EFFECTS OF NATURAL RESOURCE AND ENVIRONMENTAL RELATED REGULATIONS ON THE CONSTRUCTION INDUSTRY

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Degree of Master of Science in Project Management

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Declaration

I declare that this is my own work and this thesis does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other University or Institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

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Dedication

This research is adoringly dedicated to my loving family; my parents and my devoted wife, who have been my constant source of inspiration all through my life. They have given me the drive and the discipline to tackle this task with utter enthusiasm and determination. Without their love and support this project would not be a reality.

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Abstract

Construction is an industry which plays a dynamic role in development of any country. Construction industry helps to bring the development goals of the country by developing infrastructure technology, machinery, engineering and services. It creates employment opportunities. The contribution of the construction industry to the Sri Lankan economy was recorded as 6.6% in 2009 to 7.6% in 2016 towards the overall GDP during the past seven years' time interval. Thus the industry has shown a significant impact to the country's economy.

Construction is an industry which uses natural resources in large amounts. Natural resource and environmental related regulations are implemented by the government to protect and manage the environment and natural resources efficiently and effectively. Due to the high demand of natural resources, environmental and natural resource regulation implementing agencies has been failed to manage the natural resources and environment in efficient and effective manner. Hence this study was aimed to evaluate the effect of natural resource and environmental related regulations on construction industry and to overcome the negative effects of such regulations in the construction industry.

This study shows that, the National Environmental Act No 47 of 1980 has average impact to every factors in construction projects such as project cost and project quality, geographical setting of the project, and procurement of materials. This act has higher impact on the project duration. Central Environmental Authority (CEA) has been frequently engaged in the construction industry than other agencies. Over 75% of the respondents says that the application of environmental and natural recourses laws is time consuming. Further over 70% of the respondents recommend that implementing an online system is the best solution to overcome such issues. Also over 80% of the respondents ranked that the identifying the relevant criteria needed to choose the ''Best'' policy including those related to political/power brings the benefits of reform process of regulation.

Key Words: Construction Industry, Natural resource and Environmental Regulations, Policy Reforms.

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List of abbreviations

Abbreviation	Description
CEA	Central Environment Authority
EIA	Environmental Impact Assessment
GSMB	Geological Surveys & Mines Bureau
ICTAD	Institute for construction, Training and Development
NBRO	National Building Research Organization
PAA	Project Approving Agency
P.S.	Pradeshiya Sabha
RDA -	Road Development Authority
SLLR&DC -	Sri Lanka Land Reclamation and Development Corporation.
UDA	Urban Development Authority

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CHAPTER ONE

INTRODUCTION

1.0 Introduction.

The construction industry has been a major beneficiary of Sri Lanka's rapid economic development over the past years. Since the end of the country's civil war in May 2009, the country has rushed to make up for more than two and a half decades of intermittent building activity across most segments, from high-end residential housing to commercial and office space to a variety of key infrastructure segments. Further, in Sri Lanka, construction contributes around 7.0% to 9.6 % to GDP from 2009 to 2016. According to Central bank annual report 2016, the value added of construction activities bounce back during the year recording a significant progress of 14.9 % in 2016 convalescing from 2.7 % shrivelling recorded in 2015. Mega scale construction projects such as Colombo International Financial City, extension of Southern Expressway, Phase III of Colombo Outer Circular Highway project and emergent condominium apartments mainly contributed toward development of construction industry.

The growth of the industry recorded a significant increment of cement production and its imports. This collectively raised by 25.3% in 2016 compared to 5.8% growth in 2015.Consequently, imports of cements and local production of cement increased from 29.5% and 17.8% respectively, in 2016.

The consumption of environment related raw materials in year 2016, in the construction industry of Sri Lanka could be shown in table 1.1

Table 1.1 Value of raw material consumed of all construction activities-2016

Type of raw material	**Value (Rs Mn)**	**Percentage**
Cement	14,036	17.1
Sand	6,131	7.5

Bricks	4,016	.9
Rubble & Metal	6,876	.4
Iron & Steel	17,372	21.2
Timber	4,175	5.1
Roofing materials	4,403	5.4
Other materials	25,088	30.6
Cement	14,036	17.1
Sand	6,131	7.5
Total	82,097	100

(Source: Survey of construction industries 2016/2017,pp 07)

An increment of investment goods and building material imports volume indices was recorded as 20.0% and 22.9% in year 2016.This indicated a positive development in the construction activities. In addition the credit facilities granted for construction activities by the Licensed Commercial Banks (LCBs) for the private sector drastically increased by 26.9% in 2016 on top of 36.1% growth recorded in 2015. The loans granted for housing construction activities, increased by 27.1% in 2016 (Central Bank Annual Report, 2016).

According to Department of Census and Statistics More than 617,000 people were directly or indirectly employed by Sri Lanka's construction industry in 2016, and in mining and Quarries it was recorded as 60,000

1.1 Background.

Construction is an Industry which uses natural resources in large amounts. According to Department and Census and Statistics the cost of materials consumption of sand and metal is very high. They were Rs 14.2 billion and Rs 59.7 billion in 2015 respectively. The construction activities related to roads and railways has recorded the highest amount of sand and metal consumption compared to others. The survey on construction industries (2016) shows that the total estimated value of work done by

all type of construction activities in Sri Lanka is Rs 319,632 million rupees. The highest contribution (44.1%) to the total value has been made by the building construction activities which is Rs 140,900 million. Hence the rapid growth of the industry will decline the amount of natural resources rapidly if they are not managed properly. After the new government of Sri Lanka became to power in 2015 lots of projects were halt due to high cost and environmental effects. Then government introduced new legislations for sand transportation and president appointed a new committee for sand soil and quarry mining to minimise the effect for the environment from the fast growing construction industry.

There are lots of regulations introduced by the government to protect the environment. The National Environmental Act introduced by government in 1980, is very important in Sri Lankan point of view. The Central Environmental Authority was established under this act, which has become the major government institution supporting the Environmental protection of the country. Other Institutions such as Geological Surveys and Mines Bureau (GSMB), National Building Research Organization (NBRO), Department of Coast Conservation, Department of Forest Conservation etc. also play a huge role in case of environmental protection of the country.

The environmental regulations are affecting the construction industry in various stages of the project life cycle. Specially, in initiation, planning and implementation stages, huge impact can be done for the project. The recent example is the Uma Oya project It was started under financial aid from government of Iraq and finally it was halted after causing serious environmental and social impacts to the central hills of Sri Lanka. Many discussions were made regarding this serious issue after the incident but the project was halted for considerable period. The technology transfer to the Sri Lankan professionals also very low in Uma Oya project (Puranegedara.P.N.L, 2017).

There were many discussions on the Port City project which was funded by republic of China, saying serious sea erosion at the South west coast of the country, and finally it was halt for two years due to political reasons rather than environmental impacts. It was started again after few contractual changes between the two governments after two years. The above mentioned two projects were halt in the implementation stage,

which many contractual issues were created affecting the bilateral understanding with the two nations. Due to these reasons public has been aware of the environmental effects causing from the various construction activities in the country.

1.2 Research question.

The consumption of natural resources has been increasing with the expansion of the construction industry. Many act are been introduced by the various governments to protect the environment from human activities. Expansion of the construction industry created a high demand for the natural resources. Hence the regulatory bodies couldn't manage the high demand with the existing natural resource and environmental related regulations. The existing government couldn't reform the policies to suit the existing situation. The actions taken by the government made the existing procedures more complex. This was badly affected to the industry, lots of suppliers left from the field, many metal quarries were abundant and caused many difficulties in supplying soil and sand and quarry products for construction sites due to prohibition of transport of sand with in day time and complexity of licence issuing procedure for borrow pits and quarries. This has caused rate increment in the field of construction and also it is very difficult to find quality materials for constructions. According to NBRO, the daily volume of gravel need to fill the central expressway exceeds the amount of gravel generated by all licences issued by NBRO.

1.3 Aim

Identify the effect of natural resources and environmental regulations on the construction industry.

1.4 Research objectives.

- To identify natural resources and environment related regulations affecting construction projects.
- To rank the positive and negative effects of regulations on the use of natural resources in construction projects

- Propose means to overcome negative effect of the regulations affecting construction projects.

1.5 Scope and limitations of the study

The scope of this study will be limited to evaluate the effect of natural resource and environmental related regulation and to overcome the negative effects of such regulations to the construction industry. This study will not focus on the supply chain of the natural resources in the construction industry.

1.6 Methodology.

Methodology includes the manner in which the research data flow fills the conclusion and recommendations. Methodology starts from the literature review, which is essential in contextualising the research problem and supporting the conclusion. This chapter deals with the methods utilized in collecting data for this research. It is identified through the Literature review, research data, conclusions and recommendations.

1.7 Recognition and Identifying of concepts

The concepts related to Environmental regulations in construction are recognized by referring to written documents, journals and downloaded material.

1.8 Dissertation organization

This dissertation consists of five chapters:

i. Chapter 1 presents the introduction to the research. This is consists of the

Overview, objectives, problem statement, methodology and the project organization.

ii. Chapter 2 includes the literature review of previously performed work by other researchers.

iii. Chapter 3 is a discussion of the research methodology used in the project.

iv. Chapter 4 discusses the collected data and presents the results.

iv. Chapter 5 analyse the results obtained in the project in conjunction with major conclusions and recommendations for further work.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction.

This chapter presents a review of current literature aiming to establish theoretical basis to reach the aim of the study.

2.1 Natural resources.

According to Ramade (1984), a resource may be defined as a form of energy and/or matter which is essential for the functioning of the organisms, populations and ecosystem. The ecological variables like energy, matter, space, time and diversity jointly are referred as natural resources.

Some resources are essential for the survival of all the living organisms like air, soil, water, plants and animals while others are specially valued by man to satisfy his material needs and desires such as minerals and fossil fuels. Thus, land, water, air, minerals, forests, wildlife as well as human beings are resources.

2.1.1 Renewable resources.

Renewable resources are the ones that are consistently available regardless of their use. They can be fairly recovered or replaced after utilization Vegetation, water, and air. Animals can also be categorized as renewable resources because they can be reared and bred to reproduce offspring to substitute the older animals

As much as these resources are renewable, it may take tens to hundreds of years to replace them. The renewable raw materials that come from living things namely animals and trees are termed as organic renewable resources while those that come from non-living things such as sun, water and wind are termed as inorganic renewable resources (Bon.R, 1988).

2.1.2 Non-renewable resources.

Non-renewable resources are the ones that cannot simply be substituted or recovered once they have been utilized or destroyed. Examples of such natural resources include fossil fuels and minerals. Minerals are categorized as non-renewable because, even though they take shape naturally through the rock cycle, their formation periods take thousands of years (Berwick, 1998).

2.1.3 Biotic natural resources.

The Biotic natural resources are the ones that come from the ecosphere (organic and living materials). These include resources such as animals, forests (vegetation), and other materials obtainable from them. Fossil fuels such as petroleum, oil, and coal are also included in this grouping because they are generated from decayed organic matter.

2.1.4 Abiotic natural resources.

The abiotic natural resources are the ones that come from non-organic and non-living materials. Examples of abiotic natural resources are water, land, air and heavy metals like iron, copper, silver, gold, and etc.

2.2 Natural resources used in construction industry.

The United Nations developed the World Charter for Nature in 1982, which recognized the need to protect nature from further depletion due to human activity. It states that measures must be taken at all societal levels, from international to individual, to protect nature. It outlines the need for sustainable use of natural resources and suggests that the protection of resources should be incorporated into national and international systems of law. To look at the importance of protecting natural resources further, the World Ethic of Sustainability, developed by the International Union for Conservation of Nature (IUCN), World Wide Fund for Nature (WWF) and the United Nations Environmental Programme (UNEP) in 1990, set out eight values for sustainability, including the need to protect natural resources from depletion. Since the development of these documents, many measures have been taken

to protect natural resources including establishment of the scientific field and practice of conservation biology and habitat conservation, respectively (Michaelowa,1998).

Natural resources such as sand, metal, soil and wood are commonly used in construction industry as raw materials. But lots of natural resources used after processing the raw materials they are cement, potty, glass, aluminium, steel and etc (Turin,1969).

At present Sri Lanka is at a critical period, where her natural resources have been exploited to the fullest extent hence very strong monitoring system is necessary for sustainable management of resources, or else they will decorate very rapidly. This will make the way to cause environmental issues in the country. Hence a controlling and managing these resources is very essential (TES of Sri Lanka, 2000).

In case of controlling the use of natural resources and to make the development sustainable, government has passed many acts by parliament and many regulations are introduced. The National Environmental Act no 47 of 1980 is introduced in order to protect the environment. Further in 1981, Central Environmental Authority was established under the provisions of the act and also Environmental Impact Assessment (EIA) was introduced in 1988 under the same act. At the time when Mahaweli project started in 1977 under President Hon J.R Jayawardena's Government, these environmental concerns were not much considered, according to the experts in the industry, one reason behind the accelerated Mahaweli project introduced by Hon J.R.Jayawardena government was to escape from the upcoming environmental policies in the global context (Karunathilake, 1988).

Today, there are lots of acts related to the environment and natural resources in Sri Lanka, Coast Conservation Act, Mines Minerals Act, Soil conservation Act are some acts used to protect the natural resources of the country. Hence these regulations regarding the natural resources and environment in Sri Lanka has been affecting the progress of the construction industry in many ways. It affects the project life cycle of the project in different potentials.

According to Athapaththu et al.,(2016) organisations which tries to use sustainable construction practices in Sri Lanka are at primary stage in sustainable construction

practices, namely legal framework, standards, guidelines or policies, design, procurement, technologies, processes and innovations, organisational structure and people, education and training, measurements and reporting.

2.3 Project life cycle.

According to the Levinne (2002), a project life cycle is a phase oriented view of the project. By definition, a project has a definite beginning and end. Between the beginning and end points, the project can be divided into four phases as shown in figure 2.1.

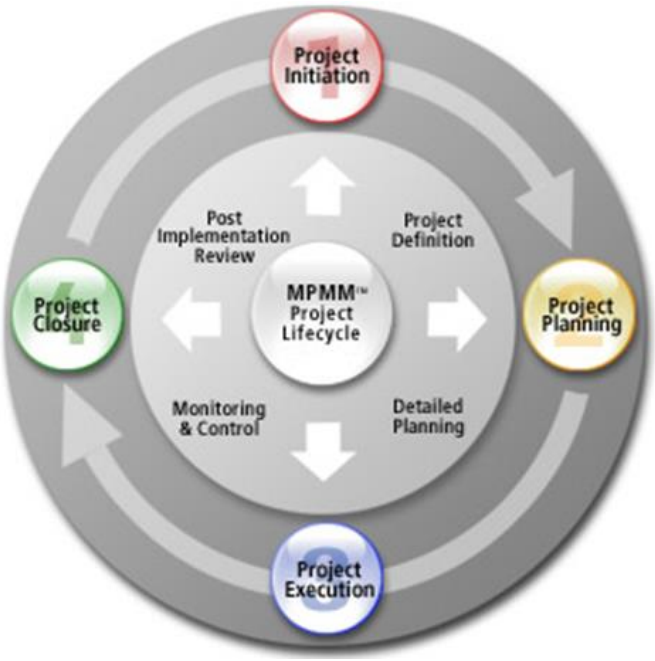

Figure 2.1 Stages of Project life Cycle.
(Source:https://www.google.com/search?q=project+life+cycle+stages&sxsrf)

2.4 Project initiation.

Project initiation is the first stage in project life cycle. The project objectives are clearly identified and project opportunities, project issues and project needs are discussed in this stage. Feasibility is examined by further investigations. Finally recommendations are been made to see the possibility of doing the project profitably. The planning is performed by the appointed key personnel of the project (Rarr, 2017).

2.5 Project planning.

In this stage project scope is defined more precisely. The team will be identified and the works are well known. A well-established detail planning been carried out depending on factors like duration, timelines, resources, expenditures, as well as policies and management procedures. Identification of possible risk and preparation of the risk management strategies will be done in this stage. In addition to this finally acceptance plan is been prepared after drafting and presenting the project plan. This will be done by the project managers (Chitkara, 2011).

2.6 Implementing

Being the third stage in the project life cycle products or services are carried out as per the planning done at the project planning stage. The project manager's involvement is very high in this stage. The project manager have to track the progress of all the activities planned. Reports are being prepared on daily, weekly and monthly basis. The stakeholder management is also a key factor in this stage. They are communicated well and managed well to continue smooth flow of work. (Rao, 2000).

2.7 Project closure.

This stage of the project is considered as the final stage of project life cycle where the service of the project is forwarded for the customer for evaluation. The key members of the project aware of the project closure and the handing over documents are also been handed over to the client at this stage. The experience gained from the project will be documented to use for the future projects (Rao, 2000).

2.8 Project evaluation

Project Evaluation is important to assess the worth or merit of a project and to identify areas for improvement. It endorses proper decisions to take, including changes to the project's objectives and methodology. Planning of project evaluation has to be done very carefully as the techniques of planning will differ from projects to project. The evaluation approach, design and methodologies should match the specific project. A close consultation with stakeholders assists to identify the most suitable approach. By

identifying the highlights and lowlights of a project, evaluation leads to conclusions that may affect future decision making. Findings of evaluation reports, based on thorough analysis, are valuable input in planning processes. Evaluation supports learning and improvement through incorporation of recommendations into new projects, programs and strategies.

2.9 Project viability.

The project viability states outcome of the project must be prudent and profitable. Determining the viability of a project requires an evaluation of a number of different factors, and viability potential will differ from one small business to the next.

2.10 Project appraisal.

Project Appraisal is a consistent process of reviewing a given project and evaluating its content to approve or reject this project, through analysing the problem or need to be addressed by the project, generating alternatives for solving the problem, selecting the most feasible option, conducting a feasibility analysis of that option, creating the solution statement, and identifying all people and organizations concerned with or affected by the project and its expected outcomes. It is an attempt to justify the project through analysis, which is a way to determine project feasibility and cost-effectiveness (Wells, 1996).

2.11 Cost benefit analysis.

Cost benefit analysis is a procedure for estimating all costs involved and possible profits to be derived from a business opportunity or proposal. It takes into account both quantitative and qualitative factors for analysis of the value for money for a particular project or investment opportunity. Benefits to costs ratio and other indicators are used to conduct such analyses (Jayadevappa & Chhatre, 2000).

2.12 Impact assessment.

Impact Assessment is a means of measuring the effectiveness of project activities by judging the significance of changes brought about by those activities. Such changes

encompass all the positive and negative; intended and unintended; direct or indirect long-term results in terms of economic, social, cultural and environmental arenas, produced by the project activities.

2.12.1 Objectives of impact assessment

- Assess the relevance of strategies to overall goal .Evaluate the effectiveness of project structures, activities and management systems to achieve the overall goal.
- Demonstrate success (to donors, ourselves, the public; to be seen to supporting progress in meeting), both to justify funds received and to solicit further funding
- Learn to understand how our efforts impact on local communities in order to improve the effectives of our interventions; to make a more significant difference in people's lives
- To rectify the strategies, activities and management styles to enhance the effectiveness of project in terms of overall goal
- To properly mobilize the resources for achievement of overall goal Pathway of a project Product Social Inputs Outputs Service Impacts Economic Deliverable Environmental.

2.13 Capacity building.

Specifically, capacity building encompasses the country's human, scientific, technological, organizational, institutional and resource capabilities. A fundamental goal of capacity building is to enhance the ability to evaluate and address the crucial questions related to policy choices and modes of implementation among development options, based on an understanding of environment potentials and limits and of needs perceived by the people of the country concerned (Eade, 1997).

2.14 Act

When a bill is favourably acted upon in the process of legislation, it becomes an Act. An act may be a private act, done by an individual managing his or her personal affairs, or it may be a public act, done by an official, a council, or a court.

2.15 Regulation

A rule of order having the force of law, prescribed by a superior or competent authority, relating to the actions of those under the authority's control.

Regulations are issued by various federal government departments and agencies to carry out the intent of legislation enacted by Congress. Administrative agencies, often called "the bureaucracy," perform a number of different government functions, including rule making. The rules issued by these agencies are called regulations and are designed to guide the activity of those regulated by the agency and also the activity of the agency's employees. Regulations also function to ensure uniform application of the law (Croome , 1977)

2.16 Policy

The general principles by which a government is guided in its management of public affairs, or the legislature in its measures. A general term used to describe all contracts of insurance. As applied to a law, ordinance, or rule of Law, the general purpose or tendency considered as directed to the welfare or prosperity of the state or community

2.17 Regulation on the use of natural resources.

The environmental protection, prevention and improvement is covered under the constitution of Sri Lanka for the benefit of the people and future generations. The protection of environment and conserving its riches is considered as a fundamental duty of every Sri Lankan.

After the implementation of 13th amendment to the constitution the power vested on the central government was decentralized to the nine provincials' councils in the

country. The initiative taken by various provincial councils to protect the environment differs from province to province.

2.18 Legal frame work.

There are over 70 laws related to natural resource and environment and human health in Sri Lanka. Most of these laws are introduced after 1980. Before 1980's there was no predominant legislation that could regulate the pollution from all sources. But there were some ordinances introduced before 1980 such as Factories Ordinance, Nuisances Ordinance, they were applied on the sector by sector issues other than the whole environment of the country.

After the power delegated by the central government on the local authorities, they got the power to involve in administration works related to environmental protection with in their area of control. But, Ad hoc policy interventions are not sufficient to find lasting solutions to existing and emerging environmental treats in Sri Lanka (Sri Lanka State of the Economy, 2015).

2.18.1 National environmental act.

This act was introduced in 1980 with the objective of protecting the environment of the country as a whole. This gave the power for the implementing agencies for the environmental protection, environmental quality and approval of projects.

2.19 Ministry of environment.

The Ministry of Environment was established in 1990 and it is responsible for providing leadership to manage the environment and natural resources in order to ensure national commitment for sustainable development for the benefit of the present and future generations.

2.20 Central environmental authority.

The Central Environmental Authority (CEA) was established on 12th August 1981, under the provision of the National Environmental Act No: 47 of 1980. The Ministry of Environment which was established in December 2001 has the overall

responsibility in the affairs of the CEA with the objective of integrating environmental considerations into the development process of the country. The CEA was given wider regulatory powers under the National Environment (Amendment) Acts No: 56 of 1988 and No: 53 of 2000. According to World Bank Report (2017), it is important to improve the efficiency of CEA for swift subproject approval at national and subnational level, therefore, along other outstanding required legal amendments, reduction of the project approving agency (PAA) is also indispensable and demanding. In this regards, comfy decision has been made to decrease the number of PAAs from 31 to 5, which currently rests with legal draftsman, as per procedural requirements for cabinet approval .environmental regulations

2.21. Institutional reforms.

The institutional reform measures should also take into consideration the need for creating inter – agency linkages with the agencies under the mandate of natural resources and environmental management. Both the agencies with a conservation mandate, listed under the ministry dealing with environment subject and other ministries and agencies which deal with environment and natural resource management should have effective coordination (Sri Lanka State of Economy, 2015).

2.22 Impact assessment of policies.

The development activities of Sri Lanka should be in accordance with the parameters set from the National Environmental Act No .56 of 1980 and Act No 56of 1988(Boruda et al., 1996).

Though these acts are introduced to protect the environment the development activities of the country cannot be done without damaging the environment. Hence there should be a balance between both the needs. The implementation of sustainable development concept there to satisfy both the needs. This is achieved through an Environmental impact assessment (EIA) and licensing systems in development projects.

2.23 Sustainable development.

Sustainable development is the achievement development activities with minimising the adverse impact to the environment and the society. Normally in development activities the environment damage cannot be eliminated. That can only be reduced to fulfil both the needs (World Commission on Environment and Development, 1987)

2.24 Environmental impact assessment mechanism.

The implementation of National Environmental Act no 56 of 1988 paved the path for submission and approval of EIA or IEE reports before commencement of development projects. According to the Act only the ‘’prescribed projects’’ are required to be submitted the above mentioned reports.

There are lots of activities that pollute or causes damage to the existing environment. They are mining activities (sand, lime, and gem) deforestation, waste disposal, construction activities, transportation, power plant operations etc. Due to these activities the environment gets polluted. The EIA and IEE are conducted prior to the development projects to analyse the effects of such projects before implementation stage. This can minimise the effect to the environment.

The strategy of balancing the environment and the development goals shouldn’t be promoted putting the other at risk. Hence both the need should be satisfied. The environmental pollution shouldn’t be eliminated in the route of economic development, even though it is sustainable (Reddy et al., 2015).

The National Programme for Environmental Conservation 2016-2018 was launched by His Excellency the President Mythreepala Sirisena to control the environmental pollution from various human activities. Lots of stake holders were participated this programme. A huge publicity is given by the media to make the programme a success.

The forest cover of the country has been reducing with the development and the population growth of the country over the past decades. According to department of census and statistics, (2005), the forest cover of Sri Lanka was recorded as the 30% of the total land area.

2.25 Millennium development goals with respect to environmental policies.

The central bank annual report, (2016), states that, 7 out of 10 people in Sri Lanka still live in areas categorised as rural. Forecasts point out that over 50% of the total population will move towards cities in the next ten years' time period. The government is in a hurry to discourage the movement of population towards cities by developing the infrastructure in the rural areas of the country.

Sri Lanka is rich from biodiversity diverse ecosystems and species. Proper management of natural resources is essential in balancing development goals and ecosystem services.

Integrated Strategic Environment Assessments is used in Sri Lanka to support guide decisions and policies that encourage climate change alteration, encourage publics to use environmentally pleasant best practices, foster green growth, decrease disaster risks and safeguard vulnerable ecosystems.

2.26 Policy planning

The policies are guides to thinking in decision making. They reflect and interpret objectives and guide decisions to achieve objectives. They establish the framework for planning programmes. They establish limits or boundaries to plans whereas planning premises provide the operational background (Shulock, 1999).

2.27 Policy implementation

Policy implementation can be defined as the third stage of policy cycle its means the stage of the process immediately after the passage of a law, or the action that will be taken to put the law in to effect or that the problem will be solved. Implementation, viewed most broadly means administration of the law in which various actors, organization, procedures, and techniques work together to put adopted policies in to effect in an effort to attain policy or program goals (Guisnger et al., 1995)

2.28. Development policy.

Development policy refers to activities that aim to reduce poverty, implement fundamental rights and promote sustainable development globally.

According to Bell and Stevenson (2006), it is important to understand the context in which policy development takes place, how policies emerge, how they form and take shape, and how they become lived through the actions of those engaged in the policy development process. Smyth (1993) has emphasized the need to recognize the pivotal role of central governments in shaping policy.

2.29 Development planning in construction industry.

Construction industry development is the deliberate and managed process to optimise the contribution of the construction industry in meeting national construction demand. This should be planned to promote national social and economic development objectives, promote industry performance and competitiveness and to provide improved value to clients.

2.30 Resource economics.

Resource economics focuses on the supply, demand and allocation of resources. Its aim is to gain a better understanding of the role of resources in the economy. Learning about the role of resources allows for development of more sustainable methods to manage resources and make sure that they are maintained for future generations. The goal of resources economics is to develop an efficient economy that is sustainable in the long run.

2.31 Regulatory instruments.

Regulatory instruments are the classical instruments of politics that are used to solve social economic conflicts. Normally, regulatory instruments comprise all those regulatory political interventions which formally influence social economic action through binding regulations. (Krott, 2005)

This indicates the importance of compliance of environmental and natural resources laws. Therefore it is necessary to identify relevant regulations and level of difficulty in use of them in practise (Rao, 2000).

2.31.1. Standards

Standards are the predominant means for direct regulation of environmental quality throughout the world. They define environmental targets and establish the permissible amount of concentration of particular substances or discharges in to air, water, land or consumer products. Generally, standards are established by the national governments. In some instances however, national governments set out framework regulations to be carried out by local, state, or regional authorities. Setting of standards presupposes the existence of a monitoring agency that oversees polluters' activities and has the power to impose a penalty for noncompliance. If the agency has no enforcement powers, the only incentive the polluter has to stay within the standards is social conscience (Hearath, 2002).

2.31.2. Policy reforms

Regulatory reform has emerged as an important policy area in any country. To become the regulatory reforms beneficial, the regulatory regimes need to be transparent, coherent, and comprehensive, spanning from establishing the appropriate institutional framework OECD Publications (1999). In Sri Lanka frequent changes of acts are been noticed. Hence policy reform process is very important factor in Sri Lankan context.

Positive effects of regulations are role of public sector agency and practice of reform process. They bring benefits of sustainable use of natural resource in the construction industry (Rao, 2000).

2.32. Market based instruments

Market based instruments are based on creating an explicit or implicit price on emissions, and generate financial incentives for controlling environmental pollution. Market signals are a key element in implementing market based instruments. These are also called economic incentives and include pollution charges or levies, tax

Economic instruments, subsidies, and tradable permits (.Sri Lanka State of Economy, 2015)

2.32.1 Administrative charge

Administrative charges are fees paid to local authorities for such services as registration or the implementation and enforcement of regulations. They usually are a component of direct regulation and are intended primarily to finance the licensing and control activities of relevant authorities (Hearath, 2002).

2.33 Social analysis

The social analysis of the project starts at the stage of project identification and flows through the various stages of project life cycle. The projects that have less attention on traditions, values and social organization of the intended beneficiaries have less tendency for being success (CIDIE, 1993).

There are lots of stake holders involved in various stages and phases of project life cycle. The main concern in this the social factor. If the society or the population needs are not addressed and or their participation is not secured properly the project will not be able to complete successfully (Baum and Tolbert, 1987).

2.34 Environmental analysis

The environmental damage can be avoided or reduced to make sure that development initiatives and their benefits are sustainable. The objective of the environmental management should be to achieve the greatest present advantage possible from the use of natural resources without dipping their potential to meet future desires and carrying capacity of the environment (CIDIE, 1993).

Taking environmental considerations in to account in development planning does not imply that the pace of socioeconomic progress will be slowed. According to the World Bank (Baum and Tolbert 1987), the projects have proved that the integrating environmental protection can enhance the social and environment remunerations otherwise can reduce the social and economic costs.

This indicates the importance of compliance of environmental and natural resources laws. Therefore it is necessary to find effects of environmental related regulations and level of difficulty in use of them in practice (Rao, 2000).

2.35 Institutional analysis.

The institutional analysis in projects has less attention in today's environment than the technical economic and financial factors. It has experienced that the availability of the required institutional structures has become a primary need of performing an efficient execution of sustainable development projects (Baum and Tolbert, 1987).

The shortage of skilled manpower, experienced staff, lack of training and staff incentives, less salaries overloaded facilities, non-productive government policies and legislations are result of insufficient institutional arrangements in some developing countries (Baum and Tolbert, 1987).

This indicates importance of monitory of environmental and natural resources laws. Therefore it is necessary to access the role of the public sector agencies on the use of natural resources in the construction industry (Rao, 2000).

2.36 Importance of a building code

A building was collapsed in Wallewatta, Colombo in year 2017 resulting fatal injuries to many people. Then government immediately announced that around 10,000 buildings around the country is identified as unauthorised and will be demolished to repeating that sort of incidents in the future.

There are some valuable documents which are applicable for the field of construction in Sri Lanka. They are as follows

- Factories Ordinance,
- Fire and safety regulations developed by CIDA
- Manual on 'Energy Savings in Buildings' developed by Sri Lanka Sustainable Energy Authority
- The construction material specifications developed by the former Institute for Construction and Development.

Though there are lots of documents and guidelines related to the industry there is no standard code of practice available to impose complete range of design, construction and compliance requirements.

Sri Lanka has a good administrative structure which the government of Sri Lanka at its peak. The decision making power has been distributed to nine provinces, nine districts, 331 divisional secretariats and 1022 Grama Niladari divisions respectively. The decisions of development activities are taken from the various levels depending on the gravity of the project. The process of approval of construction activities became more complex when institutions like Urban Development Authority (UDA), Sri Lanka Land Development Corporation (SLLDC) and Department of Agrarian Development were pushed in to decision making mix.

As a result of the above mentioned setup, there are lots of conflicts of instructions overlaps of authority, extraordinary regulations and compliance loopholes. Hence a sensible approach is very important to design a code of practice for design and construction of buildings in Sri Lanka and it should be legalised country wide. In this case UDA can play the leadership role.

2.37 Construction waste management

Construction Waste Management is a part of a growing movement toward a sustainable world. Sustainability or "green" management techniques are designed to protect the environment, save resources, and conserve energy. The use of construction waste management techniques which rely on salvage, recycle and reuse of materials have proven to have economic benefits for the construction industry (OCED, 1975).

2.38 Green Buildings

The construction sector accounts for a large percentage of the world's total energy consumption and greenhouse gas emissions. One of the effective and intelligent initiatives in infrastructure sector is sustainable development through green building concept. "Green Building" concept is a practice of creating structures and using processes that are environmentally responsible and resources-efficient through the building life cycle. Implementing the green building concept can result in reduction

of carbon emissions by 35%, water usage by 40%, and energy usage by 50% and solid waste by 70% (Bombugala & Atputharajah, 2010).

2.39 Issues in environmental governance.

At policy level, the subjects of natural environment and resources are being handled by a specific ministry in the country's administrative structure, as in many countries. The ministry is expected to provide leadership to manage the country's environment and natural resources in line with sustainable development initiatives. In order to achieve this, it is very important that the ministry and its implementing agencies have a common policy direction. In case of Sri Lanka, there have been ad hoc changes in the implementing agencies under the subject ministry. Accordingly, the name of the ministry has undergone significant changes during the Cabinet reshuffles. Agencies which are not directly dealing with environment and natural resource issues have also been included under the purview of the ministry (Sri Lanka State of the Economy, 2015).

This indicates the importance of governance of environmental and natural resource laws. Therefore it is necessary to find means and strategies to overcome negative effects of environment related regulations and natural resource laws (Rao, 2000).

2.40 Chapter Summary.

The literature review includes definitions of natural resources, project life cycle, policies acts and etc. These acts are implemented by various government institutions. The legal framework, impact assessment of policies and environmental impact assessment mechanisms are also discussed in this chapter. Policy planning and its implementations, resource economics, regulatory instruments, social analysis and institutional analysis are presented in this chapter. Finally relative importance index (RII) is discussed in case of analysing the gathered data from the questionnaire survey to fulfil the aim and objectives of the dissertation

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Introduction

After determining the scope, aim and objectives of the research it is very vital to outline the methodology to fulfil the issues regarding the research question. This methodology represents the philosophy and strategic approach. These issues are discussed in this chapter.

The research are been conducted by the various people for many years and they have undertaken various methods to achieve this aim and objectives of the researches. The 'nested' research methodology is mostly referred. It compromise the assumptions on ontology, epistemology and axiology. This is mostly related with nature of values, generating theory, testing that theory and also the techniques use in process of data collection (Kagioglou, 1998).

3.1 Research strategy and design

This research strategy is a quantitative method and generally such method involved in two main stages as follows.

(1) A literature review to bridge the knowledge gap

(2) The development of the questionnaire from the knowledge gathered from the literature review and the distribution of the questionnaire among the experts in the construction industry.

A survey is defined as a most appropriate method to study on perceptions of the job in question and the behaviour of the stakeholders (Rea and Parker, 1997).The research design demonstrates the method of data collection and analysis in order to answer the research questions (Bryman and Bell, 2003).

The method proposed by Grill and Johnson (2002), shows that researchers should be able to outline deductive logic and define independent, dependent and extraneous to the ones being tested. According to Yin (2003) the important innovation have to be dealt with case studies in four test. The following tests are useful in design research methodology of the study.

- Constructive validity
- Internal validity
- External validity
- Reliability

3.2 Research process

The research process includes very important steps to carry out the research steps the errors can be minimised during the research. This further reduce the mistakes made by the researcher. The research process includes following factors which are to be used in this research study.

- Research approach,
- Research technique,
- Data collection techniques
- Data analysis strategy

The important steps of the process illustrated in following figure 3.1.

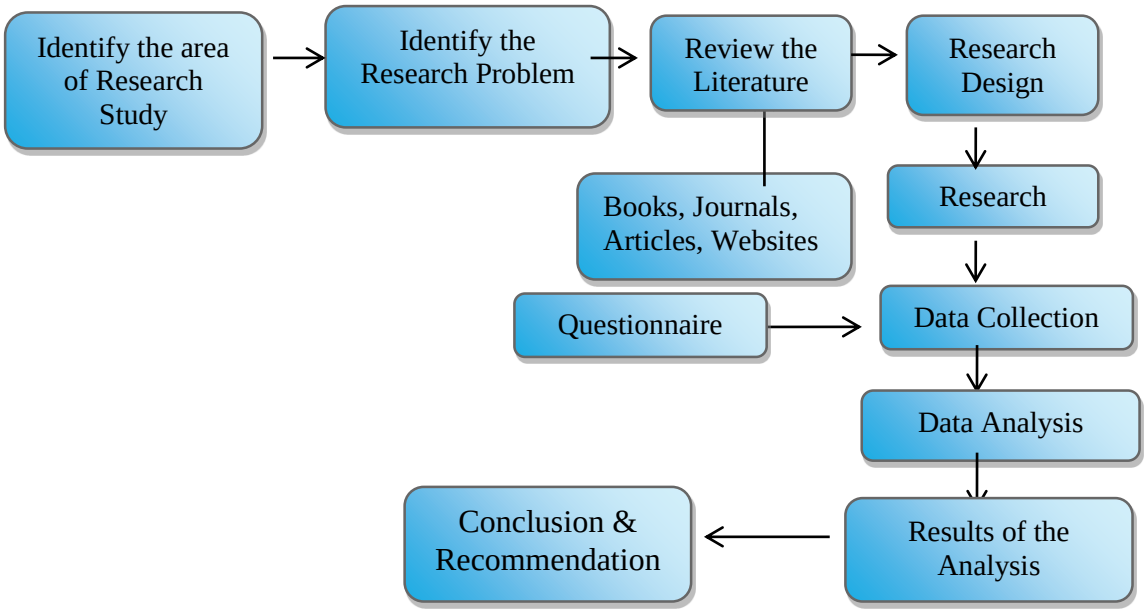

Figure 3.1 Research Process

3.3. Research approach

Research approaches are of two categories, i.e. quantitative and qualitative. Naoum (1998) defined the research strategy as the way in which the research objectives can be questioned. Two types of research strategies are used at studies, quantitative and qualitative research. Quantitative approach is used to gather factual data and to study relationships between facts and how such facts and relationships accord with theories and the findings of any research executed previously, but the qualitative approach seek to gain insights and to understand people's perception of "the world" whether as individuals or groups (Fellows and Liu, 2003). The combination of quantitative and qualitative approaches is mixed approach. Naoum (1998) mixed approach favour to gather realistic data for study relationships with cases and compare the findings of any previous researches

The research strategy adapted for this research is quantitative research.

3.4 Research technique

Once research approach is selected, suitable research techniques should be identified to operatize the research. Research techniques can be discussed under two broad

categories as data collection techniques and data analysis techniques. Selecting proper data collection techniques and data analysis techniques affects the quality of the findings obtained from the research study.

3.4.1 Data collection technique

The researches must follow accurate procedures to obtain accurate data (Field, 2009). Panas and Pantouvakis (2010) also proves this statement saying that correct measure have to be taken by the researches to get accurate data.

There are two types of data surveys used in research studies. They are correlation data surveys and experimental data surveys.

Cross sectional data survey- This provides a natural view of the answers which are been searched for the study and also these data collected on relevant variables. The disadvantage behind this is that the researcher can be bias on measurements of the variables hence researcher being impartial is very much needed.

Experimental data survey- This data survey involves in collecting data for a long period of time and the variables are selected from the gathered data (Knight and Ruddock, 2009).

The data for this study are gathered from questionnaire and literature review.

3.5 Literature review

A literature review was done to fill the knowledge gap of the study, develop a proper methodology to achieve the aims and objectives of the project. This will also help to refine the objectives of the research questions (Fellows and Liu, 2003). The literature survey help to understand the necessities, paybacks and issues connected environmental and natural resource regulations in construction industry. This survey consisted review of textbooks, journals, newspaper publications, and electronic sources.

3.6. Questionnaire survey

A questionnaire will be distributed among 20 professionals who are engaged in the construction industry. A survey will also be undertaken to gather and list the Acts and Laws relating to environment and natural resources in Sri Lanka. These Acts and Laws will be listed according to their relevance to project cycle.

3.6.1 Questionnaire approach

A questionnaire was assess to identify the impact of natural resource regulations on the construction industry. First examine and identify the relevant regulations affected in the construction projects through the literature review.

3.6.2 Questionnaire content

Through the literature review in regulations related to natural resources and their effects for the various stages of project life cycle were identified. The courses were tabulated in to a questionnaire form. The questionnaire is divided into five sections.

Section one related to general information of the stakeholder. Section two and three are related to compliance of Environmental and Natural Resources laws and effectiveness of Environmental and Natural Resource Laws.

Section four and five are focused on monitoring of Environmental and Natural Resource laws and governance of Environmental and Natural resources laws.

3.6.3 Questionnaire design

- Participants information, which would help in gather information about the organization, requested to answer questions pertaining to their experience in construction categorizing the respondents into different groups for the purpose of comparisons.
- Identification of issues related to the construction projects with respect to environmental legislation is done in the questionnaire survey and effects of such issue for the construction project is identified. A Likert scale was used in this study to identify the level of importance of the variables considered. Likert

scale method was identified as a most suitable method for gathering data from the respondents (Baker, 2003).

3.7 Selection of the sample

The sample selection for gathering data can be done using both probability sampling and non-probability sampling. In probability sampling, each person in a population have equal chance of being selected. In non- probability sampling the researcher selects the sample from the population (Knight and Ruddock, 2009). In this study, the researcher used a non-probability sampling frame since the focus was narrow.

3.7.1 Probability sampling (Representative samples)

Probability samples are selected in such a way as to be representative of the population. They provide the most valid or credible results because they reflect the characteristics of the population from which they are selected. There are two types of probability samples:

Random sampling - The term random has a very precise meaning. Each individual in the population of interest has an equal likelihood of selection.

Stratified sample - A stratified sample is a mini-reproduction of the population. Before sampling, the population is divided into characteristics of importance for the research.

In this research random sampling is used to select the sample of government officers and agents, professionals and specialist to seek their participation in the questionnaire survey and a survey on Acts and regulations.

3.7.2 Non-probability samples

As they are not truly representative, non-probability samples are less desirable than probability samples. However, a researcher may not be able to obtain a random or stratified sample, or it may be too expensive. A researcher may not care about generalizing to a larger population. The validity of non-probability samples can be increased by trying to approximate random selection, and by eliminating as many sources of bias as possible.

Quota sample- The defining characteristic of a quota sample is that the researcher deliberately sets the proportions of levels or strata within the sample. This is generally done to insure the inclusion of a particular segment of the population. The proportions may or may not differ dramatically from the actual proportion in the population. The researcher sets a quota, independent of population characteristics.

A purposive sample - is a non-representative subset of some larger population, and is constructed to serve a very specific need or purpose. A researcher may have a specific group in mind, such as high level business executives. It may not be possible to specify the population -- they would not all be known, and access will be difficult. The researcher will attempt to zero in on the target group, interviewing whoever is available

Convenience sample-A convenience sample is a matter of taking what you can get. It is an accidental sample. Although selection may be unguided, it probably is not random, using the correct definition of everyone in the population having an equal chance of being selected. Volunteers would constitute a convenience sample.

3.8. Data analysis

The data gathered from the questionnaires survey are analysed and presented in the graphical and tabular form. This is to be presented in a manner to understand the reader easily. They should also be presented in a way to encourage the reader to have a comparison between different data sets and reveal the findings.

According to Panas and Pantouvakis (2010), the researcher should have a good understanding of statistical data analysis to obtain successful outcome of the research.

Scaling measures are used to obtain the respondents judgement on the effects of environment and natural resource laws on the construction industry based on the respondent's experience. Thus, this research adopts numerical analysis with the support of quantitative data analysis technique to rank the effects using RII calculation.

3.9 Relative importance index (RII)

RII, Relative Importance Index, is the mean for a factor which gives it weight in the perceptions of respondents. The factor with the highest weight has RII = 1, while the next factor with lower weight has RII = 2, and so on. Weighting = Summation of Rensis Likert allocation divided by number of responses.

3.10 Chapter summary

This chapter presented the research methodology used in this research to achieve the aim and objectives of the study based on the theoretical background. A quantitative technique is used to gather data from the respondents. The non-probability sampling method is used to gather data from a selected sample from the population. The Questionnaire was based on the Likert scale to gather information from the respondents and the data was analysed based on the RII analysis.

CHAPTER FOUR

DATA ANALYSIS AND RESEARCH FINDINGS.

4.1 Introduction

The study attempts to collect the information from twenty respondents attached to various organizations in the country representing various fields in construction sector. Using that data it is expected achieve the aims and objectives of the study.

4.1.1 Environmental and natural resource laws affecting construction projects. Documentary survey regarding acts affecting the use of natural resources are listed below. There are over seventy laws related to natural resources and environment in Sri Lanka. Most of the laws are very old and they are very rarely applied to construction industry. According to the industrial experts, depending on the frequent applications of laws, these 70 laws were reduced to 14 laws and they further categorised as environmental related laws and natural resource related laws. And also they categorised depending on the various stages of project life cycle and related implementing agencies.

Environmental laws

- National Environmental Act No 47 of 1980
- Urban Development Projects Act No 02 of 1980
- Fauna and Flora Protection Ordinance No 02 of 1937
- Forest Ordinance No 16 of 1907.
- Coast Conservation Act No .57 of 1981
- Felling of Trees (Control) Act No.9 of 1951
- Nuisances Ordinance no 15 of 1862

Natural resource laws

- Municipal Councils Ordinance No .29 of 1947

- Urban Councils Ordinance No.61 of 1939
- Pradeshiya Sabha Act No.15 of 1987
- Urban Development Authority Law No 41 of 1978
- Soil Conservation Act No.25 of 1951
- National heritage Wilderness Area Act No 3 of 1988
- Sri Lanka Sustainable Energy Act No 35 of 2007.

Table 4.1 Regulations & related agencies in various stages of life cycle

No	**Project Execution Stages**	**Activity**	**Regulation/Act/Legislation**	**Approving Institution**
01	Initiation	Approval EIA	National Environmental Act. Cost Conservation Act Mines and Minerals Act Urban Development Authority Act Pradeshiya Sabha Act	CEA DCC GSMB NBRO SLLR&DC UDA Pradeshiya Sabha.
02	Planning		Mines and Minerals Act National Environmental Act.	GSMB, NBRO

03	Implementation	Soil, metal and sand transportation and supply, Emission Control, Waste Disposal,	Mines and Mineral Act National Environmental Act	GSMB CEA UDA Pradeshiya Sabha
04	Project Closure	Waste disposal	National Environmental Act.	CEA UDA Pradeshiya Sabha

4.2 Description of respondents.

A quantitative analysis is used in this study to do a numerical analysis to see the real and more accurate effects of the acts to the construction industry. This study was conducted among seventeen professionals attached to regulatory bodies and implementing agencies in the construction industry representing various organizations. Two respondents, Assistant Divisional Secretory & Planning Director are from Divisional Secretariats Office Kolonnawa. Three respondents, representing the Colombo Municipal Council (CMC), Central Environmental Authority (CEA) and Board of Investment (BOI). Out of these three, two of them are engineers and one represent CEA is an environmental officer.

Six respondents represent Construction Industry Development Authority (CIDA), Urban Development Authority (UDA) , National Building Research Organisation (NBRO) , Industrial Technical Institute (ITI), Geological Surveys and Mines Bureau

(GSMB) & Central Engineering and Consultancy Bureau (CECB). It consists four engineers, one geologist and architect.

Engineers representing State development and Construction Corporation (SD&CC) , Sri Lanka Land Reclamation and Development Corporation (SLLRDC), Quantity Surveyor representing Sanken Constructions (Pvt) Ltd also responded for the survey.

4.2.1 Survey profile

Data was collected from seventeen respondents representing various institutions related to construction industry. According to figure 4.1 53% of respondents were Engineers while others represent 6% each. In addition to the responses from seventeen respondents, survey findings from regulations and Acts and related agencies in various stages of project cycle are tabulated and presented to support respondent's views.

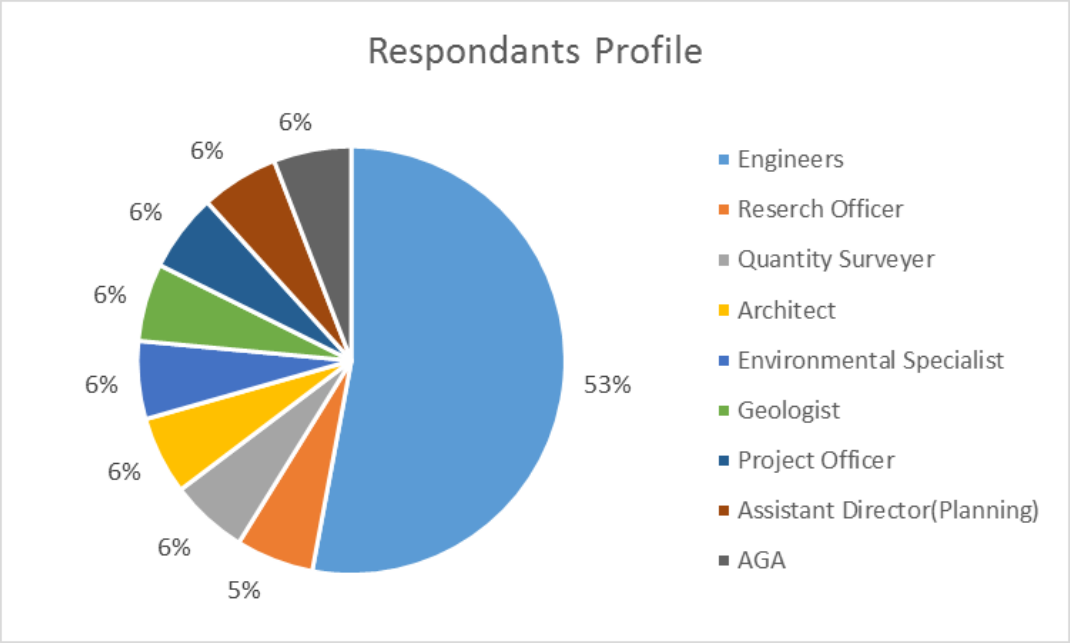

Figure 4.1 Respondents profile

4.2.2 Compliance of environmental and natural recourses

According to figure 4.2, 94% of respondents says that they are aware of the Environmental and natural resources laws of the country.

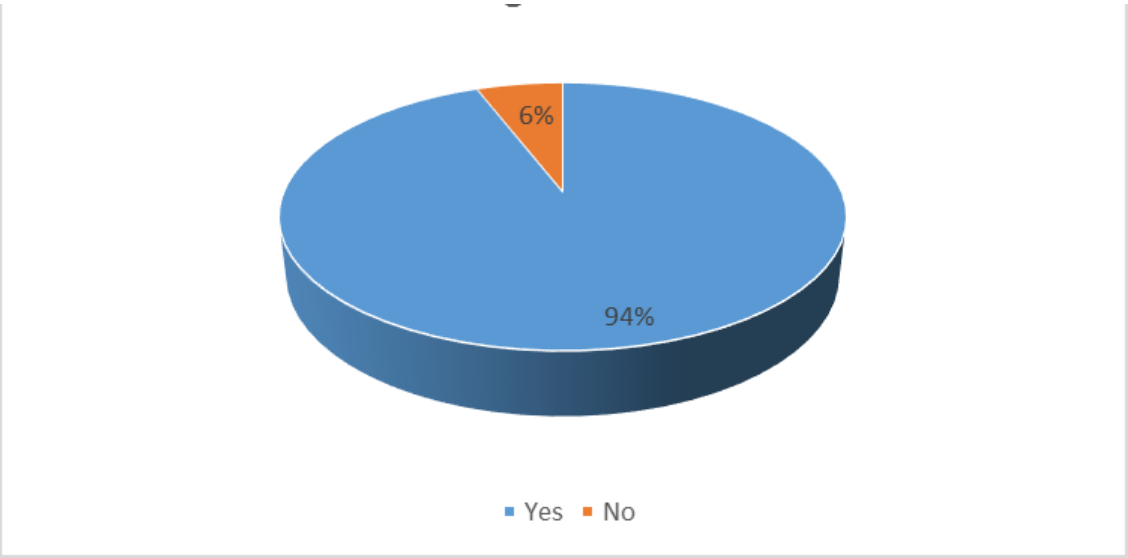

Figure 4.2 Awareness of environmental & natural resource regulations

Figure 4.3 shows that 100% of the respondents are in a view that, practicing Environmental and Natural resources laws benefit for them and the industry. That shows that the stakeholders know the importance of practising these environmental and natural resource laws in the country.

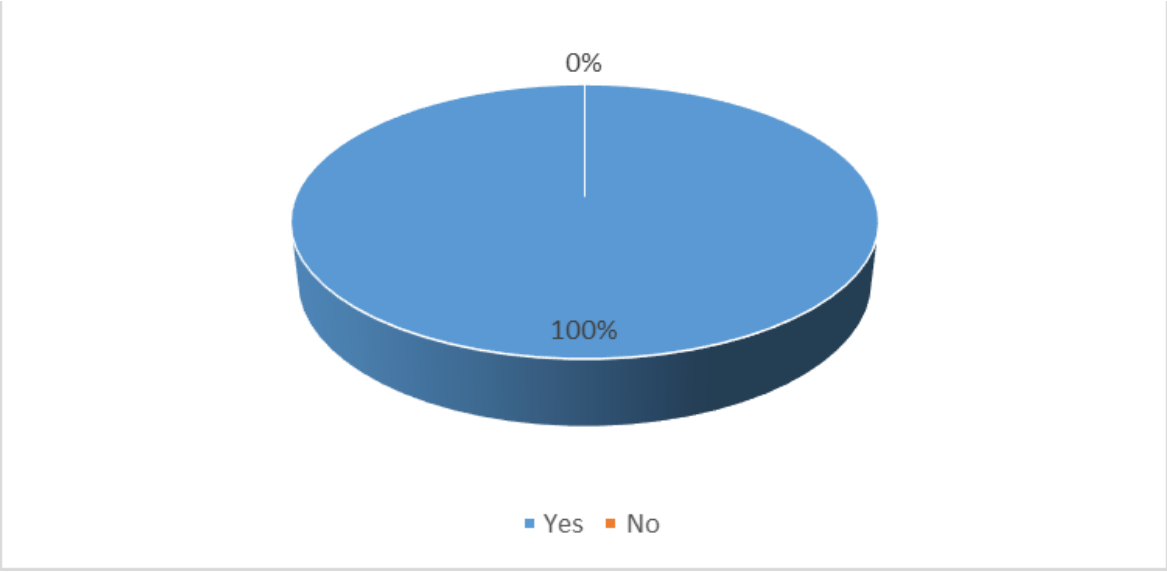

Figure 4.3 Benefits of practicing environmental & natural resource laws.

Figure 4.4 shows that 71% of respondents involve in implementing Environmental and Natural resource laws in the construction industry. That shows that majority of the respondents know the sequence behind these environmental and natural resource laws in the country.

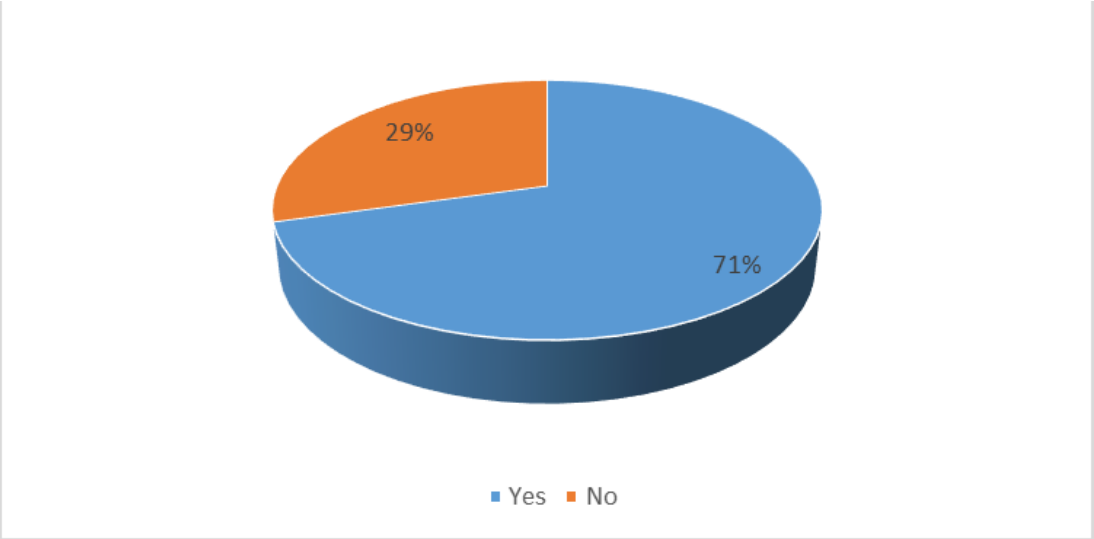

Figure 4.4 Respondents involvement in practising environmental and natural resource laws.

According to figure 4.5, 53% of the respondent who implement the Environmental and Natural resources laws are Engineers while 12% are Environmental officers. This may be due to lack of experienced Environmental officers in the industry or giving less weightage on the environment safeguard rather than project progress. Normally in Sri Lankan context in foreign funded projects provision for environmental and social officers are been made and they are monitored with the environmental and social specialists. But in locally funded projects this practice is not applied and such weightage in not given to safeguard the environmental as in foreign funded projects.

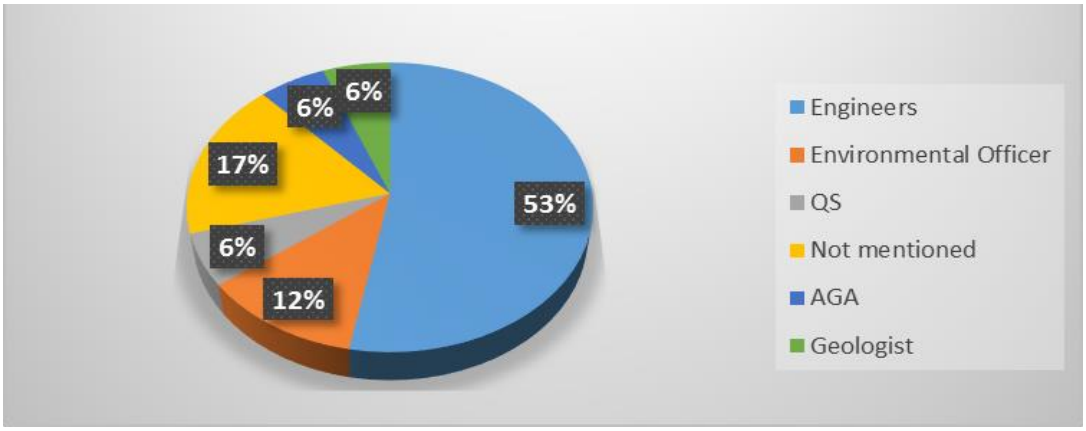

Figure.4.5 Officers implementing the environmental and natural resource laws.

4.2.3. Quantitative analysis on level of use and level of difficulty in implementation of natural resource laws.

Under the detailed questionnaire survey, Environmental and Natural Recourses regulations affecting construction projects were discussed and identified.

In this section the respondents were asked to rank the level of use and level of difficulty in implementation of the natural resources and environmental related regulations affecting construction projects based on five point Likert scale.

The applicability of the important regulations related to the construction sector were analysed based on RII method. The minimum and maximum values considered in Likert scale is one and five.

According to the data gathered from the questionnaire and analysed using RII method, level of usage and level of difficulty in implementation is given in the table. 4.1 and table 4.2 respectively.

According to the table 4.1 the maximum RII value recorded in Environmental Laws is 0.65. That is for National Environmental act no 47 of 1980. Only two environmental acts shows RII vale above 0.5. That is above mentioned act and Urban Development Projects Act No. 2 of 1980. These Environmental laws are used very frequently in the construction industry. In natural resource acts Soil Conservation Act No. 25 of 1951 shows a RII vale of 0.56. Other Natural resource Acts are below RII 0.5. This shows that the only few Environmental and Natural resource laws are been used in the

construction industry very frequently though there are lots of act to protect the environment. The type of law applied may depend on the type of the projects, location geography and etc.

Table 4.1. Level of usage of environmental & natural resource laws.

Environmental & Natural Resource Laws	**RII Value**
Environmental Laws.	
National Environmental Act No. 47 of 1980	0.65
Urban Development Projects Act No. 2 of 1980	0.51
Fauna and Flora Protection Ordinance No. 2 of 1937	0.33
Forest Ordinance No. 16 of 1907	0.39
Coast Conservation Act No. 57 of …..	0.41
Nuisances Ordinance No. 15 of 1862	0.42
Felling of Trees (Control) Act No. 9 of 1951	0.35
Natural Resource Laws.	
Soil Conservation Act No. 25 of 1951	0.56
Municipal Councils Ordinance No. 29 of 1947	0.44
Urban Councils Ordinance No. 61 of 1939	0.47
Pradeshiya Sabha Act No. 15 of 1987	0.40
Urban Development Authority Law No. 41 of 1978	0.48
National Heritage Wilderness Area Act No. 3 of 1988	0.34
Sri Lanka Sustainable Energy Act No. 35 of 2007	0.32

Table 4.2. Level of difficulty in implementation of environmental and natural resource regulations.

Environmental & Natural Resource Laws	RII Value
Environmental Laws.	
National Environmental Act No. 47 of 1980	0.54
Urban Development Projects Act No. 2 of 1980	0.54
Fauna and Flora Protection Ordinance No. 2 of 1937	0.36
Forest Ordinance No. 16 of 1907	0.42
Coast Conservation Act No. 57 of …..	0.42
Nuisances Ordinance No. 15 of 1862	0.48
Felling of Trees (Control) Act No. 9 of 1951	0.39
Natural Resource Laws.	
Soil Conservation Act No. 25 of 1951	0.47
Municipal Councils Ordinance No. 29 of 1947	0.40
Urban Councils Ordinance No. 61 of 1939	0.51
Pradeshiya Sabha Act No. 15 of 1987	0.46
Urban Development Authority Law No. 41 of 1978	0.48
National Heritage Wilderness Area Act No. 3 of 1988	0.45
Sri Lanka Sustainable Energy Act No. 35 of 2007	0.41

Table 4.2 shows that Environmental laws such as National Environmental Act No. 47 of 1980 as well as Urban Development Projects Act No. 2 of 1980 shows RII value of 0.54 each they are easy to implement than the other mentioned Environmental Laws.

According to table 4.2 Urban Councils Ordinance No. 61 of 1939 shows RII value of 0.51. It is the only act implemented easily than the other Natural Resources laws.

These Environmental and natural recourses laws have been used rarely except few mentioned above. The rarely used laws are difficult to implement. That is because when a particular act is been used very frequently, people get used to it and can be easily implemented with time than others.

In the analysis of level of difficulty in implementation of natural recourse laws is accessed based on the respondent's decisions on the level of their enforceability in practice.

4.3. Effectiveness of environmental and natural resource laws.

Environmental and Natural resource regulations affects for various factors of construction projects. This effect is analysed as shown in table 4.3

According to the table 4.3, The National Environmental Act is ranked on the top in every factors affecting construction projects. The soil conservation act is ranked number one on factors like project cost, project duration and project quality. The RII values of environmental and natural resources acts are above 0.5 for project cost, project duration and project quality. This shows that National Environmental Act no 47 of 1980 has average impact to all the factors of the project such as project cost, project duration, and project quality, geographical setting of the project, use of technology, procurement of materials. The highest RII value recorded in National Environmental Act is 0.7. This shows that the National Environmental Act is highly affected to project duration than the other factors.

The urban development act No 2 of 1980 is also has average impacts to project cost, project duration, project quality and Geographical setting of the project. The forest Ordinance No 16 of 1907 and coast conservation Act & Felling of Trees (Control) Act No. 9 of 1951also affect the factors like project cost, project duration, and project quality.

Table 4.3 Effect of natural resource and environmental regulations to various factors in projects.

Environmental & Natural Resource Laws.	PROJECT COST		PROJECT DURATION		PROJECT QUALITY		GEOGRAPHYCAL SETTING OF PROJECT		USE OF TECHNOLOGY		PROCUMENT OF MATERIAL	
	Rank	RII	Rank	RII	Rank	RII	Rank	RII	Rank	RII	Rank	RII
Environmental Laws												
National Environmental Act No. 47 of	1	0.6	1	0.7	1	0.6	1	0.6	1	0.5	1	0.6
Urban Development Projects Act No. 2	2	0.6	2	0.6	2	0.5	2	0.5	2	0.4	2	0.4
Fauna and Flora Protection Ordinance	7	0.3	7	0.4	7	0.3	7	0.3	7	0.3	7	0.3
Forest Ordinance No. 16 of 1907	4	0.5	3	0.5	3	0.5	5	0.4	5	0.4	4	0.4
Coast Conservation Act No. 57 of…	5	0.5	5	0.5	4	0.5	3	0.5	3	0.4	3	0.4
Felling of Trees (Control) Act No. 9 of	3	0.5	6	0.5	5	0.4	4	0.4	5	0.4	5	0.4
Nuisances Ordinance No. 15 of 1862	6	0.4	3	0.5	6	0.3	6	0.4	4	0.4	6	0.3
Natural Resource Laws.												
Municipal Councils Ordinance No. 29	2	0.6	2	0.5	2	0.5	1	0.5	2	0.4	3	0.4
Urban Councils Ordinance No. 61 of	4	0.5	3	0.5	3	0.5	1	0.5	2	0.4	3	0.4
Pradeshiya Sabha Act No. 15 of 1987	7	0.4	6	0.5	6	0.5	4	0.4	7	0.4	7	0.4
Urban Development Authority Law No.	3	0.5	6	0.5	5	0.5	5	0.4	5	0.4	6	0.4
Soil Conservation Act No. 25 of 1951	1	0.6	1	0.6	1	0.6	3	0.5	5	0.4	2	0.4
National Heritage Wilderness Area Act	4	0.5	3	0.5	6	0.5	5	0.4	4	0.4	3	0.4
Sri Lanka Sustainable Energy Act No.	4	0.5	5	0.5	4	0.5	5	0.4	1	0.5	1	0.4

This shows that the forest ordinance No 16 of 1907 has average impact on the project while other two having low impact.

The natural resources Laws are also affected to the factors mentioned in the projects. The Soil Conservation Act No. 25 of 1951 and Municipal Councils Ordinance No. 29 of 1947shows the highest RII value 0.6. This is for project cost, project duration and project quality respectively. All these Acts has average impact to construction projects. All the natural resources Acts except Pradeshiya Sabha Act No. 15 of 1987 affects the project cost, project duration and project quality. The Pradeshiya Saba Act No 15 of 1987 mostly affected to project duration and quality not the cost.

The soil conservation Act No 25 of 1951 has law impact for the geographical setting of the project.

4.4. Monitoring of environmental and natural resource laws.

The role of the public sector agencies on construction projects is very important in Sri Lankan context. Because large number of projects are government funded or the government agencies are being the approving agencies of the projects. Hence government agencies play a huge role in the construction industry.

Table 4.4.Public sector agencies affecting construction projects.

Public Sector Agency	**RII VALUE**
Road Development Authority	0.84
Urban Development Authority	0.87
National Housing Development Authority	0.67
Chamber of the Construction Industry	0.58
Construction Industry Development Authority	0.69
Central Environmental Authority	0.92

National Building Research Organization (NBRO)	0.91
Geological Survey and Mines Bureau (GSMB).	0.73
Sri Lanka Land Reclamation & Development Corporation (SLLRDC).	0.75
National Physical Planning Department.	0.55
Ministry of Irrigation and Water Resources Management.	0.69
Ministry of Housing and Construction.	0.65

According to the table4.4, the highest RII value recorded is for Central Environmental Authority i.e. 0.92. National building research organization has a RII value of 0.91. Urban Development Authority (UDA), Road Development Authority (RDA), Sri Lanka Land Reclamation and Development Corporation (SLLRDC), Geological Surveys and Mines Bureau (GSMB) records 0.87, 0.84, 0.75 and 0.73 respectively. Ministry of Irrigation and Construction Industry Development Authority shows a RII value of 0.69 while National housing Development Authority and Ministry of Housing and Construction 0.67 and 0.65 respectively. Chamber of Construction Industry recorded the lowest RII value of 0.58. All the agencies mentioned in the survey are affecting the construction projects. The Central Environmental Authority is been affecting the projects than the other agencies. This is covered the various activities related to construction. Hence the involvement of CEA is very frequent in construction industry. The involvement of NBRO is also at a high level because due to increase of environmental disasters such as earth slips and floods NBRO play a vital role in approving the project locations. UDA is also very vital in getting the approval for such construction projects. It is a project approving government agency. RDA and SLLRDC are also project approving agencies which doesn't apply much than the above mentioned agencies.

4.4.1. Practise of reform process of regulations affecting construction projects

The reform process of regulation is shown in table 4.5.According to the RII analysis the identification of the relevant criteria needed to choose the ‘’best’’ policy including those related to political/power is recorded as the highest RII value of 0.81. Identification or create alternative solutions and recommendation of the best alternative shows RII value of 0.74. Communication of the recommendation & the reasoning behind it to a client/decision maker shows a RII value of 0.73. Defining & frame a policy problem & identifying the key stakeholders [individual & groups] for an issue shows a RII value of 0.71. Assessing the outcome of each alternative in terms of each criterion and assessing the trade-offs between alternatives record a RII value of 0.69.

The identification of relevant criteria needed to choose the best policy including those related to political power has the highest RII value. This proves that in Sri Lankan context the most important factor in decision making is the political power. The identification and creation of alternatives and recommend best alternatives are also shown the next importance. Communication of the recommendation & the reasoning behind to client/decision maker is also very important and it is ranked third in the reform process. This is also very important factor in policy reform process because if proper communication is not conveyed to the decision maker it will not work as expected.

Table 4.5 Reform process of Regulation

Reform Process of Regulation	**RII Value**
Define & frame a policy problem	0.71
Identify the key stakeholders [individual & groups] for an issue	0.71
Identify the relevant criteria needed to choose the ‘’best’’ policy including those related to political/power	0.81
Identify or create alternative solutions	0.74

Asses the outcome of each alternative in terms of each criterion	0.69
Asses the trade-offs between alternatives	0.69
Recommend the best alternatives	0.74
Communicate your recommendation & the reasoning behind it to a client/decision maker	0.73

4.5. Governance of environmental and natural resources laws.

Environmental and natural resources laws are been affecting positively and negatively on construction projects. Table 4.6 shows that 82% of the respondents says that implementing National Environmental Act No 47 of 1980 and Urban Development Act No 2 of 1980, is time consuming. Generally over 75 % of the respondents says that the implementation of Environmental and natural resource laws is time consuming.

Over 70% of the respondents are in a view that implementing an online system is the best solution to overcome such issues. This shows the importance of time and how the existing regulations waste the valuable time of the people. The newly appointed government are also moving towards in simplifying the rules and regulations in the country and implementation of online systems to facilitate the people do get their service done without facing much difficulties and wasting time.

Table 4.6 Reform process of regulation

Environmental and Natural Resource Law.	Negative effect of the law on the project			Strategies to overcome the identified negative effect			
Environmental Laws	Time Consuming	Difficult to implement	No Effect	Implement online system	Simplify the Rules	Find Alternative Method	Appoint separate Office to handle such issues
National Environmental Act No. 47 of 1980	82%	18%		71%		12%	6%
Urban Development Projects Act No. 2 of 1980	82%	6%		71%	6%	6%	
Fauna and Flora Protection Ordinance No. 2 of 1937	76%		12%	71%		6%	
Forest Ordinance No. 16 of 1907	76%		12%	71%		6%	
Coast Conservation Act No. 57 of …	76%		12%	71%		6%	
Soil Conservation Act No. 25 of 1951	76%	12%		71%		12%	
Felling of Trees (Control) Act No. 9 of 1951	76%	12%		71%		12%	
Nuisances Ordinance No. 15 of 1862	76%		12%	71%			
Natural Resource Law							
Municipal Councils Ordinance No. 29 of 1947	76%		12%	71%		6%	
Urban Councils Ordinance No. 61 of 1939	76%		12%	71%		6%	
Pradeshiya Sabha Act No. 15 of 1987	82%		12%	71%	6%	6%	
Urban Development Authority Law No. 41 of 1978	82%		12%	71%		6%	
Soil Conservation Act No. 25 of 1951	76%	12%		71%		6%	
National Heritage Wilderness Area Act No. 3 of 1988	82%		12%	71%		6%	
Sri Lanka Sustainable Energy Act No. 35 of 2007	76%		12%	71%		6%	

4.6 Chapter summary

The data gathered from the questionnaire survey and opinions of professionals in the construction industry are analysed in this chapter in the tabular and graphical form. Accordingly level of usage of environmental & natural resource laws, difficulty in implementation, their effects on the various factors in projects are presented in this chapter. Public sector agencies affecting construction projects, reform process of regulations are also presented at the end of this chapter.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS.

5.0 Introduction

The construction industry is considered as very important field in any country in the world. But it uses natural resources in large amounts. With the rapid development of the construction industry the amount of natural resources consumed is increased rapidly by pushing the environment to a risky situation. The implementation of environmental and natural resource laws was aimed to control the contamination of the environment. In Sri Lanka context there are lots of Act and regulations to protect environment and natural resources in the country. Hence a proper evaluation of the impact of these Acts and regulations to the construction industry is a timely need. Thus this study was aimed to investigate on the impacts of environmental and natural resource regulations on the construction industry in Sri Lanka.

5.1 Conclusions

Objective I - To identify natural resources and environment related regulations affecting construction projects.

The environmental and natural resources laws associated to construction industry related to Sri Lankan context were reviewed in the literature review. Journals, conference papers books, websites are used in this review

There are over 70 acts related to natural resources and environment, but out of seventy only14 acts were considered in this study. The industrial experts mentioned that only 14 of them are directly affecting the construction projects, because most of them are very old and they are not directly affecting to construction industry. Such Laws were rejected from the list to narrow down the research study.

Objective II - To rank the positive and negative effects of regulations on the use of natural resources in construction projects.

The environmental and natural resource laws affecting construction projects were identified in objective one. Qualitative questions were provided in the questionnaire survey to identify the significant difficulties in use of such laws. The level of difficulty of each environmental and natural resources laws was identified by the Likert scale in the questionnaire survey.

The National Environmental Act No 47 of 1980 Urban Development Projects Act No.2 of 1980 and Soil Conservation Act No .25 of 1951 are the acts which are used frequently in the construction industry. The National environmental Act No 47 of 1980, Urban Development Projects Act No 2 of 1980 and Urban Councils Ordinance no 61 of 1939 are easy to implement than the other acts mentioned in the questionnaire survey.

The National Environmental Act No 47 of 1980 affect every factors in construction projects such as project cost, project duration, and project quality, geographical setting of the project, use of technology and procurement of materials. Out of them this act has higher impact on the project duration.

The Soil Conservation Act No. 25 of 1951 and Municipal Councils Ordinance No. 29 of 1947 affects for project cost project duration and project quality respectively. All the natural resources Acts except Pradeshiya Sabha Act No. 15 of 1987 affect the project cost, project duration and project quality. The Pradeshiya Saba Act No 15 of 1987 mostly affected to project duration and quality not the cost.

All the agencies mentioned in the survey are affecting the construction projects. The Central Environmental Authority affects the projects than the other agencies. This is covered the various activities related to construction in the country. Hence the involvement of CEA is very frequent in construction industry. The involvement of NBRO is also at a higher level because due to increase of environmental disasters such as earth slips and floods NBRO play a vital role in approving the projects. UDA is also

very vital in getting the approval for construction projects. It is a project approving government agency. RDA and SLLRDC are also project approving agencies which doesn't apply much than the above mentioned agencies.

In Sri Lankan context the most important factor in decision making is the political power. Hence the identification of relevant criteria needed to choose the best policy including those related to political power has the highest RII value. The identification and creation of alternatives and recommend best alternatives are also shown the next importance. Communication of the recommendation & the reasoning behind to client/decision maker is also very important and it is ranked third in the reform process. This is also very important factor in policy reform process because if proper communication is not conveyed to the decision maker it will not work as expected. Poor policy planning may subject the frequent changes in acts.

Objective III- Propose means to overcome negative effect of the regulations affecting construction projects.

Generally over 75% of the respondents says that the implementation of Environmental and Natural recourses Laws is time consuming. According to the World Bank Report (2017) it was also revealed that, it is important to improve the efficiency of CEA for swift subproject approval at national and subnational level, therefore, along other outstanding required legal amendments, reduction of the project approving agency (PAA) is also indispensable and demanding. In this regards, comfy decision has been made to decrease the number of PAAs from 31 to 5, which currently rests with legal draftsman, as per procedural requirements for cabinet approval .environmental regulations. Over 70% of the respondents are in a view that implementing an online system is the best solution to overcome such issues. This shows the importance of time and how the existing regulations waste the valuable time of the people. The newly appointed government are also moving towards in simplifying the rules and regulations in the country and implementation of online systems to facilitate the people to get their service done without facing much difficulties and wasting time.

5.2 Recommendations

The implementation system of this laws should be simplified and use an online system to getting approval from the various agencies to save time.

5.3 Further researches

Other researchers who are interested in doing further study in this field could ascertain economic evaluation of natural resource and environmental products including pricing of natural resources using economic formulas to suit the market conditions.

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APPENDIX 01

DETAIL QUESTIONNAIRE

TO IDENTIFY THE EFFECT OF NATURAL RESOURCE REGULATIONS ON CONSTRUCTION INDUSTRY.

Dear Sir/Madam;

Request for filling the Questionnaire

I am H.D.R.L.Kulasinghe , a student at MSc in Project Management programme conducted by the Department of Building Economics, University of Moratuwa. To fulfil my degree program I am carrying out my dissertation on the topic of "Effect of Natural Resource Regulations on Construction Projects".

I would be grateful if you could complete the attached questionnaire with in your busy work schedule. The information furnished here with will only be used to complete my research program and all of your information will be treated confidentially by the research team .Your early responses would be highly appreciated since I have to undergo with a tight –time schedule.

Thank You,

Yours Faithfully

H.D.R.L.Kulasinghe

Project Engineer

State Development and Construction Corporation.

Questionnaire Survey on the Effect of Natural Resource Regulations on Construction Industry.

SECTION 1

RESPONDENT'S DETAILS/PROFILE

Project Name/Organization -
…….....

Designation -
…….

Experience in the Industry/Organization-
……..

SECTION 2 (Compliance of Environmental and Natural Resource Laws)

IDENTIFY NATURAL RESOURCES RELATED REGULATIONS AFFECTING CONSTRUCTION PROJECTS

1. Are you aware of environmental and natural resource laws related to construction projects in Sri Lanka?
2. Are there any benefits of practicing environmental and natural resource laws to your construction project?
3. Do you involve in implementing environmental and natural resource laws in your construction project?

   If No,

4. Who are implementing environmental and natural resource laws in your construction project?

   If yes,

5. Are there any difficulties when implementing environmental and natural resource laws?

   If yes.

6. Please mention the difficulties

……
……
……
……

……
……
……

7. State the level of difficulty and level of usage in implementing each environmental and natural resource law in your construction project.

Please put a tick (v) on the table according to your choice.

1	2	3	4	5	1	2	3	4	5
Never used	Rarely Used	Frequently Used	Difficult to use	Very Difficult to use	Very Difficult to implement	Difficult to implement	Moderately difficult to implement	Easy to implement	Very easy to implement

Environmental & Natural Resource Laws	Level of Usage						Level of Difficulty in Implementation				
	1	2	3	4	5		1	2	3	4	5
Environmental Laws.											
National Environmental Act No. 47 of 1980											
Urban Development Projects Act No. 2 of 1980											
Fauna and Flora Protection Ordinance No. 2 of 1937											
Forest Ordinance No. 16 of 1907											
Coast Conservation Act No. 57 of …..											
Nuisances Ordinance No. 15 of 1862											
Felling of Trees (Control) Act No. 9 of 1951											
Natural Resource Laws.											
Soil Conservation Act No. 25 of 1951											
Municipal Councils Ordinance No. 29 of 1947											
Urban Councils Ordinance No. 61 of 1939											
Pradeshiya Sabha Act No. 15 of 1987											
Urban Development Authority Law No. 41 of 1978											
National Heritage Wilderness Area Act No. 3 of 1988											
Sri Lanka Sustainable Energy Act No. 35 of 2007											

SECTION 3 - (Effectiveness of Environmental and Natural Resource Laws)

ANALYSE OF THE EFFECT OF ENVIRONMENTAL AND NATURAL RESOURCE LAWS ON THE CONSTRUCTION PROJECTS

8. **Please rank the level of impact of each environmental and natural resource law related to the given factors on construction project performance.**

Please state the relevant number on the table according to your choice.

1	2	3	4	5
No Impact	**Low Impact**	**Average Impact**	**High Impact**	**Very High Impact**

Environmental & Natural Resource Laws.	**Project cost**	**Project duration**	**Project quality**	**Geographical setting of Project**	**Use of technology**	**Procurement of materials**
Environmental Laws						
National Environmental Act No. 47 of 1980						
Urban Development Projects Act No. 2 of 1980						
Fauna and Flora Protection Ordinance No. 2 of 1937						
Forest Ordinance No. 16 of 1907						
Coast Conservation Act No. 57 of …						
Felling of Trees (Control) Act No. 9 of 1951						
Nuisances Ordinance No. 15 of 1862						
Natural Resource Laws.						
Municipal Councils Ordinance No. 29 of 1947						
Urban Councils Ordinance No. 61 of 1939						
Pradeshiya Sabha Act No. 15 of 1987						
Urban Development Authority Law No. 41 of 1978						
Soil Conservation Act No. 25 of 1951						
National Heritage Wilderness Area Act No. 3 of 1988						
Sri Lanka Sustainable Energy Act No. 35 of 2007						

SECTION 4 - (Monitoring of Environmental and Natural Resource Laws)

IDENTIFICATION OF ROLE OF PUBLIC SECTOR AGENCIES ON THE OF CONSTRUCTION PROJECTS

9. **What about the importance of the role of public sector agencies for the construction projects?**

Public Sector Agency	1	2	3	4	5
	Very Significant	Significant	Some	No	Do not know
Road Development Authority					
Urban Development Authority					
National Housing Development Authority					
Chamber of the Construction Industry					
Construction Industry Development Authority					
Central Environmental Authority					
National Building Research Organization (NBRO)					
Geological Survey and Mines Bureau (GSMB).					
Sri Lanka Land Reclamation & Development Corporation (SLLRDC).					
National Physical Planning Department.					
Ministry of Irrigation and Water Resources Management.					
Ministry of Housing and Construction.					

0	1	2	3	4
No Importance	Little Importance	Somewhat Importance	Importance	Great Importance

10. Practice of reform Process of regulations affecting Construction project

Reform Process of regulation	**0**	**1**	**2**	**3**	**4**
Define & frame a policy problem					
Identify the key stakeholders [individual & groups] for an issue					
Identify the relevant criteria needed to choose the ‘’best’’ policy including those related to political/power					
Identify or create alternative solutions					
Asses the outcome of each alternative in terms of each criterion					
Asses the trade-offs between alternatives					
Recommend the best alternative					
Communicate your recommendation & the reasoning behind it to a client/decision maker					

SECTION 5 (Governance of Environmental and Natural Resource Laws)

PROPOSE MEANS TO OVERCOME NEGATIVE EFFECT OF THE REGULATIONS AFFECTING CONSTRUCTION PROJECTS IN SRI LANKA

11. Please state, what are the barriers in implementing respective environmental laws and the strategies to overcome them.

Environmental and Natural Resource Law.	**Negative effect of the law on the project**	**Strategies to overcome the identified negative effect**
Environmental Laws		
National Environmental Act No. 47 of 1980		
Urban Development Projects Act No. 2 of 1980		
Fauna and Flora Protection Ordinance No. 2 of 1937		
Forest Ordinance No. 16 of 1907		
Coast Conservation Act No. 57 of …		
Soil Conservation Act No. 25 of 1951		

Felling of Trees (Control) Act No. 9 of 1951		
Nuisances Ordinance No. 15 of 1862		
Natural Resource Law		
Municipal Councils Ordinance No. 29 of 1947		
Urban Councils Ordinance No. 61 of 1939		
Pradeshiya Sabha Act No. 15 of 1987		
Urban Development Authority Law No. 41 of 1978		
Soil Conservation Act No. 25 of 1951		
National Heritage Wilderness Area Act No. 3 of 1988		
Sri Lanka Sustainable Energy Act No. 35 of 2007		

APPENDIX 02

Table 1. Distribution of value of work done by type of construction activity-2016

Source: Survey of construction industries-2016/17

Type of Construction Activity	Value of work done (Rs Mn)	Percentage
Construction of buildings	140,900	44.1
Construction of roads and railways	106,030	33.2
Construction of utility projects	52,622	16.5
Construction of other engineering projects	7,520	2.4
Demolition and site preparation	73	0.0
Electrical, plumbing and other construction installation activities	9064	2.8
Building completion and finishing	3089	1.0
Other specialized construction activities	314	0.1
Total	319,632	100.0