and large scales which have licentiates to produce FMCG products, here the study mainly focuses on 45 companies including local & multinationals all over in Sri Lanka and 5 questionnaires were distributed for each company for the purpose of collecting authorized data after the pilot survey confirmed the validation.

Altogether 210 primary responses were received out of the sample of 300 distributions by making available the questionnaire for a period of 50 days and secondary data was gathered from secondary sources such as scholarly articles, journals, reports and web pages based on waste management concepts in Sri Lanka as well as in international regimes.

However, varieties in the industry led researcher towards the stratified random sampling technique to design the sample & hence all the distributed questionnaires categorized as 75% for multinationals & 25% for local FMCG players as per the percentage in population since currently the market is dominating by multinationals from a percentage of 75% whilst local FMCG players only can afford for 25% market share in the competitive market.

Hence, selected sampling approach can be statistically justified since the sample represented more than 50% of the population with consideration of 95% confidence level.

D. Validity and Reliability

Cronbach's Alpha is used in statistics to measure the internal consistency/ reliability which is most commonly used to verify the reliability of the scale in a multiple Likert-Scale questionnaire. Higher rate of Alpha coefficient measured the questionnaire as being more reliable to collect the primary data related to the survey.

Conventionally, it is recognized that Cronbach's alpha coefficient requires 0.70 or has to be elevated to be reliable. Following equation (1) is for calculating total Cronbach's Alpha coefficient. The reliability test using Cronbach's Alpha coefficient has been carried out in this paper to check the reliability of the pilot and main surveys.

$$\alpha = \frac{N.C}{V + (N-1).C} \quad \text{..... (1)}$$

N = the number of items.
C = average covariance between item-pairs.
V = average variance.

E. Statistical Methods of Data Analysis

Data collected through the questionnaire survey were fed into SPSS 16.0 (a statistical software tool) in order to generate a broad analysis of the study.

F. Descriptive Analysis

Descriptive analysis is broadly utilized as a part of the field of research, keeping in mind the end goal to summarize and show the information set close by. This specific factual train fundamentally compresses the elements in the sample in a quantifiable way, instead of summing it up to the population. Together with basic graphical presentations, descriptive measurements give a quantitative depiction of the example which is particularly helpful in distinguishing test attributes that are persuasive in making determinations of the sample. Insights, for example, frequency distribution, measures of central tendency & measures of variability are analysed among others.

G. Factor Analysis

There are two types of factor analysis: exploratory factor analysis and confirmatory factor analysis. In this study exploratory factor analysis has been carried out which is a statistical method used to uncover the underlying structure of a comparatively large set of variables. The goal of exploratory analysis is to identify the underlying relationships between measured variables [5].

Descriptive insights, Bartlett's and Kaiser-Meyer-Olkin (KMO) test, Communalities, Total Variance, and Rotated Component Matrix is computed and analysed using SPSS 16.0 software. The Bartletts test compares the observed correlation matrix to the identity matrix. It checks whether there is a particular redundancy between the variables that can be summarized with a small number of factors. If the variables are perfectly correlated, only one factor is sufficient.

The Bartletts test checks whether the observed correlation matrix R= (rij) (p x p) deviates significantly from the identity matrix.

H1a: Correlation matrix is an identity matrix.
H1b: Correlation matrix is not an identity matrix.

Total variance is explained in the initial solution table. Eigen value is the total variance described by each factor. Eigen values that are less than one does not have enough total variance explained to represent a unique factor.

Eigen values which are less than 1 can be excluded from the variables. Thus, the overall KMO index is computed as follows.

$$\frac{\sum_i \sum_{j \neq} (r^2)}{\sum_i \sum_{j \neq} (r^2) + \sum_{j \neq} (p^2)} \quad \text{..... (2)}$$

p = Partial Correlation

r = Correlation

H. Chi-square Test of Independence

This particular test concludes whether there is a significant relationship between the two variables in the particular hypothesis or not. It is significant to state a significance level for this test beforehand which according to most researchers, is usually 0.5. Same significance level has been used in this study when conducting the Chi-square test. Chi-square random variable (X^2) is defined by the equation below.

$$X^2 = \sum \left(\frac{(O\gamma\varepsilon - E\gamma\varepsilon)^2}{E\gamma\varepsilon} \right) \ldots\ldots (3)$$

X^2 = Chi-square random variable

$O\gamma\varepsilon$ = the observed frequency count at level γ of Variable A and level ε of Variable B

$E\gamma\varepsilon$ = the expected frequency count at level γ of Variable A and level ε of Variable B.

Significant variables can be identified by analyzing the results of Chi-square test of independence. These significant ariables can be used to further analysis.

III. DATA ANALYSIS

I. Descriptive Statistics

TABLE I
COMPANY SIZE

		Frequency	Percent	Cumulative Percent
Valid	Small – Below 150 employees	70	34.3	34.3
	Medium – 150 to 500 employees	84	41.2	75.5
	Large – Above 500 employees	50	24.5	100.0
	Total	204	100.0	

According to Table I, 34.3% of the respondents in the sample represent small scale FMCG companies which acounts for 70 responds and consequently 41.2%. 24.5% of the responds which account for 84 & 50 respondents respectively represents Medium & Large scale FMCG companies. Hence table demonstrates that the highest percentage of responds is in Medium scale FMCG companies where within the industry. And the all respondents positioned in all categories which will reduce the biasness. Hence the data set which is collected for the analysis will be very significant.

TABLE II
MONTHLY PRODUCT WASTAGE GENERATION

		Frequency	Percent	Cumulative Percent
Valid	Below 4 ton	58	28.4	28.6
	Between 4 – 8 tons	73	35.8	64.5
	Between 8 – 14 tons	45	22.1	86.7
	Above 14 tons	27	13.2	100.0
	Total	203	99.5	
Missing	System	1	.5	
Total		204	100.0	

As per the Table II, the highest percentage level of generated waste size is occupied by 4-8tons category or 35.8% which accounts for 73 responds & 28.4%, 22.1% & 13.2% precentages of wasgate generation has occupied by below 4 ton, between 8-14 ton & above 14ton categories respectively & accounts for 58, 45 & 27 responses. Hence it concludes that most of the companies generate 4 to 8 tons of FMCG waste per month.

TABLE III
FREQUENCY OF WASTE CLEARANCE

		Frequency	Percent	Cumulative Percent
Valid	Weekly	24	10.7	17.4
	Once a month	87	42.6	62.1
	Twice a month	73	35.8	99.5
	Thrice a month	11	6.5	100.0
	Total	195	95.6	
Missing	System	9	4.4	
Total		204	100.0	

According to Table III, Waste clearance frequency of FMCG companies are high in once a month & twice a month category which is shown as 42.6% & 35.8% of the responses. In the perspective of recyclers Table II & Table III, it concludes the business of recycling isn't unstable industry waste generation is huge as well as promising.

Figure 1 illustrates that the highest product wastage is generated in Expiration as well as in the production process & smallest level of waste is generated at the transportation & within warehouse hence in the FMCG Company's perspective; expiration is the critical scenario that need to be balanced somehow to manage waste generation.

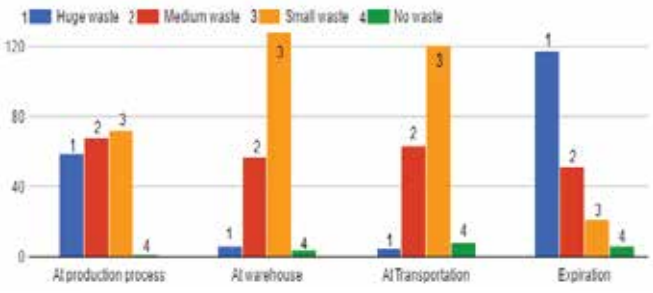

Fig.1 Waste generation scenarios

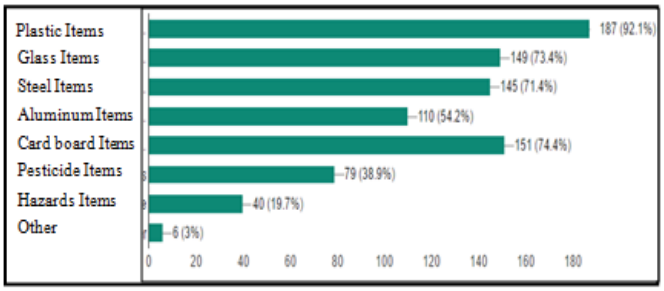

Fig.2 Types of FMCG waste

According to the figure 2 focused on parts & components which an FMCG product is made of, most of the responses are weighted on plastic, glass, steel, aluminium & cardboard items in a frequency of 187, 149, 145, 110 & 151 respectively out of 205 total responses thus it could be concluded that almost 75% of FMCG companies use these types of parts & components to develop finished products. Ultimately in waste disposal process also, the same percentages of components & parts will be available resulting in recyclers collect enough levels of input to recycle.

However, components which can't be recycled or do not have legal authorization to recycle such as pesticide items & hazardous waste should be disposed under incurring a cost whilst FMCG player has the option to choose whether all other normal components such as plastics, glass, steel etc. need to be disposed along with pesticides or sent to be recycled.

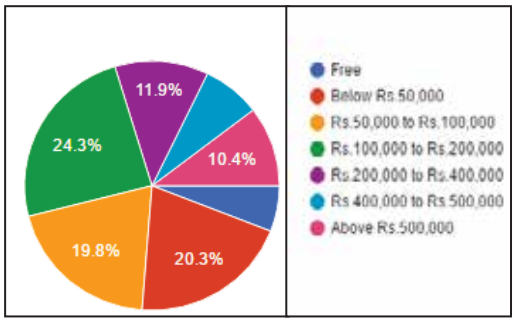

Fig.3 Cost of waste removal process

According to the Figure 3, 76.3% percentage of FMCG companies have already paid up to Rs. 500,000 per month for their waste removal process which is a huge waste of money for unprofitable action. 10.4% of companies have paid more than Rs. 500,000 per month which isn't acceptable by any FMCG player in Sri Lanka. Besides there are some methods such as recycling where revenue can be generated and can smooth line this process.

Furthermore, 2 important questions were asked in the warehouse focused questionnaire to identify the qualitative answer through the companies' view point. It is based on some options whereas if the municipality offered wastage pickup service to pick up unsorted waste from company's doorstep for a fee of Rs 20,000.00 per ton which is currently done by most of private disposers. The problem will be simple and will reduce the workload. However, confusion, reluctant to accept new innovations may reduce Sri Lankan business opportunities from achieving. Accordingly figure 4 illustrates acceptance levels are similarly distributed to all Yes, No, don't know categories in percentages of 38.6%, 28.2% & 33.2% respectively. Hence it is concluding that the same level of attitude will be there in the industry on accepting costs, sensitive on cost as well as having doubts on accepting the process which accounts for 33.3%.

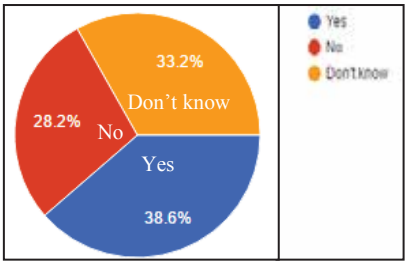

Fig.4 Acceptance level if the municipality offered services for waste collection

TABLE IV
PERCENTAGES OF RECYCLABLE PRODUCTS OF A COMPANY

		Frequency	Percent	Cumulative Percent
Valid		6	2.9	2.9
	0%	1	.5	3.4
	10%	18	8.8	12.3
	30%	32	15.7	27.9
	50%	68	33.3	61.3
	80%	79	38.7	100.0
	Total	204	100.0	

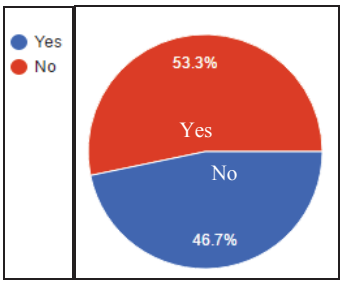

Fig.5 Does the company recycle its waste?

The above figure summarizes the percentage of companies who are already in recycling business and the rest. 53.3% of the respondents denote that presently companies don't focus on recycling processes where as 46.7% of companies are engaged in recycling. Besides Table IV denotes that 79 respondents accounts for 38.7% and 68, 32,18 respondents account for 33.3%, 15.7% & 8.8% respectively who products which can be recycled in its removal situation in a percentage of 80%, 50%, 30% and 10%. Hence it is not a disability to send for recycling but there another reason which is analysed below in Figure 6.

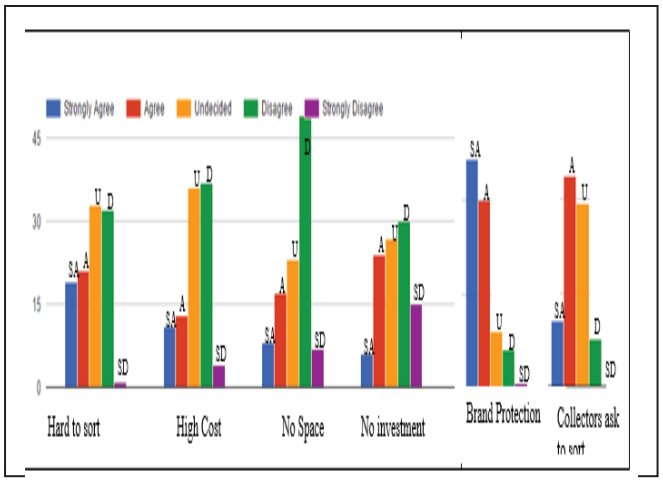

Fig 6: Reasons for not recycling

As illustrated in figure 6, most respondents noted that Hard to sort, High cost, no space & No investment are not critical factors that drive companies away from recycling because reality is that sorting is not hard since one or two men can sort at the time of receiving the damaged/ expired products to warehouse collection centre without storing for post separation. Thus, most of respondents noted as neutral & disagree on sorting point of view whereas some respondents accepted it is as a strongly agree scenario where they might be on situations in post separation.

Secondly, additional cost will not be generated if the process is going as stated in the above paragraph. Thirdly, there is no need of further investment & space as sorting can be done in the same storage & only an initial small investment will be needed.

However, there are 2 major factors as per the analysis which diminishes the ability to recycle. Those are Brand protection policies & Collectors ask to sort before collection. However, brand protection policies is a major issue in the industry for instance if a recycler tries to misuse the collected expired FMCG product by changing expiry dates & sending to market again, it would be a reputational damage to product owner.

Nevertheless, some respondents suggested cutting the plastic bottles, breaking the glass bottles, chopping the steel & aluminium products may reduce the effect of this product misuse situations & hence open up ways for greater recycling.

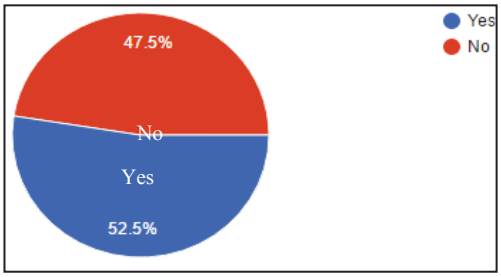

Fig.7 Does company sort product waste?

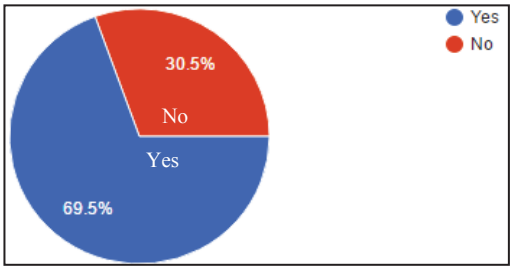

Fig.8 Existence of professional waste collectors

Figure 7 illustrate that currently 52.5% of companies sort their product waste for recycling purposes whilst 47.5% of companies do not sort. Thus, it's a kind of 50-50 scenario where companies may face confusion whether to accept recycling or to continue the same procedure by just giving for disposal. Because a major barrier in developing countries is that not having professional product waste collectors who don't have proper contractual agreements on collection. However, Figure 8 illustrates that Existence of professional waste collectors in Sri Lanka is 69.5% while respondents who don't have awareness about professional collectors are 30.5%. Hence it can be concluded that the existence of professional waste collectors is a reality in Sri Lanka besides it needs some kind of effort to identify them in areas nearby.

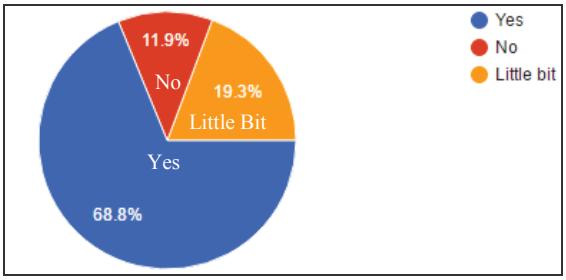

Fig.9 Awareness of FMCGs in other countries which make revenue out of recycling

However, figure 9 illustrate that most of the Sri Lankan FMCG companies are aware of FMCGs in other countries which make revenue out of recycling. But still people in Sri Lanka won't grab these opportunities.

In spite of that researcher tends to conclude that revenue can be generated if FMCG players focus on recycling rather than just disposing. Hence relevant hypothesis is,

H0 = 0: Revenue cannot be generated from recycling

H1 = 1: Revenue can be generated from recycling

TABLE V
CROSS TABULATION - (DO YOU RECYCLE YOUR WASTE? IF YES) * (CAN SAVE MONEY (ECONOMICAL)

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	13.067a	3	**.004**	.008		
Likelihood Ratio	9.114	3	.028	.023		
Fisher's Exact Test	9.567			.012		
Linear-by-Linear Association	2.040b	1	.153	.220	.122	.066
N of Valid Cases	100					

a. 4 cells (50.0%) have expected count less than 5. The minimum expected count is .11.

b. The standardized statistic is 1.428.

Table V is a cross tabulation between 'Do you recycle' & 'Revenue can be generated with a chi-square of 0.004 (0.05>0.004) which concludes that the relationship is very significant due to rejecting the null hypothesis. Therefore, the effort of this overall analysis results in a success which can be contributed to the FMCG industry as well to the recycling industry. Thus, this study concludes that revenue can be generated from recycling as it is an economy generative opportunity [26].

J. Applicability of the Factor Analysis

TABLE VI
RELIABILITY STATISTICS

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.860	.860	21

Cronbach's Alpha is a measurement to test the reliability of the data set collected for analysis where higher the test statistics, higher the data set acceptance will be. Accordingly test statistic is 0.860 which illustrates higher Cronbach's Alpha value and thus the reliability of the variables is in the best level and data set can be acknowledged.

TABLE VII
KMO AND BARTLETT'S TEST

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.745
Bartlett's Test of Sphericity	Approx. Chi-Square	1.306E3
	df	210
	Sig.	.000

The Kaiser – Meyer – Olkin measure is a measure for degree of suitability of collected data for factor analysis. Accordingly, the test statistics of Table VII concluded that Kaiser-Mayer-Olkin (KMO) value as 0.745 which is greater than recommended value of 0.6 resulting in accepting the sample adequacy & proceeding further with the factor analysis.

K. Determine Number of Factors

[6] & [7] have noted the following regarding model development; initially the data should be analysed using a Principal Analysis to determine the number of factors. Hence Eigenvalue rule and Scree plot test were used to determine the appropriate number of components of the analysis.

TABLE VIII
ROTETED COMPONENT MATRIX

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.984	28.495	28.495	5.984	28.495	28.495
2	3.010	14.333	42.828	3.010	14.333	42.828
3	2.471	11.765	54.594	2.471	11.765	54.594
4	1.290	6.141	60.735	1.290	6.141	60.735
5	1.148	5.465	66.200	1.148	5.465	66.200
6	1.048	4.989	71.189	1.048	4.989	71.189
7	.922	4.390	75.579	.922	4.390	75.579

Table VIII indicates the eigenvalues coupled with each linear factor before extraction, after extraction and after rotation where SPSS analysis has identified 21 factors within the data set. Moreover, 6 factors which total Initial Eigenvalues exceeds value 1 have been extracted initially in the extraction sums of squared loading section. However, scree plot denotes that the 7th criterion also can be taken into consideration because its shape straightens not from criterion 6th onwards but from 7th onwards. Additionally, table VIII shows that its initial total eigen value is closer to 1. Thus those 7 overall factors represent the overall 21 factors which the researcher had considered initially in the study because the '% of variance' column of the extraction sums of squared loadings section summarizes degree of the total variability which can be accounted for. Accordingly, factor 1, 2, 3, 4, 5, 6 & 7 of table VIII accounts for 28.495%, 14.333%, 11.765%, 6.141%, 5.465%, 4.989% & 4.390% respectively of the total variance whilst altogether these 7 gears explain the 75.579% variation of total variation.

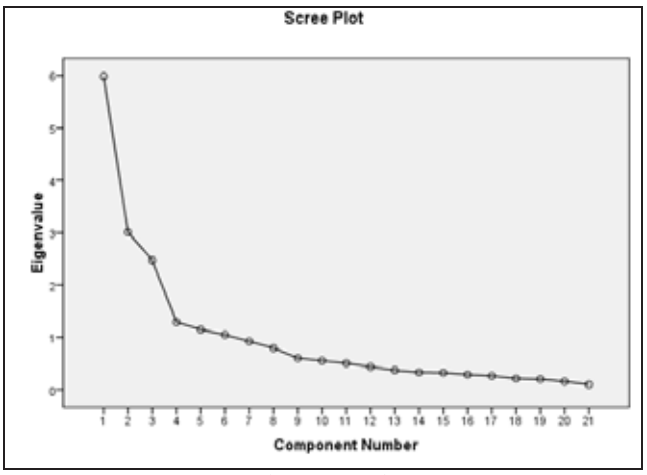

Fig.10 Scree Plot

According to Figure 10, there is a sharp turn (elbow) after the 7th Eigen value. Hence scree plot further denotes that 7 of those factors explain most of the variability because the line starts to straighten after factor 7. The rest of the variables clarify a little extent of the fluctuation and are likely to be insignificant. Thus, only six factors are retained for further analysis.

And those factors are identified as Regulatory Management & prioritized Communication, Effective handling Process, Knowledge, Forecasting ability, Effective delivery Management, Production procedure management & Quality of storage.

L. Relationship between Extracted Factors and Demographics

Relationship between Tons of wastage the company throw away monthly and the seven factors:

H0: ith factor is independent from the Waste tonnage per month in the FMCG Company

H1: ith factor is depending on the Waste tonnage per month in the FMCG Company

ith: (Regulatory management & prioritized Communication, Effective handling process, Knowledge, Forecasting ability, Effective delivery management, Production procedure management, Quality of storage)

TABLE IX
CHI SQUARE TEST STATISTICS FOR 7 FACTORS VS. FMCG WASTAGE GENERATED MONTHLY

	Regulatory Management & prioritized Communication	Effective handling Process	Knowledge	Forecasting Ability	Effective delivery Management	Production procedure management	Quality of storage
Chi-Square	27.096	1.595	2.748	16.183	1.237	.477	2.555
df	3	3	3	3	3	3	3
Asymp. Sig.	.000	.660	.432	.001	.744	.924	.465

a. Kruskal Wallis Test

b. Grouping Variable: Tons of wastage the company throws away

According to the statistics in above table, significance value of factor 1 & 4 (Regulatory management & prioritized Communication, forecast ability) is lower than the recommended P-value of 0.5 thus leading to rejection of the null hypothesis and concludes that Regulatory management/ prioritized Communication & Forecast ability are depending factors on Waste tonnage per month in the FMCG Company and have a better relationship too.

Relationship between amounts paid for waste removal process and seven factors:

H0: ith factor is independent from the Amount pay for waste removal process

H1: ith factor depends on the Amount paid for waste removal process

ith: (Regulatory management & prioritized Communication, Effective handling process, Knowledge, Forecast ability, Effective delivery management, Production procedure management, Quality of storage)

TABLE X
CHI SQUARE TEST STATISTICS FOR 7 FACTORS VS. EXPENSES FOR WASTE REMOVAL

	Regulatory Management & prioritized Communication	Effective handling Process	Knowledge	Forecast Ability	Effective delivery Management	Production procedure management	Quality of storage
Chi-Square	17.798	7.110	4.998	26.844	11.894	3.508	3.335
df	6	6	6	6	6	6	6
Asymp. Sig.	.007	.311	.544	.000	.064	.743	.766

a. Kruskal Wallis Test

b. Grouping Variable: Amount pay for waste removal process monthly

According to statistics in above table, significance value of factor 1 & 4 (Regulatory management & prioritized Communication, forecast ability) lower than recommended P-value of 0.5 thus lead to reject null hypothesis & concludes that Regulatory management/ prioritized Communication & Forecast ability are depending factors on

Amount pay for waste removal process and have a better relationship.

IV. CONCLUSION AND RECOMMENDATION

As the initial step of study, researcher could be able to find some of the characteristics in sample population and as per the analysis it concludes that majority of the respondents were medium size companies who were actively engaged in waste collection & accounts for 41.2% & further concluded that amount of monthly wastage generated is between 4ton to 14ton for 57.9% of the companies in Sri Lanka. And the frequency of waste clearance is twice or once a month for 78.4% which ensures recyclers input frequencies for recycling purposes where most of the recycler's mindsets are in a narrowed on the view of they could not be able to collect enough level of wastage to carry out the recycling business. Thus, here the study concludes that there is numerous level of FMCG wastage & collection frequencies are wider to have a good recycling business.

In regarding the waste generation places, study concludes that highest product wastage generates in Expiration as well as in the production process & smallest level of waste generates at the transportation & within warehouse hence in the FMCG Company's perspective; expiration is the critical scenario that need to be balanced somehow to manage waste generation. And in the perspective of components which a FMCG product is made on, most of the responses are weighted on plastic, glass, steel, aluminium & cardboard items thus conclude almost 75% of FMCG companies uses those type of parts & components to develop finished products.

Currently, 76.3% percentages of FMCG companies have been already paying up to Rs. 500,000 per month for their waste removal process which is huge money waste for unprofitable action. Furthermore, two strong qualitative questions which based on warehouse sorting perspective concludes that, same percentages of attitudes will be there in the industry on accepting costs, sensitive on cost as well as some companies have doubts on accepting the recycling process.

In this sense, 53.3% respondents denote that presently companies don't focus on recycling processes but have 72% of recyclable items with them which can be recycled. Hence, reasons which most of respondents denoted are that Collectors ask to sort before collection & Brand protection policies. However, brand protection policies are a major issue in the industry on reputational damage on actual product owner in situations where collectors misuse the collected expired FMCG product by changing expiry dates & send to market again [9]. And most of respondents noted that Harder to sort, High cost, no space & No investment are not critical factors that drives away from recycling because reality is that sorting is not hard since one or two men can sort at the time of receiving the damaged/ expired products to warehouse collection centre without storing for post separation. Thus, most of respondents noted as neutral & disagree on sorting point of view whereas some respondents accepted it is as a strongly agree scenario where they might be on situations in post separation.

However major barrier in developing countries are that not having professional product waste collectors which don't have proper contractual agreements on collection [10] whereas study concludes that existence of professional waste collectors in Sri Lanka is 69.5% while respondents who don't have awareness about professional collectors are 30.5%. Hence it can be concluding that existence of professional waste collectors is a reality in Sri Lanka besides it needs some kind of effort to identify them in nearby.
Hence the fact is that businessmen reluctant to enter into this recycling area not due to workload, but of course FMCG don't know about the opportunity available in the industry where recycling is an economical, environmentally friendly process & preserves existing raw material resources too. Finally, cross tabulation on recycling contribution vs economy generation concludes that Revenue can be generated from recycling as an economy generation process to the FMCG Company.

Moreover, though recycling is a strategy to reduce cost of waste disposal, priority of waste reduction by identifying factors of waste generation may also very important to cure the root of the problem. Hence in order to identify the factors of waste disposal cost, the structured questionnaire was constructed with 21 latent variables. Because of the large number of variables available in the research, factor analysis was carried out to reduce the number of variables & accordingly factors were extracted to seven factors from the results of factor analysis. Rather with the assist of comprehensive literature evaluation concluded seven factors were named as "Regulatory Management & prioritized Communication", "Effective handling Process", "Knowledge", "Forecast ability", "Effective delivery Management", "Production procedure management" & "Quality of storage" for the ease of interpretation.

However, for recycling to achieve its intended purpose of contributing to waste management in Sri Lanka, the following recommendation may be helpful. As per the analysis carried out through the study it can be recommended to the FMCG companies that step on to recycling business where it can generate revenue as well as preserve environment far than now. In regarding the factors summarized in the analyze it is recommended to regulation makers to see on a big picture to identify where the regulations should be tightened as well as the places which regulations need to be loosened to make proper smooth pesticide & hazardous disposal process in Sri Lanka.

And in the view point of expiration, most of the FMCG waste incurred through expiration where it happened due to lack of communication throughout the supply chain, but somehow in the modern trade the expiration can be managed by making value additions, banding the expiration nearby products when the products are on shelf using existing staff within the super markets thus it need proper coordination & communication management to identify the needs relevant bands, stickers& time limits of both FMCG player &

modern trade partners [11]. However, in traditional trade this expiration nearby product value addition can't be executed due to lack of proper coordination throughout Sri Lanka.

Further, forecasting of proper demand levels have to be properly executed & thus production planners of the FMCG industry must directly adhere with that forecasted plan to reduce unwanted stocks in the market which will be ultimately be expired at the end & thus increase waste removal cost too [12].

Despite of that, effective delivery, effective handling of product & quality of storage are other facts which need to be focused in reducing the wastage amount in the industry for further extent.

Finally, despite of all above recommendations the major conclusion identified through this study is that the waste which incurred in the FMCG industry can be recycled & it's an opportunity to transform current cost generating disposal process to revenue generating process. However most of the FMCG companies in Sri Lanka still confuse on this process. But here the study concludes & recommended that any FMCG company can generate revenue through the recycling but it's up to the FMCG player to manage their sorting process accordingly by executing the sorting at the same time of receiving product waste to the warehouse collection point without stocking for post sorting because sorting is the biggest challenge which make barriers to enter into that recycling business.

V. Contributions and Implications

This study is very significant to the FMCG industry in a context of most of FMCG players incurred a huge level of money waste on the waste disposal process in each & every month in Sri Lanka. Because, finding of this research become more & more significant to make economical disposal process & to contribute environment in more sustainable way.

In a framework of a better research, looking at waste from one perspective as a waste only is that an environmental disaster. Sometimes in the supplementary side it will have rich source of valuable resources that could be recovered profitably. Moreover, this dissertation investigates on how to dispose of unusable waste in more sustainable way which will helpful to existing FMCG players & for new entrants to get viable opportunities swing in the industry. However, this must be controlled through the national legal & environmental perspectives while delivering required obligations and responsibilities for the main actors.

VI. Scope & Limitations

The study is limited to the FMCG industry and as a major limitation it focuses only on industrial waste (FMCG product) disposal which was collected at the end of the month as expired, transport damages as well as handling damages etc & not focuses on municipal waste & e-waste of the companies. However, the study describes determinants to product waste disposal cost & uses them to investigate a better & sustainable way of cost effective waste disposal strategy.

Further the data was collected from fast moving consumer goods companies in Sri Lanka only, thus analyze the current situation within the country & a comparison was done with the international countries on how they manage their waste management system through the reliable data sources obtained online.

VII. Acknowledgment

At the completion of this dissertation it is a great pleasure to convey my gratitude for dedication and admiration made by many individuals in making this a success.

VIII. References

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Factors Affecting Waste Disposal Cost in Supply Chain Operations and Ways of Optimising: Pharmaceutical Industry

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***Abstract* – Waste is one of a greatest problem faced by people in any country where waste contaminates indigenous habitat with devastating results if the authorities fail to take care accurately. In any case, it appears to be practically unavoidable that our public, manufactures, industrial businesses etc. produces waste whereas only can be minimized hence the point of this rationale thesis has been to explore how to recover the material assets by rethinking waste as an asset. The study mainly focuses on pharmaceutical companies in Sri Lanka who produces numerous waste per month with compared to other industries whereas don't have much focus on degree of treating those waste at disposing where companies spend millions of money on the process of disposing. This paper investigates a way of sustainably disposing those product wastes of pharmaceutical companies and the determinants of waste disposal cost and ways of optimizing. Thus, questionnaire survey was distributed focusing on pharmaceutical players within Sri Lanka to measure factors affecting to waste disposal cost as well as to prove that concluded strategy can aid to generate profits from the previously used cost generative process of direct disposing the pharmaceutical wastage and also the researcher apply that strategy on a PQR company to evaluate the degree of successfulness of the strategy. Thus, the outcomes are included here under 3 main objective analysis with six major factors named as "Effective operational process", "Standard procedures", "Quality of storage/operation", "Regulatory awareness", "Traceability" and "Knowledge" which were identified as factors affecting waste disposal cost as well as the study concluded a successful waste disposal strategy as sorting and recycling where can change the current game play of the pharmaceutical companies to a new direction.**

***Keywords*– Waste management, Pharmaceutical Industry, Recycling**

I. INTRODUCTION

Throughout the history of mankind, the application of logistics and supply chain continues to emerge with the growing needs and wants of users where Pharmaceutical Goods play a vital role by satisfying those requirements in daily lives of patients all over the world. The rapid developments in the Pharmaceutical sector over the past few decades achieved an unprecedented growth record in terms of sales, exports, advanced capacity, and by-product potential for connected activities in medication field. Therefore, from the supply chain perspective, pharmaceuticals manufacturers and importers must keen on huge production capacities and high frequent of distribution to fulfil the market demand. As per the quote of "prevention is better than cure", resources are essential to realize anything great or small to cater the market demand, because many of drugs and vaccines for patients are very important to have in the market at the correct time. However, tribulations arise from using resources unproductively, applying the wrong resources, failing to tap into necessary resources, or directing resources toward the wrong outputs. In each of these instances, waste is created, costs are incurred, time is consumed, opportunities for value creation and growth are lost, and customers are left less than satisfied. Accordingly, different ways of those product wastages also started to emerge. Hence, the rate of disposal has been on the rise, more and more damaged and expired are thrown away by wasting money and efforts while making threats to the environment as well. As there is a twofold scenario where people can't eliminate this issue it needs urgent solutions by changing the existing tracks on how companies work on this crucial area of managing waste.

A. Wastage in Pharmaceutical Industry

Basel Convention (1989) has defined that 'Wastes' are substance or objects, which are disposed of or are intended to be disposed of or are required to be disposed of by the provisions of national law. Waste is one of the major challenges being faced by our society which affects natural environment with devastating results attributable with increasing population and developing of industries and thus can be categorized into various categories. In modern trade and traditional trade in Pharmaceutical sector, waste can be found in expiration, transport damage, handling damage, quality rejects and municipal waste and e-waste inside of the organization. However, here the dissertation covers only the areas in Inventory waste (production) disposal process only but not the municipal and e-waste disposal areas. In the arena rapid growing demand for Pharmaceuticals, reasons for increasing product wastage is that free return policies which drives by unplanned demand levels by modern and traditional trade both drivers which latterly lead towards expirations and not properly handling and storing methods inside vehicles during transportation also are some of major negative factors too which drives the disposal cost of a Pharmaceutical organization.

At the moment most of the multinationals don't focus on their product wastage disposal cost reductions and just give to direct disposers to dispose due to their brand protection policies which is a major issue in multinational perspective which attributable

to opportunities for the 3rd parties to misuse company own products by changing marks and labels etc. and position into market again for the purpose of ruin the market image of the company. Moreover, not giving priority on this consciously because amount of cost generate within disposal process isn't very high compared to overall cost structure of the organization and it is already environmentally sustainable because geo cycle burn waste totally for their clinker production for cement. But in the perspective of sustainability, most of companies forgot one main thing where existing process is totally environmentally sustainable from multinational's perspective but within clinker production process Geo cycle again produces CO2. Besides this is a possible area of cost saving if companies can recycle, reuse those wastes under quality approvals as well.

B. Recycling Industry in Sri Lanka

Recycling is a practice of reprocessing materials or waste management process in order to turn them into new raw materials. In a speculative context there are lots of types for recycle as reuse, recycle, refurbishment, repairing, use them to generate another power source and furthermore. However, there are many obstacles to recycling product waste in the developing countries, including the lack of recycling infrastructure and lack of national regulations as in Sri Lanka existing regulation held only for pesticides products disposal process and products/ materials in normal conditions which about to dispose still don't have any governmental regulation on how to dispose those. Nevertheless, it's a fact that regulations may differ from

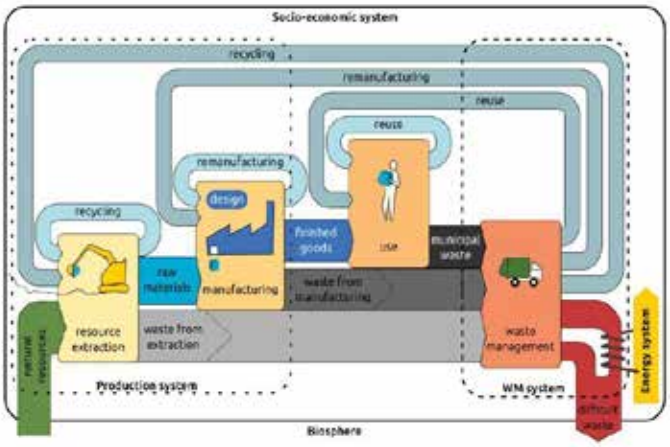

Figure 0.1 Material flows through society.
Source: [21]. Turning waste in to resources.

country to another. There are many international governments who give free hand to their Pharmaceutical companies to get benefits out of this waste disposal process while on the other hand, they are committed to contribute more and more to the country's economic strength. Because of that support, most of the international pharmaceutical companies in USA, Australia, France, China etc. introduced and adopted many of integrated disposal processes mainly such as recycling and achieve greater advantages as generate revenue out of it which was earlier consist as cost generative process. But in Sri Lankan context people are not innovative, reluctant, lack of knowledge as well as not prioritize new things due to culture itself make uncertainties which ultimately drive to do the same process again and again.

Usually number of damaged/ expired/rejected items which a multinational will collects per day is average as 2-3 pallets where a comparatively small and medium level companies having lesser no of pallets at the damaged/ expired/rejected collection place (DRN place). Currently most of the companies keep them until the end of month and then send for dispose without belief of what they can do with those damaged/ expired/rejected items to generate useful resource out of it. Nevertheless, when seeing over a big picture on this industry there are lots of waste recyclers who collects those damaged/ expired/rejected items and sort for plastics, glass items, cardboard, aluminium, etc. and then use those sorted items as resources for newer production process. Some recyclers crush the plastics into small pieces and make new plastics related products while some are collected and exported in larger quantities and have more revenue out of it. Using a similar kind of process glass items can be used for re-production or newer glass production, paper and cardboard to recycle, aluminium to metal item production etc. But anyway, some products are there which need to be disposed completely such as medicinal drugs, cream items, hazardous items because it is a mandatory requirement by the regulators. So anyway, it generates some level of cost out of these disposal process but the part which most of companies have forgotten or reluctant to accept is that they can cover that said cost through the revenue generating out of selling those sorted plastics, papers, glasses, aluminium etc. for recyclers without disposing which currently giving to dispose by paying money too.

The key issue which Sri Lankan pharmaceutical companies not try such kind of process is that they might think that there will be no professional waste collectors who give preferable rates and sorting is a kind of time consuming work which they need not to focus on by giving priorities. Thus, to resolve this twofold view points of the industry where many countries generate benefits and some countries still lagging behind, the researcher tends to realize what is the actual scenario hidden within the Sri Lankan context. Hence this dissertation is conducted to analyse determinants on product disposal cost in pharmaceutical industry and to see whether how an organization can reduce its disposal cost, to break even or to prove ability of transformation from cost generation to revenue generation via changing the way of disposal process and be sustaining in the fast-developing sector by stepping up with the globe.

C. Significance of the Research

The study is scientifically significant since this area of study has not been given an intensive focus with related to the field of reverse logistics in Pharmaceutical industry in Sri Lanka. There exists a lack of researches conducted for the waste disposal process cost optimization in Pharmaceutical industry and is not given much prominence due to the complexity of the research. Because the lack of knowledge in this arena make gaps between theories of optimizing cost and practices. Therefore, this empirical study will reduce that gap with practicable applications. Industry of pharmaceutical belongs which care about the entire health of living being thus is more important than other sectors in current context in any nation. However, this industry is controlled with higher standards in most of the countries rather than the Sri Lanka, hence it's an obligation to take care of this industry with all related activities which care about the health. Therefore, overall significance is that, this

thesis work will also serve as a working document for policy makers and other relevant authorities to carry out its processes in more sustainable manner. So, it is hoped that this document shall be useful to other countries particularly in developing sector which help to balance economic, social and environmental objectives.

D. Objectives of the Research

The overall objectives of this paper have been grouped into three folds:

Primary Objective:

- Identifying and proposing a more sustainable and cost-effective waste disposal strategy.

Secondary Objectives:

- Determining the factors affecting to the waste disposal cost in pharmaceutical industry.
- Applying the above proposed strategy and investigating the cost savings in PQR company.

E. Research Questions

In a context where pharmaceutical companies in Sri Lanka do not focus on having savings from the industrial waste (product) disposal process which can be turned into revenue generation process rather current cost generating process, this empirical research tend to address following key questions and ultimately propose more cost effective and sustainable strategy which can be use in Sri Lankan context too where international countries already having favourable process to make it revenue generation and use them with economically beneficial

Question 01:

What are the waste clearance approaches available for pharmaceutical industry in Sri Lanka?

Question 02

What are the positively and negatively correlated factors those will be affected to the waste disposal cost in pharmaceutical industry?

F. Hypothesis of the Research

H0: There is no relationship between wastage cost and i^{th} factor

H1: There is a relationship between wastage cost and i^{th} factor

i = {Standard levels at production stage, Inaccurate forecasting, Quality issues in RM, Handling procedure, Expiration detection procedure, Careless manual handling, Unsafe use of forklift, Temperature fluctuation inside warehouse, Regulatory awareness, Lack of employee knowledge, Fire within warehouse, Falling high stack pallets, Dusty environment, Improper loading plan, Unstandardized packing materials, Pilferage during transportation, Availability of SOP, Storage conditions in distributor points and Quality issues leads to reject the whole lot}

G. Wastage in the Industry

According to Basel Convention (1989) it defined the waste as "Wastes are substance or objects, which are disposed of or are intended to be disposed of or are required to be disposed of by the provisions of national law" and European Commission was said "it's become waste when it loses its primary function for the user. Therefore, waste can be relative to its primary function and second perspective or secondary function can have considered as waste about this primary function. Further it can be describing as waste of someone is can be another one else's raw material. Though, the final conclusion most of businesses try to make on these regards is that waste isn't not always waste which can be turn again into resources in the form of money as well as raw materials.

It exists because of waste can't be eliminated 100% and only can do is that reduction. Moreover, there are several authors mentioned in their studies regarding zero waste concepts [10], [24], [21] where they tried to connect end of forward supply chain with the reverse flow of supply chain. Despite of that [4] has concluded that most of businesses in worldwide execute the Waste management (WM) processes not only for preserving environment but also as a main source of generating revenues into the organization where in developing countries still use traditional disposing process as a predominant way due to several reasons.

The famous Researcher [9] has mentioned that "Waste is what is left behind when imagination fails". And it may be due to unstandardized packing material, pilferage in transportation and improper loading plans. This saying generally adventures in Reverse Logistics environment because however waste has ability to be made from every step of forward and reverse supply chains consequently open provocations to waste management experts to come up with artistic discipline to bring about it for the improvement of everyone who are living in the society.

The waste cannot be removed 100% and only can do is that decrease the waste because the ultimate assumptions are most of businesses related to supply chain attempt to make on this favour are that waste isn't not always waste. It can be go again into resources in the form of money as well as raw materials which we help to reuse it.

H. Types of Waste

Waste can be categorized in too many standards such as Origin, composition, toxicity or management. Origin waste can be describing as the waste depending on where it is generated such as production waste, transportation damages, retail expirations and warehouse damages. Also, the Composition waste can be referred to what the waste is made of such as plastics, glass, metal, paper and hazardous. Toxicity refers to waste per how dangerous it is for human health or for the environment such as radioactive, toxic, infectious, and corrosive and management refers to the waste how it is treated such as collected, sorted, recycled, land filled, incinerated.

TABLE 0.1 SOURCES OF WASTES

Source	Typical waste generation	Types of solid waste
Residential	Single and multi-family dwelling	Food waste, paper, cardboard, plastic, metal, wood, yard waste, glass consumer electronics, white goods, household hazardous waste.
Industrial	Light and heavy manufacturing, fabricating, power and chemical plants	Housekeeping waste, packaging waste, paper waste, construction and demolition of raw materials, hazardous waste
Commercial	Stores, hotels, market, office buildings	Paper, cardboard, plastic, glass, food waste, metal
Municipal Services	Street cleaning, landscaping, parks, recreational areas, waste water treatment plants	Street sweeping, general waste from parks, recreational areas, sludge
Process	Heavy and light manufacturing refineries, power plants, mineral extraction and processing	Industrial process wasters, scrap materials, specification products
Agriculture	Crops, vineyards, dairies, farms	Spoiled products, agricultural waste

Source: Waste streams classified by source -adopted from Tchobanoglous and Kreith (2002)

I. Reverse Logistics Process in Sri Lanka

The consequence of reverse logistics had been on the increase more than ever before from now more over the past decades. El Saadany et al, (2011) have noted that the concept of reverse logistics has increased more attention due to the growing responsiveness of environmental protection.

The famous researcher Wong, (2010) has stated the area of reverse logistics has been investigated wide times by the researchers with the topics of dissimilar interests rather than environmental concerns, but missing point is most of them didn't have much attention on manufacturing product waste management where it can produce economical step within the recycle scheme where factors Wong, (2010) has identified that careless manual handling, unsafe use of machine handling, falling from high stacked pallets and dusty environment.
Reverse logistics was well-defined by Sumalee Pumpinyo et al, (2014) as "a term that refers to the role of logistics in production returns, source reduction, recycling, and materials substitution, reuse of materials, waste disposal, refurbishing, repair, and remanufacturing as a reaction for the waste generation due to temperature fluctuation within the storages, expiration and rejections due to quality issues".
[7] has transformed the definition to "The process of planning, executing and controlling flows of raw materials, in process inventory, and finished goods, from a manufacturing, distribution or use point to a point of recovery or point of proper disposal".

J. Types of Reverse Logistics

As per to [26], difference of return items as products and packing Table 2.2 classification becomes too general. Hence in 2002, [7] categorize the groups of refunded items in much more complete way as foods, civil objects, consumer goods, industrial, transport and fighting equipment, oils, chemicals and pharmaceuticals. Consequently, this classification was more thorough and comprehensive which have its own exclusive characteristics which need an exclusive way for reusability.

TABLE 0.2 TYPES OF REVERSE LOGISTICS

Material	Reverse Logistics Activities
Product	Return to Supplier Resell Sell via Outlet Salvage Recondition Refurbish Remanufacture Reclaim Materials Recycle Landfill
Packing	Reuse Refurbish Reclaim Materials Recycle Salvage

Source: [25], p.10 11

As per to characteristics Product recovery procedure could be separated into 3 forms and those are bulks recycling networks, assembled-product remanufacturing networks and returnable network. Correspondingly Thierry et al, (1995) alienated regaining/non-refundable selections into the following eight types: direct recycle/resale, repair, renovating, remanufacturing, cannibalization, recycling, burning and disposal in landfill. The results gained from the model recommended that networks for recycling carpet waste can be cautiously viable, though a few tasks were complicated, including identification, sorting, separation and compaction.

II. RESEARCH METHODOLOGY

A. Research Design

This research design falls in to the category of casual research where the main objective of such a category is to verify the extent and nature of cause –and-effect relationship between variables. Rather, research assesses the effects of changes on one variable which is called the dependent variable as per the variations of the other variable which is called the independent variable. Casual researches are exploited for explanatory purposes, for prediction and testing of hypothesis which enables the researcher to predict probable scenarios that would take place with changes as well as a better opportunity to exploit cause-effect relationship and the industry behaviour. However, not everything can be measured in a casual or numerical way, the qualitative approach sometimes needed to be applied to obtain a conclusion with reference to the recyclers' perspective as well.

The main objectives of the study are to determine the factors affecting to the waste disposal cost in supply chain operation and ways of optimising pharmaceutical industry with reference to the industry of pharmaceutical in Sri Lanka as well as to identify and propose a more sustainable and cost effective waste disposal strategy. Hence these characteristics further concluded that this research takes the nature of a casual research.

B. Conceptual Framework

The applied system of the exploration of conceptual framework has been produced utilizing the reviews that have been summarized in Chapter 2. Figure 3.1 illustrates the conceptual framework which makes the base for the study by holding the relationship, the concepts and the research context used in the study.

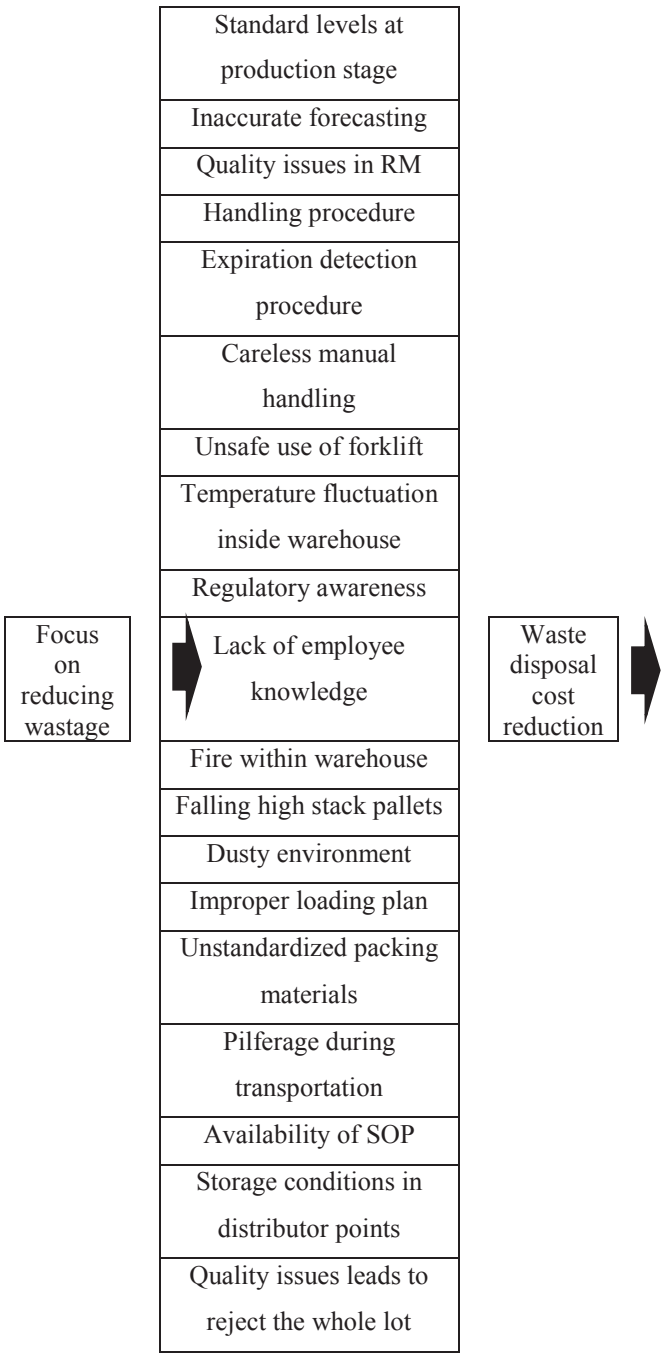

Figure 0.2 Conceptual Framework

C. Data collection

The primary data was collected through the structured questionnaire which was distributed to the pharmaceutical companies all over in Sri Lanka. Initially a web-based survey was used to overcome geographical barriers while the pilot survey was carried out with a total of 20 conveniently collected responses in order to verify the validity and reliability of data related to the survey. The Cronbach's Alpha was calculated for find the reliability of data collected from the pilot survey to statistically verify the validity and reliability of the questionnaire and the alpha coefficient was in the acceptable range which permitted the questionnaire to be used in the main survey.

D. Primary Data Set

The research is based on primary data collected through the questionnaire survey which was distributed among 240 respondents in the chosen sample of pharmaceutical industry. Once the pilot survey confirmed the validation of the questionnaire, the final survey was initiated. The survey was available on the internet for a period of 60 days during which additional responses were collected. 207 responses were received out of the sample of 240 respondents.

E. Secondary Data

Secondary data was gathered from secondary sources such as journals, scholarly articles, reports and web pages based on waste management concepts in Sri Lanka as well as international regime. In addition to that, quantitative data concerning monthly pharmaceutical waste generated of PQR Company for 12 months were collected under the approvals. Further secondary data was also helpful in areas such as deciding the sample size, formation of the questionnaire, scaling of questions and also in analysing data.

F. Validity and Reliability

Cronbach's Alpha is used in statistics to measure the internal consistency/ reliability which is utmost commonly used to verify the reliability of the scale in a multiple Likert-Scale questionnaire. Higher rate of Alpha coefficient is measured as questionnaire being further reliable to collect the primary data related to the survey. Conventionally, it is recognized that Cronbach's alpha coefficient requires 0.70 or higher to be reliable. Following (01) is the equation for calculating total Cronbach's Alpha coefficient. The reliability test using Cronbach's Alpha coefficient has been carried out in this study to check the reliability of the pilot and main surveys.

$$\alpha = \frac{m_w\left(\sum_s \gamma S^{\overline{2}} - 1\right)}{\sum_s \gamma S^{\overline{2}}\left(m_w - 1\right)} \quad \ldots\ldots\ldots\ldots (01)$$

α = Cronbach's Alpha value

G. Statistical Methods of Data Analysis

Data collected through the questionnaire survey were fed into SPSS 16.0 (a statistical software tool) in order to generate a broad analysis of the dissertation which is discussed in the subsequently chapters. Following statistical data analysis methods were used in analysing the data set obtained.

H. Descriptive Analysis

Descriptive analysis is broadly utilized as a part of the field of research, keeping in mind the end goal to summarize and show the information set close by. This specific factual train is fundamentally worried with compressing the elements in the sample in a quantifiable way, instead of summing it up to the population.

Together with basic graphical presentations, descriptive measurements give quantitative representation of the example seriously which is particularly helpful in distinguishing test attributes that are persuasive in making determinations of the sample. For instance: frequency distribution, measures of central tendency and measures of variability are analysed amongst others.

I. Factor Analysis

This is a statistical apparatus which is utilized to discover factors among watched factors. Regularly factor analysis is done to reduce the quantity of factors into gathering components when there are number of factors are high. Factors with reasonable qualities are gathered under one variable. Factor analysis can create little number of components from extensive number of factors which has the capacity to clarify the watched difference in the bigger number of factors. Multi-dimensional factors have been studied in this factor analysis. There are two types of factor analysis are existing which are exploratory factor analysis and confirmatory factor analysis where in this study, only the exploratory factor analysis has been carried out. According to Norris et al (2009), it's a statistical method used to uncover the underlying structure of comparatively large set of variables. The utmost goal of exploratory analysis is to identify the underlying relationships between measured variables. Several benefits can be gained from the factor analysis. Reduction in number of variables and identification of the interrelated variables of groups can be given as the example of advantages in factor analysis. The basic steps of the factor analysis are Correlation matrix is generated for all the variables, secondly factors are extracted from correlation matrix based on correlation co efficient of the variables. Thirdly factor rotation is done in order to maximize the relationship between variables. Finally compute values for each factor.

Descriptive insights, Bartlett's and Kaiser-Meyer-Olkin (KMO) test, Communalities, Total Variance, and Rotated Component Matrix are computed and analysed using SPSS 16.0 software. The Bartlett's test compares the observed correlation matrix to the identity matrix. It checks whether there is a particular redundancy between the variables that can be able to summarize with a small number of factors. If the variables are perfectly correlated, only one factor is sufficient.

The Bartlett's test checks whether the observed correlation matrix R= (rij) (p x p) deviates significantly from the identity matrix.

H1a: Correlation matrix is an identity matrix.
H1b: Correlation matrix is not an identity matrix.

The Bartlett's test statistic indicates to what extent deviate from the reference situation KMO value measured the sampling adequacy. Normally KMO should be greater than 0.5 is to agree to the factor analysis.

Higher KMO values are better because higher correlations between pairs of variables. 0.5 is barely accepted value. Value between 0.7-0.8 is in the acceptable level. Value of above 0.9 is superb. Communalities are the proportion of variance accounted for the common factors of a variable. Communality scores range from 0 to 1. Zero value means that the common factors will not explain any variance. Value one means that the common factors will explain all the variance. Total variance explained in the initial solution table. Eigenvalue is the total variance described

by each factor. Eigenvalues that is less than one does not have enough total variance explained to represent a unique factor.

Eigen values which is less than 1 can be excluded from the variables. Thus, the overall KMO index is computed from below equation (02).

$$\frac{\sum_i \sum_{j \neq} (r^2)}{\sum_i \sum_{j \neq} (r^2) + \sum_{j \neq} (p^2)} \ldots\ldots\ldots (02)$$

p = Partial Correlation
r = Correlation

J. Chi-square Test of Independence

Chi-square test is conducted in order to verify whether there is a considerable association between two categorical variables in a given population. Data collected from the questionnaire survey in this dissertation are of data yielded in categorical manner which implies that Chi-square test of independence is viable test for this particular survey.

The first step of Chi-square test procedure is to state the hypotheses. In order test the hypothesis, first, an alternative hypothesis and a null hypothesis must be constructed.

Ha: alternative hypothesis state dependent; dependency exists between two variables

Hb: null hypothesis state independent; dependency does not exist between two variables

Once hypotheses are constructed, the next step involves testing of hypotheses using Chi-square test for independence using sample data available. This particular test concludes whether there is a significant relationship between the two variables in the particular hypothesis or not. It is significant to state a significance level for this test beforehand which according to most researchers, is usually 0.5. Same significance level has been used in this study when conducting the Chi-square test. Chi-square random variable (X2) is defined by the below equation (03).

$$X^2 = \sum \left(\frac{(O\gamma\varepsilon - E\gamma\varepsilon)^2}{E\gamma\varepsilon}\right) \ldots\ldots (3)$$

X2 = Chi-square random variable

$O\gamma\varepsilon$ = the observed frequency count at level γ of Variable A and level ε of Variable B
$E\gamma\varepsilon$ = the expected frequency count at level γ of Variable A and level ε of Variable B.

Significant variables can be recognized by analysing the results of Chi-square test of independence. These significant variables can be used to further analysis.

III. DATA ANALYSIS

A. Descriptive Statistics

Descriptive statistics has been applied to express, illustrate and summarize raw data in a meaningful way which patterns can be obtained from the raw data. Descriptive statistics are very important since presenting raw data are hard to visualize. In this study, different types of methods to summarize data such as tabulated description (tables), graphical description (charts and graphs), and statistical commentary (discussion of the results) have been used. Two types of statistics are used to describe data. They are the measures of central tendency (mean, median, and mode) and measures of spread (range, absolute deviation, variance and standard deviation

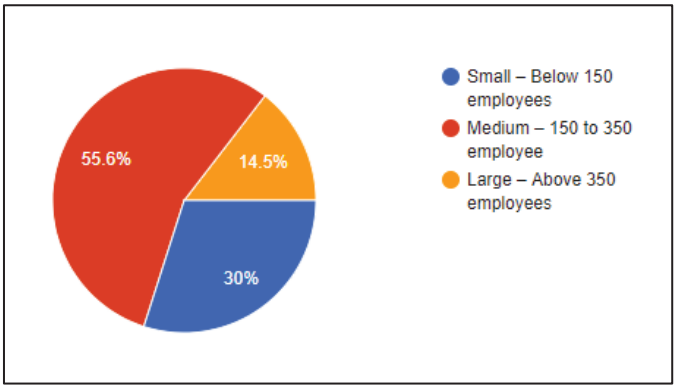

Figure 0.3 Company Size

According to figure 4.1, 30 % of the respondents in the sample represents small scale pharmaceutical companies and respectively 55.6 % and 14.5 % of the responds accounts for medium and large scale pharmaceutical companies. Hence table demonstrate that highest percentage of responds are in Medium scale pharmaceutical companies where within the industry also occupied by similar percentage of companies when compared with others. Hence the data set which is collected for the analysis will be very significant.

TABLE 0.3 MONTHLY PRODUCT WASTAGE GENERATION

How many Tons of wastage does your company throw away each month?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Below 2 ton	54	26.1	26.1	26.1
	Between 2 ton – 4 ton	77	37.2	37.2	63.3
	Between 4 ton – 8 ton	61	29.5	29.5	92.8
	Above 8 ton	15	7.2	7.2	100.0
	Total	207	100.0	100.0	

According to the Table 4.1, highest percentage level of generated waste size has occupied by 2-4-ton category as 37.2 % which accounts for 77 responds and 26.1 %, 29.5 % and 7.2 % of wastage generation has occupied by below 2 ton, between 4-8 ton and above 8-ton categories respectively and accounts for 54, 61 and 15 altogether responses. Hence it concludes that most of pharmaceutical companies generates 2 to 4 tons of waste per month.

TABLE 0.4 FREQUENCY OF WASTE CLEARANCE

How often do you use the waste clearance?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Weekly	30	14.5	14.5	14.5
	Once a month	102	49.3	49.3	63.8
	Twice a month	23	11.1	11.1	74.9
	Other	52	25.1	25.1	100.0
	Total	207	100.0	100.0	

As per the Table 4.2, Waste clearance frequency of pharmaceutical companies are high in once a month and other category which shown as 49.3 % and 25.1 % of the responses. In the perspective of recyclers figure 4.1 and table 4.3, it is a better clue which concludes the business of recycling isn't unstable the industry due to waste generation is huge as well as promising.

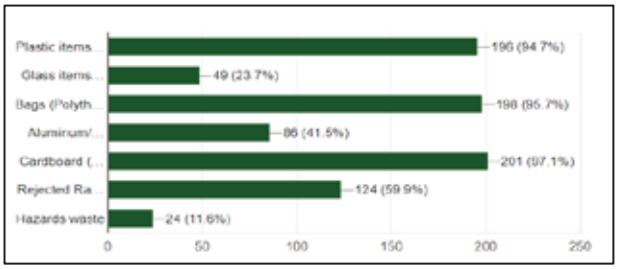

Figure 0.4 Types of pharmaceutical waste

According to the figure 4.2 where focused on parts and components which a pharmaceutical product is made on, most of the responses are weighted on cardboard, polythene bags, plastic items, in a frequency of 201, 198 and 196 respectively out of 207 total responses

However, wastes which can't be recycled or not have legal approval to recycle such as expired medicines and hazardous waste should be dispose anyway under incurring a cost whilst pharmaceutical player has the option to choose whether all other normal components such as plastics, glass, cardboard, aluminium, steel etc. needs to be dispose along with expired medicines and hazardous wastes or sent those to recycle.

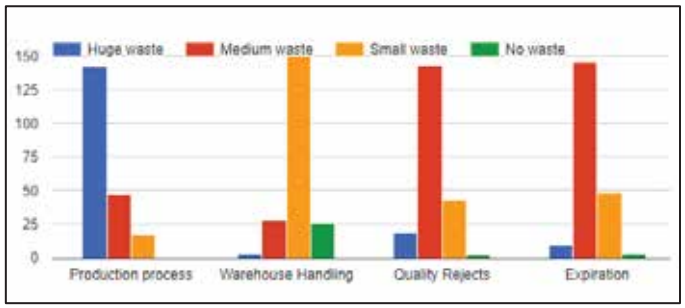

Figure 0.5 Waste generation scenarios

Figure 4.3 demonstrate that highest product wastage generates in production process as well as from quality rejects and smallest level of waste generates at the warehouse handling operations hence in the pharmaceutical Company's perspective; managing the production process is the critical scenario that need to be addressed somehow to manage waste generation.

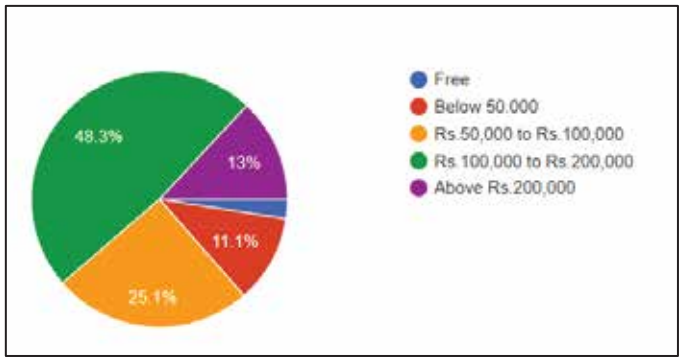

Figure 0.6 Cost of waste removal process

According to the Figure 4.4, 84.5 % of pharmaceutical companies have already paid up to Rs. 200,000 per month for their waste removal process which is huge amount of money waste for unprofitable action. 13 % of companies have paid more than Rs. 200,000 per month which isn't acceptable by any pharmaceutical player in Sri Lanka. Besides there are some methods such as recycling where revenue can be generated and can be smooth-lined this process.

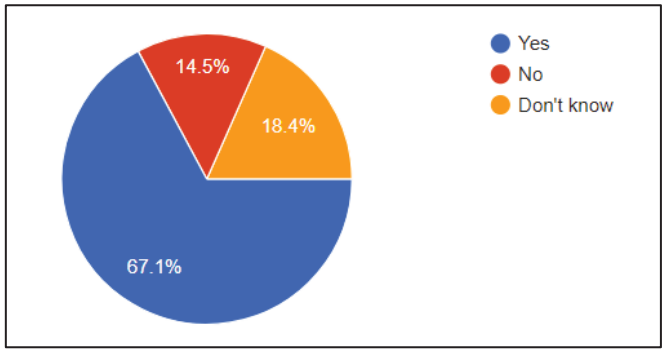

Figure 0.7 Acceptance level if the municipality offered service to waste collection

Furthermore, strong two questions were asked in the warehouse focused questionnaire to identify the qualitative answer through the companies' point of view. It is based on some options whereas if the municipality offered wastage pickup service to pick up unsorted waste from the company for a fee of Rs 10,000.00 per ton which is currently done by most of private

disposers which struggle to indicate that process is simple and decrease workload. Whereas confusions, reluctant to accept new innovations may stepped down from grabbing Sri Lankan new business opportunities and accordingly figure 4.5 confirmed it by illustrating acceptance levels distributed to 67.1 % to Yes, 14.5 % to No and 18.4 % as Don't know categories respectively.

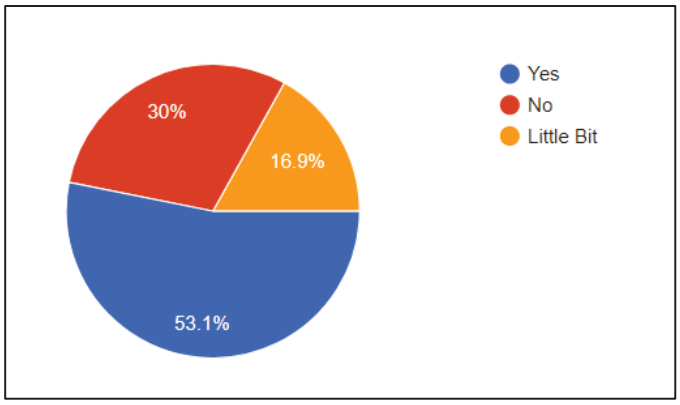

Figure 0.8 Awareness of pharmaceuticals in other countries which make revenue out of recycling

However, figure 4.6 denotes that most of the Sri Lankan pharmaceutical companies aware on pharmaceutical businesses in other countries which make revenue out of recycling. But still people in Sri Lanka won't grasp that opportunities.

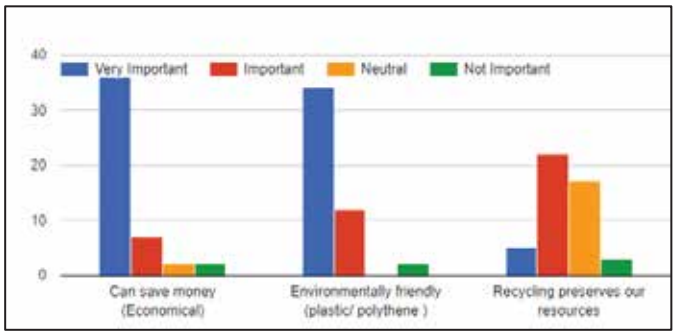

Figure 0.9 Reasons for recycling

Moreover, the Figure 4.7 depicts the benefits of sorting and recycling whilst most of respondents agreed upon as it is an economical process and environmental friendly too. hence it summarises that most of respondents make positive attitudes towards the recycling business. By considering above all demographic factors that analysed, researcher can conclude that recycling is the most suitable and cost-effective waste disposal strategy that can be applied for a pharmaceutical company to remove the waste sustainably.

B. Chi Squared Test for Association

In order to check the relationship between the waste disposal cost and company demographic variables, a chi square test was conducted using the responses obtained for various items such as company size, tons of wastes and waste removal frequency.

Ho: Waste disposal cost is independent from the ith variable
H1: Waste disposal cost is depending on the ith variable – company size, tons of wastes and waste removal frequency

TABLE 0.5 RELATIONSHIP BETWEEN COMPANY DEMOGRAPHIC VARIABLES AND WASTE DISPOSAL COST

Variable Name	P- Value
1. Company Size	0.000
2. Tons of waste	0.000
3. Waste removal frequency	0.000

As described in the table 4.9, all Chi-Square values are lesser than 0.05 hence all null hypothesis can be rejected. There by these variables are depended on waste disposal cost and relevant variables.

C. Cross Tabulation Analysis

In order to summarise the categorical data, Cross tabulation analysis was conducted to waste disposal cost using the responses obtained for various items such as company size, tons of wastes and waste removal frequency.

TABLE 0.6 CROSSTABULATION BETWEEN WASTE DISPOSAL COST AND COMPANY SIZE

Crosstabulation

		How much would you averagely pay per month for the waste removal process?					
		Free	Below Rs. 50,000	Between Rs. 50,000 to Rs.100,000	Above Rs. 100,000 to Rs.200,000	Above Rs.200,000	Total
What is your company size?	Small – Below 150 employees	4	19	28	10	1	62
	Medium – 150 to 350 employees	0	2	21	81	11	115
	Large – Above 350 employees	1	2	3	9	15	30
Total		5	23	52	100	27	207

TABLE 0.7 PERCENTAGE TABLE FOR WASTE DISPOSAL COST AND COMPANY SIZE

Waste disposal cost / Company size	Free	Below Rs.50, 000	Between Rs.50,000 to Rs.100, 000	Above Rs.100, 000 to Rs.200, 000	Above Rs.200, 000	Total
Below 150	6.45 %	30.6%	45.1%	16.1%	1.6%	100 %
150-350	0%	1.7%	18.2%	70.4%	9.5%	100 %
Above 350	3.3 %	6.6%	10%	30%	50%	100 %

Companies that have below 150 employees are categorized as small, 6.45% of small companies remove their waste for free. 30.6% companies spend below Rs. 50,000 hence 45.1% of companies pay above Rs. 50,000 – Rs. 100,000 and 17.7% of small pharmaceutical companies spend above Rs. 100,000 per month for their waste removal process. Companies categorize under medium size, 19.2% of companies spend up to Rs. 100,000 for their waste removal process while 79.9% of medium size pharmaceutical players spend above Rs. 100,000 per month for the waste clearance. In large size companies 20% of the companies spend up to Rs. 100,000 and 80% of large pharmaceutical companies pay above Rs. 100,000 for waste removal.

TABLE 0.8 CROSSTABULATION BETWEEN WASTE DISPOSAL COST AND TONS OF WASTE

How many Tons of wastage does your company throw away each month? * How much would you averagely pay per month for the waste removal process? Crosstabulation		
		Total
How many Tons of wastage does your company throw away each month?	Below 2 ton	54
	Between 2 ton – 4 ton	77
	Above 4 ton – 8 ton	61
	Above 8 ton	15
Total		207

TABLE 0.9 PERCENTAGE TABLE FOR WASTE DISPOSAL COST AND TONS OF WASTE

Waste disposal cost / Tons of waste	Total
Below 2 ton	100%
Between 2-ton -4 ton	100%
Above 4-ton -8 ton	100%
Above 8 tons	100%

Below 2 tones category 9% companies does not spend any amount of money for the waste removal process while 77% of companies spend up to Rs. 100,000 for their waste clearance process and 13% of companies spend above Rs. 200,000 for the waste removal process. Between 2 ton - 4-ton category, 40% of companies spend up to Rs.100, 000 for the waste clearance process while 60% of pharmaceutical players spend above Rs.100, 000 per month for the waste removal process. Above 4-ton -8-ton categories, only 3% of companies spend up to Rs.100, 000 for the waste clearance process and 97% of pharmaceutical companies spend more than Rs.100, 000 per month for the waste removal process. In above 8 tones category, 20% of companies spend between Rs.100, 000 to Rs.200, 000 for waste removal and 80% of pharmaceutical companies spend above Rs.200, 000 for waste removal.

TABLE 0.10 CROSSTABULATION BETWEEN WASTE DISPOSAL COST AND WASTE CLEARANCE FREQUENCY

How often do you use the waste clearance? * How much would you averagely pay per month for the waste removal process? Crosstabulation		
		Total
How often do you use the waste clearance?	Weekly	30
	Once a month	102
	Twice a month	23
	Other	52
Total		207

TABLE 0.11 PERCENTAGE TABLE FOR WASTE DISPOSAL COST AND WASTE CLEARANCE FREQUENCY

Waste disposal cost / Waste clearance frequency	Total
Weekly	100%
Once a month	100%
Twice a month	100%
Other	100%

Companies that use weekly waste clearance strategy, 6.7% of companies remove their waste for free, 46.7% of companies spend up to Rs.100, 000 for waste removal while 46.7% of the pharmaceutical companies pay more than Rs.200, 000 for the waste clearance. Companies that remove their waste once a month, 32.3% of companies spend up to Rs.100, 000 for the

waste clearance process while 67.6% of pharmaceutical players spend above Rs.100, 000 per month for the waste removal process. Companies that remove their waste twice a month, 13% of companies spend up to Rs.100, 000 for the waste removal process whereas 87% of pharmaceutical players spend more than Rs.100, 000 per month for the waste clearance. Companies that remove their waste in other category, 53.9% of companies spend up to Rs.100, 000 for the waste clearance process and 46.1% of pharmaceutical companies spend above Rs.100, 000 per month for the waste removal process.

IV. ADVANCE ANALYSIS

TABLE 0.12 RELIABILITY STATISTICS

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.822	.827	19

Reliability analysis allows to study the properties of measurement scales and the items that compose the scales. It calculates a number of commonly used measures of scale reliability and also provides information about the relationships between individual items in the scale. In this study, Cronbach's Alpha value is 0.822 which greater than 0.70 which concludes that data set is applicable to carry out the study further. Because higher the reliability statistics, higher will be the data set acceptance.

TABLE 0.13 KMO AND BARTLETT'S TEST

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		**.794**
Bartlett's Test of Sphericity	Approx. Chi-Square	1.282E3
	df	171
	Sig.	**.000**

The Kaiser – Meyer – Olkin measure is a measure for degree of suitability of collected data for factor analysis. Accordingly, the above test statistics concluded that Kaiser-Mayer-Olkin (KMO) value as 0.794 which is higher than recommended value of 0.70 resulting to acknowledge the sample adequacy and proceed further with the factor analysis.

Accordingly, the hypotheses are given below.

H0: Correlation matrix is an identity matrix.
H1: Correlation matrix is not an identity matrix

Here the significance value of the Bartlett's test is 0.000 which is less than 0.05 and thus reject the null hypothesis and summarized that correlation matrix is not an identity among variables used in factor analysis matrix which further wires the strength of the relationship

A. Determine Number of Factors

Miller et al (2002) and Pallant (2005) have mentioned regarding model development; initially the data should be analysed using a principal analysis to decide the number of factors. Hence Eigenvalue rule and Scree plot test were used to determine the appropriate number of factors of the study.

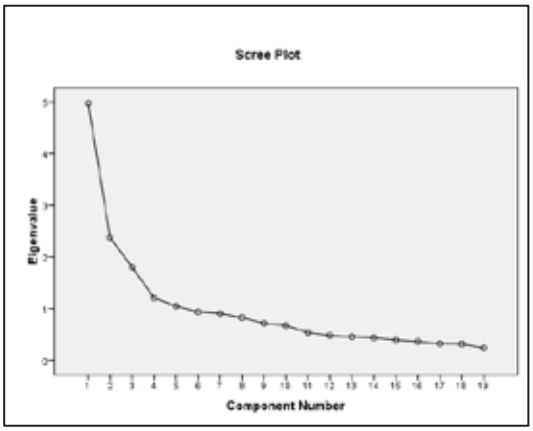

Figure 0.10 Scree Plot

The graph illustrates a sharp turn (elbow) after the 6th Eigen value. Hereby scree plot denotes that 6 of those factors explain most of the variability because the line starts to straighten after 6th factor. Rest of the factors clarify a little extent of the variation and are likely insignificant.

TABLE 0.14 TOTAL VARIANCE EXPLAINED

Component	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.979	26.205	26.205	3.222	16.959	16.959
2	2.377	12.508	38.714	2.274	11.967	28.926
3	1.800	9.474	48.188	2.185	11.497	40.424
4	1.206	6.348	54.535	1.662	8.745	49.169
5	1.047	5.510	60.045	1.600	8.419	57.587
6	.936	4.928	64.973	1.403	7.386	64.973
7	.906	4.769	69.742			
8	.826	4.349	74.091			
9	.716	3.766	77.857			
10	.671	3.534	81.391			
11	.535	2.816	84.207			
12	.480	2.526	86.733			
13	.455	2.392	89.125			
14	.435	2.290	91.415			
15	.392	2.065	93.480			
16	.363	1.908	95.388			
17	.323	1.698	97.086			
18	.315	1.660	98.747			
19	.238	1.253	100.000			

Above table summarises list of Eigenvalues coupled with each linear factor before extraction, after extraction and after rotation where SPSS analysis has identified 19 factors within the data set. Moreover, 5 factors which total initial Eigenvalues exceeds value 1 have been extracted initially in the extraction sums of squared loading section.

However, scree plot represents that 6th criterion also can be taken into consideration because of its shape becomes straighten not from factor 5th onwards but from 6th onwards and also table 4.7 shows that its initial total Eigenvalue very closer to 1.

Thus those 6 overall factors signifies the overall 19 elements which researcher considered initially in the study. Accordingly, factor 1, 2, 3, 4, 5 and 6 of table 4.7 accounts for 26.205%, 12.508%, 9.474%, 6.348%, 5.510% and 4.928% respectively of the total variance whilst altogether these 6 factors explaining the 64.973% variation of total variation.

The values are defined as per the degree of correlations between each of the variables and the estimated components where highest number gives the higher correlation which illustrates the high relationship with the variables. Accordingly, analysis has shown that there are 6 factors which can represent all 19 variables. Those are summarized as per to the highest correlation values where variables which got highest values in a column represent the involvement to create each summarised factor.

Factor 1 (Effective operational process) = f {Having inventory handling procedure for pharmaceutical FG/RM, Careless manual handling, Unsafe use of forklifts, falling of high stacked pallets, Improper product cases loading plan into the vehicle lead to damage products during transportation, Products are damaged due to not use of standard packing material}

Factor 2 (Standard procedures) = f {Wastage of product due to not adhering to the standard level at the production stage, Manufacturers produce more due to inaccurate forecasting, Pilferage happens during transportation}

Factor 3 (Quality of storage/operation) = f {Dusty environment within warehouse, Products are damaged in distributor's points due to not having proper standard storage conditions, sometimes whole of the lot which was imported rejects due to quality issues}

Factor 4 (Regulatory awareness) = f {Awareness of regulatory requirements, Availability of SOPs for waste management}
Since 'Quality issues of raw materials may lead to reject all relevant lots to dispose' have a negative value (-.438) and less than 0.5 this variable can be remove from factor 4.

Factor 5 (Traceability) = f {Having expiration detection procedure, Temperature fluctuations inside the cold storage warehouse may harm products}

Factor 6 (Knowledge) = f {Lack of employee knowledge on overall pharmaceutical processes, Fire within warehouse}

B. Reliability Analysis

Reliability analysis allows the researcher to study the properties of measurements, scales and the items that compose scales. It measures the reliability and also provide information about the relationship between individual factors. Hence Cronbach's alpha value is tested for each factor and should be higher than recommended value of 0.6 to be in acceptable level.

TABLE 0.15 RELIABILITY TEST FOR EACH FACTOR

Factor	Cronbach's Alpha Based on Standardized Items
Effective operational process	.809
Standard procedures	.648
Quality of storage/operation	.710
Regulatory awareness	756
Traceability	.708
Knowledge	.691

According to the results of the reliability analysis all 6 factors which have been done reliability test, has been taken for further analysis as those factors were reliable.

C. Hypothesis Testing

Hypothesis has been carried out for all the factors using Kruskal Wallis test

Hypothesis testing for factor 1 (Effective operational process)

H_o: Effective operational process is independent from the i^{th} variable
H_1: Effective operational process is depending on the i^{th} variable
i^{th} variable – Company size, Tons of waste, Waste removal frequency

TABLE 0.16 KRUSKAL WALLIS TEST FOR FACTOR 1

Variable Name	P- Value
1. Company Size	0.065
2. Tons of waste	**0.000**
3. Waste removal frequency	**0.001**

Tons of waste and waste removal frequency are highly significant when considering effective operational process.

Hypothesis testing for factor 2 (Standard procedures)

Ho: Standard procedures is independent from the ith variable
H1: Standard procedures is depending on the ith variable
ith variable – Company size, Tons of waste, Waste removal frequency

TABLE 0.17 KRUSKAL WALLIS TEST FOR FACTOR 2

Variable Name	P- Value
1. Company Size	0.638
2. Tons of waste	**0.009**
3. Waste removal frequency	0.224

Tons of waste is highly significant when considering standard procedures.

Hypothesis testing for factor 3 (Quality of storage/operation)

H_o: Quality of storage/operation is independent from the i^{th} variable
H_1: Quality of storage/operation is depending on the i^{th} variable
i^{th} variable – Company size, Tons of waste, Waste removal frequency

TABLE 0.18 KRUSKAL WALLIS TEST FOR FACTOR **3**

Variable Name	P- Value
1. Company Size	0.778
2. Tons of waste	0.403
3. Waste removal frequency	**0.047**

Waste removal frequency is highly significant when considering Quality of storage/operation

Hypothesis testing for factor 4 (Regulatory awareness)

H_o: Regulatory awareness is independent from the i^{th} variable
H_1: Regulatory awareness is depending on the i^{th} variable
i^{th} variable – Company size, Tons of waste, Waste removal frequency

TABLE 0.19 KRUSKAL WALLIS TEST FOR FACTOR 4

Variable Name	P- Value
1. Company Size	0.631
2. Tons of waste	**0.045**
3. Waste removal frequency	**0.038**

Tons of waste and waste removal frequency are highly significant when considering regulatory awareness.

Hypothesis testing for factor 5 (Traceability)

H_o: Traceability is independent from the i^{th} variable
H_1: Traceability is depending on the i^{th} variable
i^{th} variable – Company size, Tons of waste, Waste removal frequency

TABLE 0.20 KRUSKAL WALLIS TEST FOR FACTOR 5

Variable Name	P- Value
1. Company Size	**0.013**
2. Tons of waste	**0.046**
3. Waste removal frequency	0.058

Company size and Tons of waste are highly significant when considering regulatory awareness.

Hypothesis testing for factor 6 (Knowledge)

H_0: Knowledge is independent from the i^{th} variable
H_1: Knowledge is depending on the i^{th} variable
i^{th} variable – Company size, Tons of waste, Waste removal frequency

Table 0.21 Kruskal Wallis Test for Factor 6

Variable Name	P- Value
1. Company Size	0.487
2. Tons of waste	0.845
3. Waste removal frequency	**0.008**

Waste removal frequency is highly significant when considering Knowledge

D. Apply Recycling Strategy to PQR Company for Cost Saving

Most of the pharmaceutical companies in Sri Lanka use direct dispose method for the waste removal process rather than recycling method due to regulation barriers and work load of the companies. As per to the objective of the dissertation, the researcher has identified two same scale pharmaceutical companies to evaluate how economical the recycling process instead of direct disposal method.
PQR Company is well known pharmaceutical company exist around 60 years in the field where still it uses traditional direct disposal to waste removal process. And below is the gathered information for period of one year.

TABLE 0.22 WASTE DISPOSAL COST STRUCTURE OF PQR COMPANY

	Waste type	Sub total
Nov-16	Pharma waste	227057.8
	Lab Chemical waste	679855.8
Dec-16	Lab Chemical waste	275192.9
Jan-17	Pharma waste	160785.3
Feb-17	Pharma waste	106853
Mar-17	Pharma waste	48766.76
	Lab Chemical waste	378586.4
Apr-17	Pharma waste	265338.3
May-17	Pharma waste	0
Jun-17	Pharma waste	190471.6
Jul-17	Pharma waste	117179.5
Aug-17	Lab Chemical waste	278443.5
Sep-17	Pharma waste	176556.6
Oct-17	Pharma waste	621701.7
Nov-17	Pharma waste	526776.5
	Total	**4,053,566**

The table 4.21 indicates the waste removal total cost for one year as Rs. 4,053,566/- which is considerable higher amount of unnecessary cost for disposing process. It includes transportation charges and charges paid to disposer due to their bargaining power where PQR Company has no option in disposing rather than doing it through these kinds of disposers around Sri Lanka. ABC Company also a well-known same scale pharmaceutical player in Sri Lanka which uses recycling method to its waste removal process. And the information gathered for a period of one year is analysed below table 4.22

TABLE 0.23 REVENUE GENERATED FROM RECYCLING BY ABC COMPANY

Waste type	UOM	Quantity (07/11/16 to 15/11/17)	Price	Total Revenue
Cardboard Drum	EA	266	30	7,980
Cardboard Waste	KG	4358	20	87,160
Damage Sugar bag	KG	166	5	830
Jumbo Bag	EA	623	50	31,150
Metal Drum	EA	229	550	125,950
Paper Drum	EA	78	20	1,560
Pet bottle	KG	84	15	1,260
Plastic Drum	EA	717	600	30,200
Plastic Jars	KG	452	20	,040
Plastic Scrap	KG	235	10	,350
Polythene Waste	KG	693	40	7,720
Wooden Pallet Large	EA	905	65	58,825
Wooden Pallet Small	EA	464	50	3,200
Y.P.J White bucket	KG	689	60	1,340
Total				**848,565**

Here the analysis summarised that the revenue that can be generated through waste recycling process as Rs. 848,565 /- which proves that considerable revenue can be generated through recycling also where most of the pharmaceutical players in the industry does not focused on. However, PQR Company has to use direct disposing also to dispose the waste which cannot be recycled which includes some amount of spending too. Hence it should implement both recycling and disposal process where according to the waste amount collected, waste types and time period: revenue which can earned can be differ. Sometimes this can be a breakeven, net revenue generation process or somewhat costly process but comparatively it's a very lesser amount of cost which was contributed than PQR Company. Hence the scenario summarises that recycling is a viable, enforceable and cost-effective technique which a pharmaceutical company can exercise to transform existing cost generating practices to revenue generation in Sri Lankan context as well.

V. CONCLUSION

Research Findings on Objective 1

As the initial step of study, the analysis was separated according to the three objectives of the study which were to identify and propose a more sustainable and cost-effective waste disposal strategy, to apply that strategy and investigate the cost savings in PQR company and finally to determine the factors affecting to the waste disposal cost in pharmaceutical industry. From the results of initial analysis, researcher able to capture some of the characteristics in sample population. According to the results, majority of the respondents were medium size companies who were actively engaged in data collection and accounts for 55.6% and further concluded that amount of monthly wastage generated is between 2 ton to 4 ton for 37.2% of the companies in Sri Lanka. And the frequency of waste removal is once a month for 49.3% which ensures recyclers input frequencies for recycling purposes where most of the recycler's mind-sets are in a narrowed on the view of they could not be able to collect enough level of wastage to carry out the recycling business. Thus, here the study concludes that there is numerous level of pharmaceutical wastage and collection frequencies are wider to have a good recycling business. In regarding the waste generation spaces, study concludes that highest pharmaceutical wastage causes in productions stage due to design waste and production washout waste are comparatively higher. As well as in quality rejects and expiration are the other critical scenario that need to be balanced somehow to manage waste generation. And in the viewpoint of features which a pharmaceutical product is made on, most of the responses are weighted on cardboard, plastic, rejected raw materials and polythene bags items where those items have the higher degree of recyclability in Sri Lankan market place. Presently, 48.3% percentile of pharmaceutical companies have been already paying up to Rs. 200,000 per month for their waste removal procedure which is huge money waste for unprofitable action.

Furthermore, two strong qualitative questions which based on warehouse sorting perspective concludes that, same percentages of attitudes will be there in the industry on accepting costs, sensitive on cost as well as some companies have doubts on accepting the recycling process. In this sense, 55.1% respondents signify that currently organizations don't focus on recycling processes but have 30% over amount of recyclable waste each and every month which can be recycled. Hence, reasons which most of respondents denoted are that collectors ask to sort before collection, time consuming, brand protection policies and regulation barriers to reuse pharmaceutical items again. However, regulation barriers are the foremost issue in the industry which restrict to reuse the product due to those are directly inter-related with personal health. However main barrier in developing countries are that not having professional pharmaceutical waste collectors which don't have proper contractual agreements on collection whereas dissertation concludes that existence of professional waste collectors in Sri Lanka is 72.1% while respondents who don't have awareness about professional collectors are 29.8%. Hence it can be concluding that presence of professional waste collectors is a reality in Sri Lanka besides it needs some kind of effort to identify them in nearby. In relation to the benefits aspect, most of respondents signify that recycling is an environmentally friendly, economical process and preserves existing raw material resources and finally cross tabulation on do you recycle vs economy can be generated concludes that revenue can be generated from recycling as an economy generation process to the pharmaceutical oriented companies.

Research Findings on Objective 2

Objective 2 of this empirical research was focused on the factor analysis on factors affecting to waste disposal cost in pharmaceutical industry in Sri Lanka. In order to recognise the elements of waste disposal cost, an organised questionnaire was developed with 19 factors. Due to the huge number of factors available in the study, factor analysis was carried out to summarise the number of factors and accordingly factors were extracted to six variables from the results of factor analysis. Rather with the assist of comprehensive literature evaluation concluded six factors were named as "Effective operational process", "Standard procedures", "Quality of storage/operation", "Regulatory awareness", "Traceability" and "Knowledge" for the ease of interpretation. Nevertheless, those six extracted variables were used for further analysis with the demographic questions based on the questionnaire and hypothesis test has been executed by using Chi-Square analysis to find out the significant factors among these six extracted factors. Moreover, overall these factors can be considered as the main factors affecting to the waste disposal cost of pharmaceutical industry in Sri Lanka.

Research Findings on Objective 3

Findings of analysis on objective 3 regarding amounts of money which PQR company spent each and every month on waste removal process is averagely Rs. 4,053,566/- which is highly considerable amount of unnecessary cost. In the context of ABC Company which uses recycling for its waste removal process generates monthly income of Rs. 848,565/-. However, all the waste can't be recycled which anyway incurs some amount of cost for its direct disposing. But the significant point is that possible revenue that can be generated can use to overcome the above said cost which ultimately brings the process towards breakeven of cost, some amount of cost but lower than what PQR company spends or some level of revenue if possible. Hence the scenario summarises that recycling is a viable, enforceable and cost-effective technique which a pharmaceutical company can exercise to transform existing cost generating practices to revenue generation in Sri Lankan context as well.

Recommendations

Respondents were requesting to give their suggestions in the end of the questionnaire hence some respondents emphasized the significance of this recycling and give their recommendations as well as here.

- Transparency of waste, company need to know the details of their waste management. Who collected it? When? How much did it weigh, and what was the end treatment process?
- Segregate the waste real time at the collection centre without stocking for post separation.
- Minimize production waste as much as possible

Nevertheless, for recycling to achieve its intended purpose of contributing to waste management in Sri Lanka, the following recommendation may be helpful. As per the analysis carried

through the study it can be recommended to the pharmaceutical companies that, step on to recycling business where it can generate revenue as well as preserve environment far than now. In regarding the factors summarized in the analyse it is recommended to regulatory makers to see on a big picture to identify where the regulations should be tightening as well as the places which regulation need to be loosening to make proper smooth pharmaceutical and hazardous disposal process in Sri Lanka. Finally, despite of all above recommendations the key conclusion identified through this study is that the waste which generate in the pharmaceutical industry can be recycled and it's an opportunity to convert current cost generating disposal process to a revenue generating process. However most of the pharmaceutical companies in Sri Lanka still confuse on recycling process. But here the dissertation concludes and recommended that any pharmaceutical company can generate revenue by recycling but it's up to the pharmaceutical player to manage their sorting process accordingly by accomplishing the sorting at the same time of receiving product waste to the warehouse collection point without keeping for post sorting because sorting is the main challenge which make barriers to enter into that recycling business.

Contributions and Implications

This study is very significant to the pharmaceutical industry in a context of Sri Lankan pharmaceutical players incurred a huge amount of money waste on the waste disposal process in each and every month. Because, finding of this research become more and more significant to make economical disposal procedure and to contribute environment in more sustainable way. In a framework of a better research, looking at waste from one point of view, waste just is that an ecological catastrophe. Sometimes in the supplementary side it will have rich foundation of valuable resources that could be recuperated profitably. Moreover, this dissertation examines on the best way to discard unusable waste in more sustainable way which will support to existing pharmaceutical players and for new entrants to get possible opportunities swing in the industry. However, this must be controlled through the national legal and ecological perspectives while conveying required commitments and obligations regarding the principle performers.

Scope and Limitations

The study is limited to the pharmaceutical industry and as a major limitation it focuses only on industrial waste (pharmaceutical product) disposal which was collected at the end of the month as expired, quality rejects, transport damages as well as handling damages etc. and not focuses on e-waste and municipal waste of the companies. However, the study describes determinants to product waste disposal cost and uses them to investigate a better and feasible way of cost effective waste disposal strategy. And as final step, apply that strategy in PQR Company and observe the effectiveness as well. Further the data was collected from pharmaceutical companies in Sri Lanka only, thus analyse the current situation within the country and a comparison was done with the international countries on how they manage their waste management system through the reliable data sources obtained online.

Future Research

It is obvious that waste management needs to provide enhanced solutions for sorting out pharmaceutical waste in a way that better engages users. Hence the author's future potential works will address probable explanations for separated collection and treatment of pharmaceutical waste, with the intention of providing a more satisfactory user experience. To increase user motivation by delivering the products for recycling, perspectives of waste on both waste generator and waste collector will also be investigated. Further this research only framed to Sri Lanka which is a small country whereas in future studies researcher has ability to focus on massive level of waste management without framing to pharmaceutical industry only where there are lots of other industries in world which has recyclable wastage items. Furthermore, there is potential opportunity to execute broader international survey to give a better and bigger knowledge on changes happening in the industry.

However, in this study, regression model was not developed to calculate the revenue which as ability to be generated. Thereby it has an opportunity to develop a model to measure the degree of relationship amongst possible waste generating factors. There are several auxiliary options for transforming waste into a type of asset where it can additionally be researched through future studies. Hence the author's future work will enlarge and evaluate these choices by examining user acceptance to various solutions, as well as their obstructions for implementation

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Improving Positive Attitudes Through Cooperative Learning

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***Abstract*- The study examined the practice of cooperative learning and working in groups have improved attitudes towards group work, communication, interpersonal skills and achievement of students. Objectives of the study are to develop positive attitude towards Social studies, to enhance the teamwork of students and achieve better productivity and to develop self-management skills. To achieve the objectives of the study the Grade 5A class has been selected and thirty-five students have participated in the study. Random sample have been used to select the respondents and both primary and secondary data collection methods have used. Data collection techniques were questionnaire and interviews for students and observations and reflective report of the teacher researcher. Study found that working in groups also can change the attitude of the students. The study revealed that there is a slight increase in attitude towards Social Studies after group work. Further the students appreciated working with one another on solving problems. Particularly when the students were in groups they feel more confident to do the work. Study revealed that cooperative learning helps to develop self-management skills since when the student gains more confident they will be able to manage themselves better.**

***Keywords* – Cooperative learning, Social studies, Positive attitude**

I. INTRODUCTION

Cooperative learning in other words working in groups have improved attitudes towards group work, communication, interpersonal skills and achievement of students. Working in groups also can change the attitude of the students. There are students in the classroom they have different abilities. Teacher has to identify the individual cases and their merits and different abilities of the students. Students can learn from their peers. Therefore, peer learning is very important. Cooperative learning is a skill that students should learn because it helps throughout their lives. Cooperative learning helps to develop team working, communication skills, interpersonal skills and social skills. All the students can be benefited through working cooperatively towards the same goal with peers since they learn from each other. Therefore, working cooperatively can solve many problems. According to Oxford American Dictionary, cooperative learning can be defined as a small group of students who are working together on a common learning task. Each student plays an important role of helping one another achieve this common goal. (Cited in Johnson, 2009).

II. PROBLEM STATEMENT

Cooperative learning closely links with activity based learning facilitated through group work and pair work. The most significant feature of the cooperative learning is the opportunity created for students to share their ideas and strategies with their peers. Teacher plays the role of facilitator and creates an atmosphere that where all students like to share their ideas, views and strategies with the peers. According to Johnson (2009) the interaction within cooperative groups support students feel confident in their own capabilities. Students can come up with different strategies to same problem. The cooperative communication between students also can be very beneficial for other subjects and co-curricular activities where the ideas of students are prevalent. If the students who can work with others cooperatively and willingly share their ideas they will be a productive member of the society for today and tomorrow.

Prior to the intervention the teacher researcher conducted five social studies lessons in grade Five A class utilizing the cooperative learning approach in which activities were executed through pair and group work. The observations made by the researcher proved that students lacked practice in maximizing learning through pair work and group work. Their group work is not up to standard. The majority was reluctant on cooperative working and thus need for the intervention was justified.

III. SIGNIFICANCE OF THE STUDY

Cooperative learning is the instructional practice of placing students into small groups and having them work together towards a common goal. Each group member learns new material and helps other group members to learn important information. Cooperative learning enhances the positive attitudes towards the subject matter and not only the subject matter but also can create and develop more positive attitudes towards teachers, principal and school as a whole. Also, a teacher creates positive attitudes towards their students and develops the student's oral communication and social skills. Further students learn to use team approach for problem solving and this gives responsibility for learning. Cooperative learning promotes innovation in teaching and classroom techniques and creates an environment of active, involved, exploratory learning and stimulates critical thinking and helps students to clarify ideas through discussion and debate. Further cooperative learning meant to enhance self-management skills. Students are taught how to criticize ideas of their peers, not people. Cooperative

learning sets high expectations for students and teachers because students are empowered with taking their own decisions about group work and teachers have trust on students and their work. Additionally, this leads to develop leadership skills of students. At the end cooperative learning will be a life skill for students.

IV. RESEARCH QUESTIONS

1. How will students' attitudes toward Social Studies change after cooperatively learning and working in small groups?
2. How will the students perform better in Social studies when working groups and pairs?
3. Will the students improve their self-management skills?

V. OBJECTIVES OF THE STUDY

1. To develop positive attitude towards Social studies.
2. To enhance the teamwork of students and achieve better productivity.
3. To develop self-management skills.

VI. METHODOLOGY

This study is a small-scale action research conducted with sample of thirty-five students from grade Five A. Random sample have been used to select the respondents of the study specifically when answered the questions. To collect data both primary and secondary data collection methods have been used. Data collection techniques are questionnaire and interviews for students and observations and reflective report of the teacher researcher. Firstly, students were asked to complete a work based project questionnaire. On second day teacher has appointed group leaders and assigned the groups. Thirty-five students were divided in to five groups and each group consists of seven members. Beginning of each day short introduction has given to students on how to do their activities. At the end in order to find out the answers students have worked together and conducted the presentation. Three different activities were given to students within seven days of the study. Activities have chosen from three different texts from the grade five Social Studies text book.

Subject area and lessons for activities

TABLE 1
SUBJECT AREA AND LESSONS FOR ACTIVITIES

Subject area	Lesson	Method
Social Studies	The Sinharaja Forest	Some question cards have given to the students. As a group, students found out the answers by working together. Finally, students presented based on their activity questions.
Social Studies	Grasslands of Sri Lanka	The students have to read their text book and find out more information on lesson by researching.
Social Studies	Sigiriya or Lion Rock	Final Activity on third day was Cooperation Cards and which distributed among students. After reading the question on cooperation card students presented their answers to the whole class.

Above table 1 presented the subject area and lessons for activities.

VII. ASSESSMENT

There were 50 points possible for each assessment. Some criteria are participation, leadership, and communication skills. Same group reward system was used as was used for the teacher-formed groups and as well as student form groups. During the last two days of the project, six students were randomly selected to answer a specific set of interview questions. Subsequently the completions of the project students were requested to complete a post-project survey. The surveys and interview responses were used to assess how students' attitudes changed during the cooperative group learning process. A teacher journal also was used as another form of data collection. At the end of the day the teacher researcher made the journal entries on the learning teaching process. During project period, the researcher also commented on what she noticed about the students' attitudes related to group work.

First activity was on lesson Sinharaja forest. The teacher has planned the activity based on Sinharaja forest. Students have given fifteen minutes to prepare for their activity which was role play about Sinharaja forest and how we protect the forest. The groups came up with creative role plays. Second activity was based on lesson Grasslands. Activity questions were chosen from the text book. Students have engaged in the activity and answered the questions. Third activity was based on the lesson Sigiriya or Lion Rock with cooperation cards which were learning through fun and very good experience for students. There were some problems related to each cooperation card and students were given fifteen minutes to prepare and come up with their solution.

VIII. IMPLEMENTATION

Daily a short introduction was given to the students about the topic of the day, and then students worked communally to solve the problems that they were assigned. On the first day of the research project, students were asked to complete a pre- project questionnaire. Questionnaires were given to students and instructed them how to fill the questionnaire. On the second day, the students were placed in groups assigned by the teacher and the first activity was based on Sinharaja forest. On third day the activity was based on lesson Grasslands. Fourth and fifth days students were taken extended time to do the activities since it was new to them. Therefore, two days were allocated for Cooperation cards activity since the teacher has given students to prepare fifteen minutes and students have to come up with the solutions. And afterwards the students have taken some time for their 10 minutes presentation. Therefore, one day was not enough for this activity. During the last two days that is 6th and 7th day of the project, interviews were conducted to obtain some information from the students and after completion of the project students were asked to complete a post-project survey respectively.

IX. FINDINGS

During this study previous day's problems were discussed with the students at the beginning of each day. Then a short introduction was given to the students about the new activity. The majority of the class time was used for cooperative group work. Three activities were based on text book and students worked together on a specific set of questions from the textbook (Sinharaja Forest, Grasslands of Sri Lanka, Sigiriya or Lion Rock). Students had freedom to work in the groups and answer the questions. Generally, this type of atmosphere worked well when all students experienced some type of success at the beginning of the activity though the students' behavior and classroom control should be monitored closely. Many students are involved in several cocurricular activities, which led them to miss the class. This instigated some problems specifically with regards to formation of groups if more than one member of a certain group would happen to be absent the same day. In such situation it was very difficult to do the group projects. Some of the students commented that during the interviews that it was helpful when their group members would help them when they were absent. On the other hand, this made it easier for the teacher researcher to see the progress of cooperative learning because the students were able to help one another.

First research question was how will students' attitudes toward Social studies change after cooperatively learning and working in small groups? Attitude can play a very important role for the success of many students. If a student believes that he or she can be successful, then many times he or she will be successful. After this study, the teacher researcher claimed that there was a slight increase in attitude toward Social Studies after group work. The students adored working with one another on answering and explaining problems. The category of group formation was varied among the students. Some students liked the teacher formed groups and others like their own groups though mostly students like their own groups better since they can work with their friends. However, the teacher has to intervene because if the students always wanted to form their own groups then they did not have opportunity work with everyone in the class and on the other hand when always friends working together class can be noisy. Therefore, to control or manage the class teacher intervention is important. All the students agreed that it is important to have group members who are willing to help. The two most common responses to the question on the post-project survey that said, "when working in groups, I wish I could work with a person who is" "clever or positive" and "supportive". When compared to pre-project survey, post-project survey indicated a slight increase in results since the changes in attitudes occurred. When asked the question, "When I think of Social Studies, I think nervous, calm or both", 57% (twenty students) choose calm, 14% stated they were nervous and 29% stated they felt both on the pre-project survey (Figure 1). When asked to rate the question "I have more confidence to try problems when I work in a group," 86% (thirty students) agreed with the statement (Figure 2). It indicates that students are not nervous anymore; especially when they are in groups they feel more confident to do the work. On the other hand, students agreed with the above statement denotes that this leads to achieve the third objective (to develop self-management skills) of the project too because if the student gain more confident they will be able to manage themselves better.

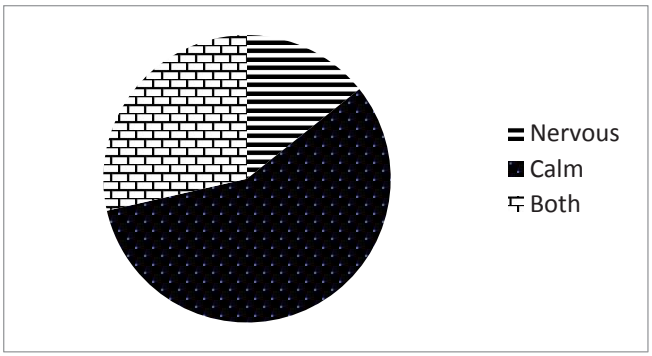

Fig.1 When I think of Social studies

Nervous	Calm	Both
14%(5)	57%(20)	29%(10)

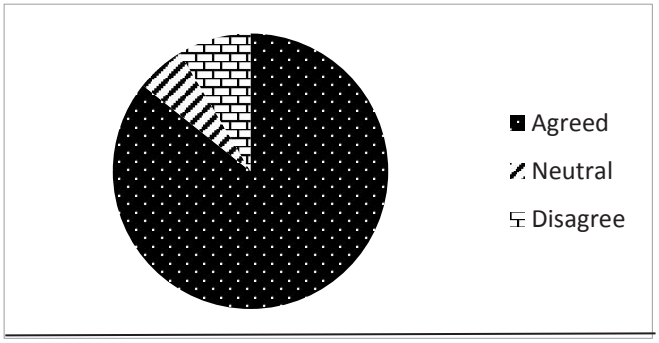

Fig 2. "I have more confidence to try problems when I work in a group,"

Agreed	Neutral	Disagree
86% (30)	6% (2)	8% (3)

Ten students interviewed with the help of another assistant teacher. During the interviews out of ten, seven students mentioned that they noticed changes in other students during group work. For example, previously not very keen students were encouraged due to group work. The students all agreed that they understood better and did not get confused. Six of the ten students interviewed said that they felt that working in groups has prepared them better than working alone. Results from the students' pre-project survey showed that the statement "working alone on assignments" (Figure 3) stated nearly 63% of the students (twenty-two students out of thirty-five) said the best way compared to the post-project survey of 83% of the students (twenty-nine students) agreed and felt that "working in a group helps them to understand the concepts better" (Figure 4). Compared to pre- project questionnaire and post project statements it indicates those students' attitudes towards working in teams have improved rather than working alone.

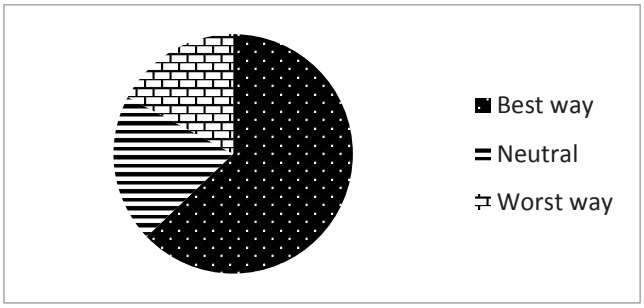

Fig. 3 "Working alone on assignments"

Best way	Neutral	Worst way
63% (22)	20% (7)	17% (6)

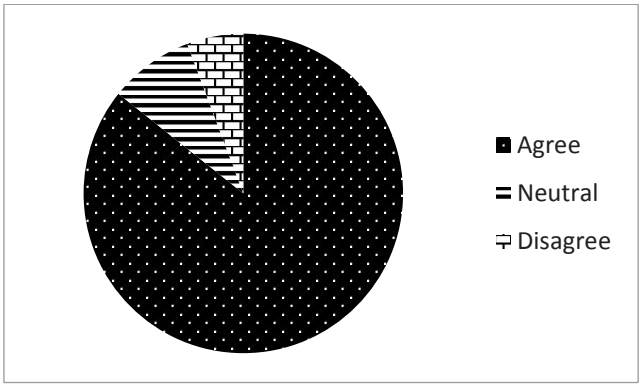

Fig 4. "Working in a group helps them to understand the concepts better".

Agree	Neutral	Disagree
83% (29)	11% (4)	6% (2)

Second research question was how will the students perform better in Social studies when working groups and pairs. As this study progressed, the teacher researcher noticed that students were trying to work with their peers before teacher intervened. The teacher always has been too quick to intervene when she realized that students are struggling rather than allow them some time to process and think about a possible solution. This study permitted teacher researcher to be more of an observer and later understood that when students work together many creative effects can occur. When the students are given sufficient time to discuss with their peers in general they asked more questions.

Further the teacher researcher noticed that the longer the groups were together, the better the students seemed to be working with one another. Initially some of the students in teacher-formed groups were not very cooperative with their peers. These students were not pleased or relaxed working with the other peers in the group. Later the students gradually realized that each member of their group does have a different or unique ability that could help them to perform better and achieve their goals. When students formed their groups, it appeared to be relaxed and easier for students to work together. The researcher believed that this is because they were in a group with their friends who they usually associate with during other time of the day. The teacher researcher noticed, however, that it was easier for the students to become distracted and sometimes not stay on task since they wanted to socialize while they work. Then again according to the post survey question 71% (25 students) students too have agreed the statement "I thought working in groups too noisy during the class". Therefore, teacher has to supervise and monitor the groups closely.

When this study proceeded to fifth day with the end of third activity the teacher researcher has realized and obtained answer for the third question, that is, did students improve their self-management skills? According to the teacher researcher's observation, when compared to first day the students' self-management skills seems to be increased in a positive manner because they were able to take the responsibility and less noise in the class. With given activities when students' get-together with their groups they were very keen of the project. The instructions should be cleared. Otherwise students can be restless. Students were more confident as well an in group that leads for their self-management. For instance, post survey question "I have more confidence to try problems when I work in a group" 86% students agreed with the statement. Further the 74% students (26 students) agreed with the statement "When I work in small group, ideas and opinions are treated with respect". These responses were the evidence that showed students' self-management skills have improved. They learnt to respect their peers and learnt to manage themselves for good effects.

X. CONCLUSION

The findings of this study indicated that an improvement in students' attitudes towards group work in Social studies, activity based learning, socialization and communication similar to Gillies and Boyle (2009) and Walmsley and Muniz (2003). These studies also found an increase in students' attitudes after working in cooperative learning groups. Gillies and Boyle (2009) suggested well documented pedagogical approach to teaching in classrooms promotes academic achievement and socialization. The teacher researcher experienced with the cooperative learning in the classroom convinced that this learning can have a positive effect on students' achievement and attitudes towards Social studies. When students working together classrooms can be noisy therefore to manage the classroom teacher intervention is vital. Further Gillies and Boyle (2009) supported the researcher's view suggested that during the group activities students socializing and not doing group activities.

However, as a whole, benefits of the cooperative learning exceed since the group work is more productive and this finally leads to positive attitudes towards subject related activities (Social studies in this study) and its achievement, improving team work, self-management skills, interpersonal skills and communication.

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Sri Lankan university students' and English lecturers' acceptance of selected Sri Lankan English prepositional verbs: pedagogical implications

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***Abstract*— One of the characteristic features of Sri Lankan English (SLE) is the use of verb-preposition combinations which do no not exist in British Standard English (BSE). Such verb formations, which could be classified as prepositional verbs, are used in abundance in SLE newspapers. This research focuses on the levels of acceptance displayed by Sri Lankan university lecturers of the English Language and Sri Lankan university students currently following English courses at the English Language Teaching Units (ELTUs) of their respective universities. The results obtained through an acceptability test firstly point to high levels of acceptance of these verb formations among university students and English lecturers of Sri Lankan universities. Secondly, the findings show that the acceptance levels displayed by the university students is higher than those displayed by English lecturers. Finally, the results reveal that, out of three SLE prepositional verbs, 'discuss about' is the verb that has received the highest level of acceptance where the university students are concerned. On the contrary, with regard to the English lecturers, 'comprise of' has received the highest level of acceptance. This paper highlights some implications that these acceptance levels displayed by Sri Lankan undergraduates and English lecturers have on the teaching of these verb formations in particular, and the pedagogy, in general, of English as a Second Language (ESL) in Sri Lanka.**

***Keywords*— prepositional verbs, World Englishes, British Standard English, Sri Lankan English, acceptance, English as a Second Language**

I. INTRODUCTION

Among the many features of SLE highlighted in Meyler's (2007) *A Dictionary of Sri Lankan English*, variations with regard to verb-preposition combinations are of particular interest. Such variations involve the addition, the exclusion or the replacement of a preposition after a verb. These practises have given rise to the usage of prepositional verbs which are not characteristic of BSE but are used by Sri Lankan users of English [10], (pp.xvi-xvii). Verb formations of this nature, according to famous English dictionaries, would have to be considered as 'errors.'

The verb formations "discuss about" (DA), "comprise of" (CO) and "consider about" (CA) are examples of when users of SLE add prepositions after verbs which, in BSE, are not required to be followed by prepositions. The Cambridge Advanced Learners' Dictionary (2008) warns users of English to "[r]emember that 'consider' is never followed by a preposition. Do not say *consider about* something. Say 'consider something'". This dictionary mentions the same about 'discuss'- it is not followed by 'about.' The Heinemann English Dictionary (2001) says "[n]ote [...] that the use of *comprise* followed by *of* is incorrect." Regardless of how the use of these verbs is codified, the verb formations DA, CO and CA, can be found in abundance in SLE newspapers. In addition, the use of both DA and CO have been attested in the written component of the International Corpus of English – Sri Lanka (ICE-SL) and the Sri Lankan component of the South Asian Varieties of English (SAVE) corpus.

There are diverse ways in which this grammatical phenomenon can be interpreted. If seen in terms of Selinker's interlanguage (IL) theory (Jenkins, 2006) according to which "a second language speaker's competence lies on an *interlanguage continuum* at some point between their first language (L1) and their second language (L2), in this case, English," this deviant use in SLE newspapers of these particular verbs would be errors which have reached the stage of *fossilization*. A critic of the IL theory would cite this as an example which proves that "outer circle English speakers are not attempting to identify with inner circle speakers or to produce the norms of an exonormative variety of English grounded in an inner circle experience." These verb formations can also be construed as "forms" produced by "learners" which reflect the "sociolinguistic reality of their English use, whatever their circle, far better than either British or American norms are able to" [4], (pp. 167-168). One could also argue that this 'incorrect' use of 'discuss', 'comprise' and 'consider' are similar to what [15], (p. 220), identifies as the insertion of "redundant prepositions," which is considered to be one of the potential features of English as a Lingua Franca (ELF) lexicogrammar.

This range of possible reactions to the way in which DA, CA and CO are used in some Sri Lankan print media gives rise to the central questions of this research – to what extent are these verb formations considered acceptable by Sri Lankan users of English who read them in print and is there a difference in how various groups of users of English in Sri Lanka react to these 'inaccurate' verb formations? If yes, how should this issue be addressed in the process of teaching English as a Second Language (ESL) or should this particular phenomenon be considered an issue at all? Writing about teaching in theory and practice, [4] mentions that most of the research conducted in WEs "stand out in their significance for the teaching of English" and that these "relate to challenges to interlanguage theory and to work exposing and resisting linguistic imperialism." Although many linguists have considered the "teaching and learning of English in relation to the realities of the language's current spread and use" and challenged the IL theory and prescriptive approaches to the English language and its pedagogy, it has not "so far led to noticeable changes in English teaching and teacher education policy." Also, the literature on teaching English still "regularly contains advice for teachers in both outer and expanding circles on how to reduce IL errors and how to reduce fossilization, while the testing of English remains wholly predicated on the concept" (pp. 158-169). If this is the case, are teachers supposed to look at the usage of DA, CA and CO as caused by L1 interference/transfer and advocate the 'standard' use of these verbs? Or are these verb formations to be used as expressions with which to resist native speaker standards?

Before attempting to answer these questions, it will be useful to situate the use of DA, CA and CO within WEs and SLE. Following this discussion, Sections 2 and 3 of this paper focus on the research questions, and methods and methodology of this research, respectively. Sections 4 and 5 present the results and discussion based on the findings of this research; a discussion which includes the implications of the findings of this research on the pedagogy of the English Language in Sri Lanka.

A. World Englishes and Sri Lankan English

Within the term 'World Englishes' is the acknowledgement of the fact that, as opposed to a single form of English, a variety of Englishes are being used all over the world. WEs can be used as an "umbrella term" which covers "all varieties of English worldwide and the different approaches used to describe and analyse them" [4], (p.139). The English language, following its contact with other languages after the advent of the colonial era, was subjected to a process of change caused by speakers of English as a second or foreign language who flavoured the language with features of their own native tongue. This caused the emergence of many varieties of English, such as American English, Nigerian English and Sri Lankan English. In addition to highlighting the plurality of the English language, WEs theory asserts that each of these Englishes should be considered as being on par with the other. This claim has resulted in the attempt to blur the distinction between 'native' and 'non-native' speakers and suggests that each variety of English deserves equal status.

[5], (p.137) attempts to explain the emergence of WEs that took place in three different phases – the initial contact of the English language with the other languages spoken on the British Isles, the second stage which saw the passage of the English language to North America and Oceania and finally the "Raj phase" during which the English language was introduced to South and South-Eastern Asia, South, West and East Africa, and the Philippines. The different Englishes that have resulted from other languages coming into contact with English have been categorized in Kachru's Three Concentric Circles model under the headings Inner Circle (norm- providing), Outer Circle (norm-developing) and the Expanding Circle (norm-dependent) [5], (p.136-138).

The initial steps towards describing a Sri Lankan variety of English were taken by Passe in 1955. He describes Ceylon English as "a form of English with a distinct flavor of its own in regard to pronunciation and intonation, and in the case of most people, idiom, grammar, and vocabulary as well." Such features have been described as having been more evident in the spoken form than in the written context (p.13). As a result of this distinctiveness of [12] from Standard English, teachers of the English language are described as having faced the issue regarding

> how to keep the local form of English as near to the Standard as possible without altogether depriving it of its warmth, colour and liveliness which some of the literal translations from the local languages contribute, especially to the colloquial idiom [12], (p.14).

What is interesting to note in the above excerpt is Passe's attitude towards Ceylon English and his belief that teachers of the language should not altogether dismiss this variety of English but strive to keep the variety close to the Standard without depriving it of its defining features.

In more recent times, SLE has been defined as "the language used by Sri Lankans who choose to use English for whatever purpose in Sri Lanka" [3], (p. 11), and "as the language spoken and understood by those Sri Lankans who speak English as their first language, and/ or who are bilingual in English and Sinhala or Tamil" [10], (p. xi). Through these definitions, one can come to the conclusion that SLE is the variety of English spoken in Sri Lanka; a variety which has emerged and stands distinct from other

varieties of English due to the changes wrought in it by speakers of Sinhala and/or Tamil languages.

B. Prepositional verbs in World Englishes

SLE is characterized by verb- preposition collocations which do not exist in BSE. Such verb formations can be termed prepositional verbs, a category of verbs which is distinct from phrasal verbs. While phrasal verbs, which, according to [7], constitute a grammar area that has come to the attention of researchers and language teachers, are described as "verb-particle combinations which are frequently not semantically transparent at all and strongly idiomatic," prepositional verbs are verbs in which "the prepositional functions of the second constituent are still preserved more strongly" [14], (p.230). Schneider also states that a "[…] possible diagnostic to distinguish between the two types is the possibility of placing an adverb between the verb and the particle or preposition: prepositional verbs allow this possibility, phrasal verbs do not" (2007, p. 231). Since the verb formations DA, CA and CO are not idiomatic and allow the meaningful inclusion of an adverb in between the two particles (eg: discuss *rapidly* about, comprise *sometimes* of, consider *always* about), they can be categorized as prepositional verbs.

According to [11], (p. 175), DA and CO are prepositional verbs which are "attested in the one million Indian component of the International Corpus of English (ICE), but not in the British component of the ICE." This assertion makes this seemingly inaccurate usage of these verbs features of Indian English. In addition, DA is also used in West African, Singaporean and South African Indian Englishes [9], (p.72). Furthermore, [16], (p. 85) writes that as a result of direct translation, prepositions are inserted in Nepali English where no preposition would be found in BSE. As an example of this phenomenon, Verma cites the use of 'discuss about.'

C. Possible reasons for these verb formations

[9], (p. 72) state that DA is a prepositional verb which is an example of when verbs "retain the same preposition associated with their corresponding nouns: discuss about (cf. discussion about)." In the light of this observation, the use of the verb CA too can be explained with regard to verbs which retain the preposition usually associated with their corresponding noun. Since the noun 'consideration' can be followed by 'about', the verb 'consider', arguably, is made to do the same.

Another motivation for such verb formations is what is called analogy. An example of analogy is the verb formation 'voice out' which may have been formed following the pattern of the phrasal verb 'speak out' [9], (p. 72). Similarly, the verb formation CO seems to follow the pattern of the verb 'consist of'.

II. RESEARCH QUESTIONS

The consideration of the prepositional verbs DA, CA and CO as features of other varieties of English inevitably leads to the question regarding their levels of acceptance where Sri Lankan users of English are concerned. This research looks at, firstly, whether a disparity exists between the degrees to which Sri Lankan university lecturers of English Language and Sri Lankan university students of English as a Second Language (ESL) are prepared to consider these verb formations as acceptable in written form. Would the English lecturers, due to their awareness of the grammar rules that govern the use of these verbs, consider the 'unusual' inclusion of prepositions after these verbs as inaccurate? Would students, on the other hand, due to the currency of these prepositional verbs within a local context, have internalized these 'unusual' verb structures and consider them 'correct'. If a disparity does exist between the lecturers' attitude and the students' attitude towards these verbs, how should it be dealt with in teaching ESL and EAP in Sri Lanka? This research seeks to answer these questions.

III. METHODS AND METHODOLOGY

In order to gauge the acceptance levels displayed by Sri Lankan university lecturers of the English language and Sri Lankan university students towards DA, CO and CA, an acceptability test was conducted. 24 sentences (8 sentences per each verb formation this research focuses on) were extracted from four local English newspapers – the DailyMirror, The Island, CeylonToday and Daily News.

A questionnaire consisting 16 sentences from the above-mentioned collection of sentences was formulated. This questionnaire had 5 sentences for each prepositional verb, and a distracter. It was administered to 20 undergraduate students studying English as a Second Language at English Language Teaching Units (ELTUs) of government and private universities. The second group of informants were English Language lecturers working in ELTUs in a variety of Sri Lankan universities, both government and private.

The respondents were requested to state if they accepted these sentences as grammatically correct or not. The questionnaire also allowed room for respondents to suggest ways in which the sentences they considered grammatically incorrect could be revised.

IV. RESULTS

According to the results (illustrated in Table 1) of this research, the three SLE prepositional verbs this research deals with have received high levels of acceptance from both the university students as well as university lecturers of English.

The university students have displayed a higher level of acceptance towards these verbs in comparison to the university lecturers.

Within the students' group, the verb that has received the highest level of acceptance is DA, followed immediately by CO and CA. On the contrary, the lecturers consider CO more acceptable than DA and CA. Overall, the verb formation that has received the highest level of acceptance is CO.

TABLE 1 ACCEPTANCE LEVELS OF DA, CA AND CO BY UNIVERSITY STUDENTS AND ENGLISH LECTURERS

	Acceptance level		
Prepositional verb	University students	English Lecturers	Overall
Discuss about (DA)	95%	50%	72.5%
Consider about (CA)	85%	50%	67.5%
Comprise of (CO)	90%	70%	80%

It is interesting to note that more than half the number of student respondents consider these verb formations as accurate while 10 out of the 20 English lecturers consider DA and CA as accurate, indicating that half the number of informants of the latter group, despite the grammar rules, consider them acceptable verb formations. Two of the lecturers who had rated CO as accurate had also mentioned that both formations i.e. 'comprise' and CO are acceptable and that a user of English would have the choice as to which verb formation to use.

V. DISCUSSION

The results obtained through this research pose two issues. Firstly, if these seemingly incorrect use of English verb-preposition combinations found in Sri Lankan English newspapers has been found acceptable, although to varying degrees, by students and English lecturers of Sri Lankan universities, how should the use of these verbs be taught in a Sri Lankan context? In addition, although this research has not focused on the acceptance of the use of DA, CO and CA specifically in academic writing, it does the raise the question regarding how these verbs should be used in academic contexts in Sri Lanka. Secondly, are the two verbs DA and CO, which have received varying levels of acceptance by the two groups of informants, to be considered as errors or features of SLE?

The levels of acceptance displayed by both the groups of informants where these prepositional verbs are concerned, if seen in relation to Selinker's IL theory, indeed form an example of 'fossilization'. Or, if looked at from the perspective of WEs, it could be said that these prepositional verbs can be considered as features of SLE. This would be especially true with regard to CO, which has received a high level of acceptance by both the students and the lecturers. Where the lecturers' responses to DA and CA are concerned no categorical statement about the 'fossilization' of these verbs can be made since only half the number of informants has rated it accurate. Due to the overall picture however, the question remains as to how the use of these verbs should be taught to Sri Lankan students of ESL and EAP. As opposed to placing these verb formations along Selinker's language continuum, I suggest that we consider them in terms of what describes as appropriation of language by local communities and use them to suit our "social practices to resist the colonizing thrust of English" [1], (p. 588). Moreover, these 'errors' seem to resemble what Seidlhofer, quoted by [4], (p. 170), considers to be "'errors' that most English teachers would consider in urgent need of correction and remediation" but yet "appear to be generally unproblematic and no obstacle to communicative success."

A. *The classroom/ lecture hall context*

As [1], (p. 587) rightfully states, the classroom is a "powerful site of policy negotiation" because "pedagogies practiced, and texts produced in the classroom can reconstruct policies ground up." Therefore, the classroom /lecture hall is the very site through which a prescriptive approach to the English language could be either advanced or challenged. Before looking at how these 'errors' can be construed as features of SLE, it would be useful to focus on how Sri Lankan textbooks on the English Language serve to reinforce 'native speaker' standards.

In Samaranayake's book *Practical English* for instance, there is an entire chapter dedicated to 'Ceylonisms'. This chapter comprises a list of 'errors' made by Sri Lankan speakers of English and it includes the following sentence – "We **discussed about** the European situation. (Omit **about**)" [13], (p.133). The book was first published in 1940, so the categorization of DA as an error is not a surprise. More interestingly though, in *GCE English Language: A study and revision course for O Level,* a textbook for students hoping to sit the London Ordinary Level Examinations, [2], (p.176), while acknowledging the existence of 'New Englishers' which, to them, seem only to include the varieties of English spoken only in the United States, Canada and Australia, stress that "[f]or the purposes of GCE examinations, standard British English will be most relevant." The above-mentioned textbooks substantiate [1], (p. 588) statement that despite nativization and resistance,

even in postcolonial communities like Sri Lanka, "it is either 'standard American' or 'standard British' English that is treated as the target for conversational and literate purposes in educational institutions." Foreign and local textbooks alike advocate the use of BSE.

This situation calls for solutions similar to code-meshing, which refers to the practice of bringing together different varieties of English in a given context both to successfully communicate in the given situation and also to challenge the hierarchy of the varieties of English in the present world. That teachers should encourage the accommodation of diverse varieties of English in academic writing and make students aware of the possibility of code-meshing in academic writing is expressed by [1]. Code-meshing, [1], (pp. 593-599) writes, is advantageous as, through doing so, minority students get to see their own variety of English in academic texts. To enable students to strive for a "repertoire of codes and discourses" and to "*shuttle* between communities in contextually relevant ways" rather than "*joining* a speech community" would, no doubt, be of more use to Sri Lankan students of ESL than the knowledge of only the dominant variety/ varieties of English.

On a similar note, with reference to what they term as an "issue of power," [6], (p. 373) write that as long as the dominant varieties prevail in public perception and teaching material, it is the duty of the teachers to make these resources available to the students allowing the student to appropriate them, *if they so choose* (emphasis mine). The teaching of the dominant discourses should be simultaneous to the teaching of the nondominant forms and functions because to "overlook the alternative uses of English can actually work against the goal of helping students develop an accurate understanding of how the English language works and how it changes over time" (p.372). In such a state of affairs, in the process of teaching the use of the prepositional verbs DA, CA and CO, the students should be taught the 'dominant discourse' surrounding the use of these verbs as well as the 'alternative' one i.e., the use of these verbs with prepositions, and make the students aware of the contexts in which they would be accepted or rejected.

But the use of a nondominant variety in academic writing would only be useful and successful provided that the students are preparing to face a local examination which would be assessed by examiners who are aware that the students have been allowed to use SLE in academic writing. But, the question arises as to what dialects of SLE would be accepted in academic writing. Also, a doubt arises as to whether the inclusion of SLE in academic writing submitted to a foreign university as part of a postgraduate course would be received by foreign examiners. If students are to be encouraged to use their own variety of English in academic writing, the examiners too should be willing to accommodate these variations in academic writing.

[8], (pp. 12-13) writes that, since developments in "research, scholarship and academy" now point to the fact that the "hegemony of British and American English as the universal language varieties of research and publication" should be reconsidered, writers, regardless of whether they are junior or senior researchers, graduate or undergraduate students, or academics must be "willing to take a risk in using localized varieties and forms of English and to continue to do so even in the face of possible rejection." This statement brings forth the idea that, instead of hoping for changes to be made in the academic writing norms, Sri Lankan academics should initiate those changes in attitudes towards the inclusion of features of non-dominant varieties of English in academic writing.

V. CONCLUSION

The findings of this acceptance study attest to the fact that there is a high level of acceptance of these verb formations both on the part of university students of ESL and university lecturers of the same. As opposed to considering them to be 'errors' and correcting their usage in classroom/lecture hall contexts, they could be seen as emerging features of SLE. In such a context, students of ESL can be made aware of the fact that the local variety is not inferior to the dominant varieties of the English language. Instead, students should be encouraged to accept both varieties as equal and use them as appropriate in their writing.

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Increasing work readiness of fresh IT graduates at interviews: A scoping review

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***Abstract* – Interviews are a widely used method in which the performance and knowledge of potential employees are evaluated. Fresh graduates who come out to the job industry are rarely armed with prior experience in facing a job and securing employment, which leads to them underperforming at actual interviews. The lack of exposure to an interviewing environment together with inadequate preparation is the main reason for such underperformance. This paper examines the short-comings associated with graduate interviews and attempts to identify the predominant factors that would contribute to an improvement in performance. It then aims to propose a solution in terms of a computer based interviewing platform to solve this problem**.

CCS CONCEPTS

• **Human Computer Interaction (HCI)**; **Artificial Intelligence**; **Speech Synthesis**

***Keywords* – Qualitative Evaluation, Scoping Review Interviews, Employment, Fresh Graduates**

1 INTRODUCTION

Two million students graduate from universities each year [1] but roughly, only 65% – 70% of them manage to obtain jobs after graduation [1]. Research carried out into this area show recession, lack of qualifications and unrealistic expectations [2] as being the main reasons for such overall unemployment in the world. However, there is accumulating evidence in terms of a fresh graduate, indicating the principal reason for unemployment to be under- performance at interviews [3].

An interview acts as a method through which a potential employer gauges the suitability of a student in terms of employment. Factors such as confidence, punctuality, together with knowledge are the deciding factors behind success at an interview. These characteristics are measured by questioning the students on various aspects in relation to the job that they apply for. The inability of a student to successfully answer and portray a demeanour of confidence at an interview results in the student being deemed unsuitable for employment.

Very few studies and system implementations carried out to identify evidence targeted towards improving performance at interviews exist. Moreover, these studies included no in-depth investigation on fresh graduates and focused mainly on job holders. Thus, this short paper seeks to evaluate and propose a method to improve the performance of fresh graduates at interviews thereby reducing their unemployment rates, with emphasis on human- human and human- computer interactions.

2 METHODOLOGY

Pope, Ziebland and Mays [4] propose a scope review as an effective means of analyzing qualitative data in terms of highlighting relevant literature in a particular research area. Such reviews are useful in identifying the main sources and types of information available especially in areas where little might be known. It was decided that the scoping review based on Arksey and O'Malley's framework [5- 6] was appropriate to meet the objectives of this study.

2.1 *Research Questions*

This study answered the following question: *What factors from literature contribute to improvement of the performance of fresh graduates, at interviews?*

2.2 *Relevant Studies*

The author searched online electronic databases such as Google and Google Scholar for articles published between 1990 and 2016. Initial keywords were used to capture the primary factors that affected performance at interviews. See Table 1 for search terms.

Table 1**:** Examples of Search Terms

Search Terms	
"performance"	"interviews"
"fresh graduates"	"employment rates"
"job interview"	"interviewing platforms"

Several industry specialists were selected to be interviewed to gather first- hand industry based information related to how interviews are conducted for fresh graduates and to discover how they fared at such interviews. The interviews were to be either one-to-one interviews or telephone interviews.

Questionnaires were used as an additional means of obtaining information directly from previous fresh graduates as to the type of questions they faced at their first interviews; their experience and their ideas on what they thought would have been worth knowing going into their first interview.

The use of several such methods to collect data covers all aspects and participants' points of view thus increasing visibility of the research and helps focus on outcomes expected from a fresh graduate during their first interview in terms of both the employer and the interviewee.

2.3 *Study Selection*

2.3.1 Peer- reviewed studies.

Peer- reviewed studies, regardless of their design, met the inclusion criteria if they contained information on the search terms included within Table 1. Studies were excluded if they were theoretical in nature and if they were not relevant to the Information Technology (IT) industry.

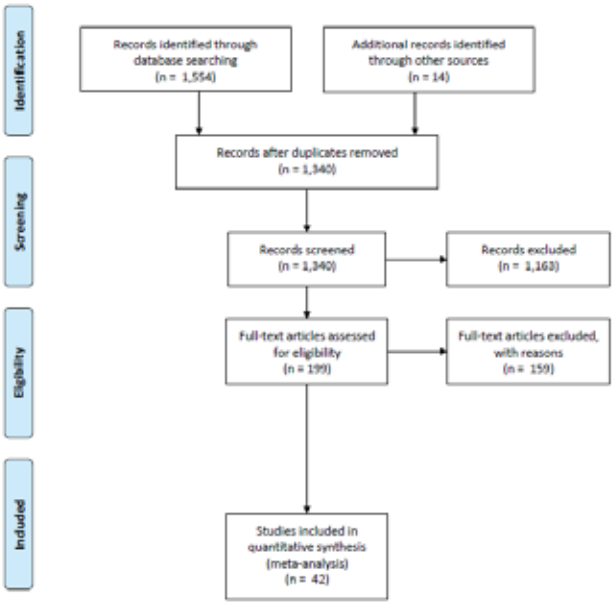

Figure 1: PRISMA Flow diagram for article selection

2.3.2 Interviews.

Similarly, a random sample of employers in IT companies within Sri Lanka were initially selected to be interviewed. Companies that were not IT related were excluded. However, the study extended to various departments within the companies such as the Human Resources Department, the Technical Department, etc. within which an interview is conducted.

2.3.3 Questionnaires.

Questionnaires were prepared, reviewed by two peers and were sent out to a random sample of thirty. The questions covered aspects related to identifying the personal experience of a person's first interview fresh out of university and their personal opinions. Only the population encompassing the IT sector were to be considered for this study.

2.4 *Chart Data*

Data was extracted from the articles, interviews with industry personnel and questionnaire responses.

2.5 *Collate Summarize Report*

The author collectively compared the data to characterize the research literature while also using questionnaire and industry interview findings to identify the breadth and gaps within the study, using descriptive statistics.

3 RESULTS

3.1 *Peer- reviewed studies*

The initial search yielded 1,554 articles with 241 duplicates resulting in 1,340 distinct potential articles. The articles were then screened by two reviewers and 1,298 removed. Of these, 13% addressed job holders, 20% professions other than IT and the remaining were purely theoretical. Forty-two of the identified articles met the inclusion criteria. They included studies with discussions on methods/ systems used to improve performance at interviews, (more). There was a notable absence of literature specifically aimed at fresh graduates.

3.2 *Interviews*

Interviews were to be conducted with ten industry specialists however only six of them could be contacted and after the data collected was analyzed, four of the interviews were selected. The two that were excluded did not contain sufficiently detailed information and/ or were missing responses.

3.2 *Questionnaires*

Questionnaires were sent out to thirty randomly selected individuals out of which twenty responses were received. Ten of the responses were excluded due to missing values and inappropriate answers.

4 DISCUSSION

4.1 *Assessment in graduate selection*

University graduates are a key source of new recruits for organizations enabling organizations to meet the need for trainable and highly educated individuals that bring a fresh perspective and new ideas into the organization. The measures of organizational effectiveness highlight that identification and selection of the best candidates depend on past achievement and range of ability [7].

Various methods of candidate assessment for recruitment exist, however, several studies have supported the use of interviews as the most appropriate selection mechanism for recruitment of candidates [8- 9]. The two most predominant interview mechanisms available are structured and unstructured interviews. Findings suggest that structured interviews are seen to be more suited as a

means of recruitment due to the ability to define content explicitly and; the ability to replicate and standardize an interview [10]. It also tends to be the popular choice with 40% of interview participants expressing so.

The aspects that determine success at an interview in terms of obtaining the best output for an organization in additional to technical knowledge; consist of speaking skills, demonstration of confidence, social behavior, and body language.

4.2 *Complications associated with graduate interviews*

A comprehensive review indicates that several factors render graduate interviews to be particularly difficult. The most significant factor elevating the complications with graduate interviews is that most graduates possess almost no direct job-related experience (reference). The lack of such experience is shown to have a direct impact on performance since even entry- level positions require a certain amount of background knowledge.

80% of graduates that answered the questionnaire agreed that even though they are exposed to verbal communication and presentations during their time at University, it does not provide sufficient preparation to match the terms of oral assessment related to interviews. Thus, graduates may not fully possess the confidence to articulate their knowledge and skills at an interview. This was further confirmed by the data collected during the industry interviews where all employers confirmed that graduates tended to have difficulty in articulating their knowledge at interviews. Further, questioning revealed nervousness to be the chief cause of shortcomings associated with communication between graduates and potential employers.

The next most significant constituent that poses a threat to graduates at an interview is the tendency of the employer to judge a candidate based on social cues such as body language, tone of voice and intonation [11], which although it may enhance value of the verbal answer provided by a candidate, can prove to tip the scale if candidates are not prepared and are nervous.

Despite the growth of recruitment of graduates through interviews, relatively little is known about the methods used to assess and select graduates to positions within an organization. The fact that graduates lack previous experience and tend to be nervous raises questions in relation to how Universities can use technology to assist in increasing employment rates of fresh graduates. A review of already existing software systems with a particular focus on interviews follows.

4.3 *Factors identified to improve performance at interviews*

4.3.1 *Pre-preparation in relation to industry segmentation*

All findings highlighted pre-preparation as key to high performance at interviews regardless of applying as a fresh graduate or as a candidate with previous work experience. According to the survey responses, this factor was ranked highest with 80% in agreement when compared to the other factors (age, experience, gender, personality, appearance, attitude and cultural fit).

Preparation differs based on the functional segment of the industry chosen by a candidate. For example, the method of preparation for a role as a Software Engineer would differ from that of a Network Engineer even though both roles reside within the same industry. In addition, the most commonly listed domains of specialization were Software Engineer (58%), Business Analyst (42%) and Network Engineer (32%).

4.3.2 *Confidence Interview*

Findings based on employer feedback identified that confidence through body language during response was ranked second highest.

4.3.3 *Gender*

The paper by Behrend et al. [12] conveys that the appearance of an interviewee's avatar has an influence on the rating of his performance. This is further confirmed with the findings of the questionnaires where 68% of respondents had agreed that the gender of an interviewer depended on the level of confidence they portrayed at the interview.

4.3.4 *Experience*

Although the most significant factor with relation to interview performance usually tends to be previous work experience, this factor had the lowest rating with only 10% of all respondents; interviews and questionnaires, in agreement since fresh graduates usually tend to have no previous experience with regard to the jobs they apply for after graduation.

4.4 *Existing systems used in interviews*

Most related work on rule based systems incorporating human computer interaction has been done in the fields of natural language processing [13] and machine learning [14]. However, Clark et al. [15] has experimented with developing a Question- Answering system merging online- text, with a knowledge base, which infers answers based on the questions posed, at- real time. This knowledge base approach uses a set of rules to carryout induction and arrives at a conclusion based on the facts and the rule extracted. We propose to use a similar concept formed around a set of 'if-else' rules to fire questions based on rules inferred.

There has been a gradual exploration in mimicking human behavior within computer based systems during the past few years [16], thereby allowing users to directly communicate and interact through a graphical representation of themselves such as Avatars. Behrend et al. [12] have used this abstraction to show that the appearance of an interviewee's avatar has a positive influence on the rating for his performance. The virtual software platform 'Second Life' [17] is based on a similar

concept whereby it acts as a 3D interactive world within which a virtual job fair can be conducted. The simulated virtual environment within Second Life allows both an employer and an interviewee to create computer-generated images representing themselves to conduct or participate in an interview. While it shows that such fully virtual platforms are beneficial for interviewees, due to the experience being less daunting, employers tend to be unsatisfied with the outcomes of such interviews due to the inability to read an applicant's body language. This suggests that a platform where only employers are represented as avatars may bring the best of both worlds. Research findings dictate that a system functioning on the basis of usability in terms of human computer interaction to eliminate the complications identified within this study to assist in providing their students with the experience required to attain optimal performance at an interview.

5 CONCLUSIONS

This scoping reveals several gaps in literature. This is also evident in terms of the studied population since the focus on most studies was directed towards improving interview performance of job holders. The majority of quantitative studies were cross-sectional in nature portraying a need for more in-depth interventional studies. The study population mainly encompassed of IT graduates and thus more research is needed to expand the study to other industry sectors.

Other gaps were highlighted by the way existing systems handled interview systems where not all factors identified to improve performance were included in a single system. Each system contained one or more aspects that could counter-act the complications identified but not one system could eliminate all factors at once.

Finally, our findings suggest that little literature attempt an interaction between computers and humans to mimic the environment of an interview to ease nervousness. Further examination of criteria is needed; notably in developing and testing a system that could eliminate all complications identified within this study.

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