FACTORS AFFECTING ENGINEERING PROJECT MANAGEMENT EFFICIENCIES IN PROVINCIAL COUNCILS

Premasiri H.D.S.N.

DEPARTMENT OF BUILDING ECONOMICS
Faculty of Architecture
UNIVERSITY OF MORATUWA.

Department of Building Economics
University of Moratuwa
Sri Lanka.

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Declaration

I hereby declare that this submission is my own work and that, it contains no material previously published or written by another person nor material which, to a substantial extent, has been accepted for the award of any other degree or diploma of a University or other institution of higher learning, except where an acknowledgement is made in the text.

UOM Verified Signature

28th February 2008.

I hereby acknowledge that Mr. **H.D.S.N. Premasiri** has followed the dissertation process set by the Department of Building Economics.

UOM Verified Signature

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Dissertation Supervisor

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LIST OF ABBREVIATIONS

APSE	-	Association of Public Service Engineers
DD	-	Deputy Director
EE	-	Executive Engineer
LSD	-	Least Significant Difference
PPSC	-	Provincial Public Service Commission
PRDA	-	Provincial Road Development Authority
PWD	-	Public Works Department
SLES	-	Sri Lanka Engineering Services
SPSS	-	Statistical Package for the Social Sciences

ABSTRACT

Provincial Councils play major role in implementing development activities within the island. Provincial Engineering services have been established in each and every province to consult, supervise and implement those development activities. As per the 13th amendment to the constitution, provincial councils are allowed to establish Provincial Engineering Organization to suit with their territorial conditions, resulting different types of engineering organizations in provinces. Accordingly, implementing a National Development Plan within the island with the help of provincial engineering organizations took place in a different backgrounds and the final out come is with disparities. So far, no any research has been done to evaluate factors that effect to the project management efficiency of engineering organizations in provincial councils. This research study aims to provide an approach to identify factors that critically effect to the project management efficiency of four selected provinces and comparison of their effectiveness.

A brain storming session was done to identify factors that effect to the project management efficiency of provincial engineering organizations. A questionnaire survey is carried out with 120 experts to identify most critical factors under Delphy round one. The Delphy round two was carried out on same set of experts to ascertain the affect of those identified factors in provincial council project implementation context.

Identified factors are grouped in to eleven categories and a comprehensive comparison was done by using SPSS Software. A parametric test one way ANOVA test, and a non parametric test, Kruskal- Wallis test, was used to test the hypothesis. A comprehensive comparison was done on the selected eleven categories and their position in provincial context was revealed. As such provincial authorities can pay their special attention to improve the factors that lay far behind the other provinces compared.

Chapter 1

Introduction

1. INTRODUCTION

1.1 Background

As a solution to prolonged ethnic problem of the country, provincial councils were established under the 13th amendment to the constitution in 1987. According to the 13th amendment, most of the authorities and powers of line ministries were delegated to provincial Councils. A chief Secretary who has been considered as equal to the Secretary to the line ministry was appointed to each and every provincial council as head of the provincial public service. Under the chief secretary there were four ministry sectaries, who headed four ministries of the provincial council. In addition, four deputy chief secretaries were appointed for specialized fields such as planning, financing, engineering & administration. Provincial engineering services were formed under the Deputy Chief Secretary (Eng.). With the introduction of the13th amendment to the constitution, most of the powers and authorities of the line ministries were vested upon provincial councils. Accordingly, all the engineering matters also vested upon Provincial Engineering Services Departments. Mean while, carder available in provinces for this works were absorbed to the provincial engineering services departments. When the works of several departments take as a bundle, it has become a huge work load. In addition to heavy work loads of education department and highways department there were line ministry works such as postal department, health department, police department etc. Most of the development activities, preferably over 90% of the total development activities within the province, were entrusted with the provincial engineering services department.

1.2. Aim

Enhance Knowledge, in ways of improving Project Management efficiency in Provincial Engineering Organizations, to the construction professionals in Provincial Councils.

1.3. Objective

1. Identify factors which critically affect the project management efficiency of Engineering Organizations in Provincial Councils.
2. Comparison of Engineering Organizations in Provincial Councils.

3. Recommend ways & means of improving the efficiency of these organizations in implementing projects.

1.4. Research Problem

At present, huge amount of budgetary allocation of the provincial council is spent through the respective engineering department of the province. In addition to supervise construction activities, which are implemented through provincial councils, Engineering services cater its services to line ministries as well. Even after 20 years of establishing provincial councils, it could be seen that no uniform structure has been identified for provincial engineering services departments up to now. All the provincial councils have their unique organization structure. In some provinces this engineering organization structures are subjected to frequent changes while some are not.

When projects are implemented through those engineering organizations some provinces shows very good progress in construction activities while some provinces shows very poor progress. This is adversely affecting the development of the country. Due to this reason, an unbalance has been generated among the provinces pertaining to development activities. Continuation of this situation for many years may generate unbalanced development within the Island. As such, serious concern should be paid over this crucial issue which may become a major national problem in near future.

1.5 Methodology

In this context, factors were designed to analyze through two main paths such that Industry review & literature review. Under the literature review all relevant documents were analyzed & some factors that effect to the project management efficiency of engineering organizations were comparatively evaluated. In case of Industry review, brain storming sessions & Delphi technique was used to evaluate factors. In this context, Survey research was designed & questionnaires were used. .Proportionate stratified random sampling method was used to select the sample. Both Qualitative & Quantitative data types were used for this analysis. One Way ANOVA test & Kruskal-Wallis test in SPSS software were used to compare identified factors.

Chapter 2

Literature Review

2. LITREATURE REVIEW

2.1.History of Engineering In Sri Lanka

Engineering is a science which made by the people to improve the quality of life of the people. Engineering is defined as the art of directing the great source of power in nature for the use and convenience of mankind. `Engineering closely related to our lives as it deals with developing and providing infrastructure, goods and services for the people. Accordingly engineering covers a vast range of activities from providing basic necessities such as drinking water, sanitation, the infrastructure needed for agriculture, houses and buildings, roads, transporting, manufacturing industry and facilities such as electricity, telecommunication and broadcasting, to all the advances of the modern world. As such it touches all aspects of our life.

Engineering history of Sri Lanka goes up to the Anuradhapura era of our Civilization. Colossal thanks, canals and gigantic religious monuments are some of these constructions which are revealed our excellent engineering history to the modern world. Stupas such as Abayagiriya and Ruwanweliseya are the largest brick buildings in the world. The hydraulic Civilization in Sri Lanka has even amazed the modern irrigation Engineers.

From ancient times to 500 AD there were great irrigation schemes and high state of metallurgical technology. It could be seen that our ancestors has designed and developed diversion dams, network of canals and colossal tanks to suit the Climate and topography of the country. The credit for doing these gigantic works should go to the ancient king's who rule the island and their responsible advisers. Large reservoirs, constructed by our ancestors, helped to increase the volume of water that could be stored and thus the extent of land to be irrigated.

The Portuguese during their occupation of the coast from 1505 to 1658 achieved domination over the coastal belt of the Island for nearly 150 Years. After Portuguese occupy the area they constructed churches, Convents, Monasteries and Hospitals alongside stately dwellings.

Then the Dutch came to the Island in 16 th century. In 1658, they were able to expel the last Portuguese from the territory and occupy the whole coastal belt which was important for maritime purposes.

The Dutch introduced distinctive ideas in their domestic architecture and town layout, with the street grid systems providing regular avenues and cross streets. In 1656 they constructed the Urubokka Dam in the South, the first new irrigation project in the Island since the Pollonnaruwa Kingdom. The canals are a most notable contribution of the Dutch to the Island economic development.

In 1795-6 English were able to take control over the Dutch territories. Finally, the British took control over the country by a treaty with Kandyan aristocracy in 1815.There were no any signs of systematic territorial Engineering Administration system in ancient Kings, Portuguese or Dutch eras. But after the British took over the control of the country they established unified administrative in 1832.In 1844 British demarcated six provinces within the Island. The public works Department, (PWD) the pioneer organization that implement all Engineering works in the Country was established in nineteen century. Originally the PWD was the only Engineering Department of the Government and undertook all government engineering projects; most of the government technical departments functioned within it. With increasing developments, specialized departments such as harbor, irrigation and electrical departments were formed for specific classes of work.

After decades of its tremendous service, the PWD, which was mainly involved in the construction of roads, bridges buildings & services, was split in 1969 in to the department of highways and department of buildings. With the formation of provincial councils in 1987 Department of high ways and department of buildings have been further fragmented. As a solution to the prolong ethnic problem of the country provincial councils were established in 1987 under the 13th amendment to the constitution. The gazette of the 13th amendment was published in 20th November 1987.By the 13th Amendment provincial councils were empowered with very high authorities and powers. A Governor, A Chief minister and Board of Ministers were appointed in this regard. Under the eighth schedule of the amendment Nine provincial councils were introduced namely Western, North Western, Uva, Sabaragamuwa, Central, Eastern, Southern, North Central and Northern.

As a independent Body, provincial councils are vested with construction and maintenance of roads and bridges other than national highways and bridges and feries on national highways. In addition, rehabilitation and maintenance of minor irrigation works, the establishment and maintenance of public hospitals, rural hospitals, maternity homes, dispensaries other than teaching hospitals and hospitals established for special purposes, establishment and maintenance of Ayurvedic dispensaries and Hospitals, provision of facilities for all state schools other than specified schools also was vested upon provincial councils.

But no any Uniform Engineering organization structure has been introduced in the provincial council Act. As such, Provincial councils established their own organization structures for the Engineering departments. When Engineering organizations were established in provincial councils ,necessary officers were absorbed from line ministries & departments. If, head of the newly established department came from building department then he made the organization structure similar to that. Consequently, if head of the department is from irrigation department then he made the Engineering services department with that features.

Finally the total out come was setting up of entirely different Engineering organizations in provinces. But the work entrusted with the Engineering organization always similar to each and every province.

2.2. Research Already Done On The Subject

2.2.1. Research on non uniform organization structures of provincial Engineering Services (1996)

After Provincial Councils were established in 1987, its Engineering Services Departments were established for each & every Provincial Council in latter years. The major problem faced by the authorities in implementing development activities within

Provinces was, non availability of uniform Engineering Organization structures of Provincial Councils. It created disparities in progress monitoring; inter province transfers, contract administration & implementing projects.

After realizing practical problems emerged due to this disparity, secretary to the Provincial Council & local government, Co-operative & indigenous medicine appointed a higher level committee to probe the matter. The committee comprise of following members.

President - Chief Secretary Uva Province

Secretary - Secretary to Sabaragamuwa Province PPSC

Member 01 - Chairmen Association of public service Engineers

Member 02 - Member Association of public service Engineers

Member 03 - Secretary to Ministry of transport, Irrigation, Housing construction & Co-operative. (Central Province)

Member 04 - Secretary (Western Province PPSC)

The committee comprise of four members from provinces and two members from APSE. The committee was entrusted with following activities.

i. To recommend suitable measures to alter Provincial Engineering organization structures, focusing solving disparities arouse due to non uniform organization structures of Provincial Engineering services.

ii. Matters pertaining to admittance of Engineers to Provincial Councils & their training activities.

iii. Promotion of Technical officers to Engineering service.

2.2.2 Pitfalls of The Report

i. Even though the report includes short explanation on existing structure of Provincial Engineering services, it excludes a detailed, scientific, managerial & critical analysis on the same.

ii. No any comparison was done on characteristics of existing organization structures.

iii. No adequate focus was made on difficulties arouse due to non uniform organization structures. No any problem has identified.

iv. No any attention was made on previous organization structures.

v. Even though the committee has suggested a common organization structure, its authorities & responsibilities have not been detailed.

vi. Characteristics of the proposed organization structure have not been evaluated.

vii. No any sign is available about getting ideas from Provincial Engineers, Technical staff, clerical staff and contractors, the major stake holders of the organization, while preparing this report.

viii. No any research was done.

2.2.3 Summary

Even though this research is in primitive stage, it included valuable details on Provincial Engineering organization system that prevailed in 1996. More over, it could be noticed that some recommendations have already been implemented in some Provinces as per the recommendations given by this report.

2.3. Western Provincial Engineering Service

2.3.1 Establishment of provincial Engineering Service

As per the 13 th amendment to the constitution western provincial Engineering service was established in the latter part of the 1989 At the beginning, all the education department building construction works were handled by the Director of Education Buildings who

served under Provincial Director of Education. Similarly there was a director for health and other buildings namely Provincial Director of Engineering. Even though minor irrigation works were entrusted to a provincial director of irrigation, later he joined the irrigation department . As such, all the minor irrigation works also were handed over to the Provincial Director of Engineering. After 3 years period, the chief minister decided to reform the engineering service due to inefficient service rendered by it. Lack of supervision, delays of payments, and inefficient use of available resources and lack of co-ordination among engineering sectors were major problems encountered. Due to these conditions the first reform was done in 1993.

2.3.2 The First Amendment

Following steps were taken through this reform.

i. All engineering activities implemented within the province were taken under the purview of the Deputy Chief Secretary Engineering.

ii. School building sector also took under control of the Director Buildings.

iii. Separate design branch has been commenced under Director (Engineering)

2.3.3. The Second Amendment

After 13 years of implementation provincial ministers wanted to reform Provincial Engineering Service. Provincial political hierarchy pointed out that the co-ordination in between engineering service and the relevant ministries are not adequate. Accordingly they wanted to establish a new system which can be easily access by relevant ministries. This amendment was mainly focused on.

i. Make an efficient service & accelerate all development activities implemented through the Provincial Engineering Service.

ii. Improve the close supervision and acquire better quality control.

iii. Make room for technical staff to work more on technical matters rather than doing procurement works & monitoring progress & project management activities.

iv. Chief accounting officer for the particular sector is the secretary to the ministry. Hence, the new organization structure facilitated close supervision & co-ordination of the secretary to the ministry over his field of works.

Major Amendments Done

Separate sectors have been established for school building & health sector which composed of major work load. In addition, a director has been appointed to work on other sectors except health & school building works. Specially he works on Irrigation &, other construction activities. In addition to these three directors, Director (Engineering) is appointed for all design works, water supply & drainage works, quality controlling, structural & Architectural works, & for procurement works. The amended organization structure is annexed as annexure 01.

2.3.4. Important Features of Present Organization Structure

2.3.4.1. Co-ordination

i. In case of co-ordination, similar features to the former system can be seen on new structure as well. But it has been improved with increased no of directors to the structure. Hence direct vertical co-ordination between Secretaries to the ministries, Department heads & particular Sector Directors(Eng) could be achieved.

ii. Design branch, quality control unit & procurement branch of the institution are activated directly under the purview of Director Engineering. Other sector directors could obtain these services from the Director Engineering. Hence good horizontal co-ordination will be developed in between Sector Directors & Director (Engineering). Similar situation can be expected for account section as well. But less co-ordination can be seen among Sector Directors.To improve the down word co-ordination an additional post, namely Chief Engineer, has been introduced to the system. Hence the gap in between Directors & Divisional engineers has been filled.

iii. At the middle & bottom level, no of implementation engineers have been increased up to 20. It is 25% increase. As such more co-ordination can be expected with clients, general public, contractors & any other service receivers.Similarly more

coordination can be expected from Director School Building & Chief Engineer School works who deals with school building activities only.

2.3.4.2. Common Goal

The common goal of the organization can be defined as implementing development activities for the betterment of the general public in an efficient & satisfactory manner with a higher standard. All the departments & sub departments of the organization adhere to this purpose in same caliber, Even though, departments have their unique purposes to be achieved, those all are within the frame work of the common goal.

2.3.4.3 Division of Labour

i. Education sector

In this organization structure division of labour has been done in a systematic & satisfactory manner. Eleven divisional engineers who do educational construction activities will do all estimating, minor designing & implementing part of the education buildings within their division. As such they can become veterans on the subject within a shorter period.

ii. Health sector

Under the new reforms health works have been separated from education works and implemented through separate set of engineers comprising provincial director, chief engineer & district engineers. All of them are doing only health sector activities. As such they will quickly familiar to all health sector aspects, rules, regulations, clients and

building requirements. Hence they can become experts on the subject.

iii Irrigation & Miscellaneous Constrictions

Similar to the two categories mentioned in the above chapter a specialization can be expected in this sector as well.

iv. Division of labour in other areas

Engineers perform under the director engineering has been increased up to five by further applying job specialization. The new sectors found were quality control unit and contracts unit. Accordingly, five specialized fields, designs, water supply & drainage, Architectural, Quality control & contracts have been specialized. According to this job specialization they can render their service to all sector directors. More experience on field work make them as veterans of this subject. In addition, Account section and administration branch perform separately. The service of Architecture & quantity surveyor is available to all sector directors as per this job specialization.

2.3.4.4. Departmentalization

Western province Engineering organization structure composed of function base, product base & process base departmentalization. It has been basically separated on functions such as four construction department's one Finance department and one Administration department. Construction departments are further departmentalized on product base such as health, education etc.. process base separation has been done, in director engineering department. It has been further divided in to Architectural, Design, Quality control etc.

Moreover, the recently formed organization structure is focused on customer based departmentalization as well. The Education constriction departments provide its service to department of Education while health building construction department provide its service to health ministry. Similarly irrigation & miscellaneous constructions department provide its service to remaining three ministers in the provincial council.

2.3.4.5. Integration

Different functions performed by different persons in an organization need to be combined together to achieve consensual goal of the organization. If different departments work independently without having regard to each other then it may lead to chaos and achievement of common goal may be come uncertain & difficult.In this structure, it has not been finalized where director offices are positioned. But it has been stated that the contract management works of the particular sector are done by the Heads of the respective

departments. As such there may be no any integration in between departments, except director engineering department because all other sector departments should fulfill their specialized needs from the director engineering department. It could be seen that the sector departments are little away from the Deputy Chief Secretaries purview. If the offices of sector directors housed in the same premises and progress monitoring is done by the deputy chief secretary (Eng.) then the desired out come may be obtained

2.3.4.6. Span of control

Span of control refers to the number of subordinates/individuals a manager can effectively supervise. In this new organization structure, the span of control from Deputy Chief Secretary to Directors are in 1:5 proportion. It can be considered as an appropriate proportion. But span of control at the middle level of the sector departments are 1:1 that should be considered as inappropriate proportion. Too small span of control caused to increased levels of supervision, complexity in the vertical communication and discourage subordinate/employees autonomy. But this weakness is eliminated at Director (Engineering) sector. It span of control at the middle level is 1:5, a proportion that can be considered as reasonable entity. In sector departments span of control at the bottom level varies from 1:3 to 1:11 that can be treated as viable entities.

2.3.4.7 Delegation of Authority

Authority refers to the rights inherent in a managerial position to give orders and expect the orders to be obeyed. In this organization structure an unbroken line of authority that extends from the top of the origination to the lowest echelon could be seen. In this chain of command each managerial position is given a place that has degree of authority to meet his or her responsibilities.

Delegation of Authorities & responsibilities to each & every managerial position is clearly defined by the Chief Secretaries circler no 02/2007 & dated 22 March 2007.According to these circular secretaries to the ministries have become Chief Accounting officers & all the development activities pertaining to his ministry should come under his preview. In addition heads of the departments, who do not have much role pertaining to construction

activities in previous structure, entrusted with a vital role in project management. They will act as the project managers and all the project management works come under their purview.

In addition, project planning & monitoring of progress also have become their role. More over, the Accounting officer, the head of the relevant department, is entrusted with all procurement works including awarding of contracts & signing of agreements.

As per this circular engineers are limited to technical service which includes preparation of estimates, supervising construction activities, giving technical instructions, quality control & certifying payments.

To achieve these responsibilities, authorities have been delegated to each and every levels including tender board limits, Limits of estimate preparation, approving of bills & approving of variation orders. But no any authority has been delegated on signing of agreements.

2.3.4.8. Formalization

All the rules & regulations pertaining to new organization structure is clearly defined in the Chief Secretaries circular No 02/2007 issued on 22 March 2007. In addition Government procurement procedure issued by the treasury in 1997 cover the rest of the tender procedure Applications. More over, Government financial regulation & Establishment code provide necessary guidelines on any other relevant matters.

2.3.4.9. Transport

In Western Provincial Council, Senior Engineers, Directors & Dep. Chief sec, are provided with an official vehicle that use for private mileage as well. Executive engineers are provided with a vehicle that use for their site visiting purposes. Some offices are provided with two vehicles. As a whole, it can be noted that, all available vehicles are in good running condition, mainly due to commendable vehicle maintenance procedures of the provincial authorities.

2.3.4.10. New Technologies

a) Computers

Total no of computers available in the Engineering Department is forty three. Each Divisional and District Engineering offices are provided with a computer that is

used for estimating, progress preparation & report writing & presentation purposes. Computers at the head office are used for preparing AutoCAD drawings, designing structural elements, checking & preparing of final estimates, preparing progress reports & for presentation purposes. But, most of the computer models are outdated & are not suit to any modern office environment.

b) Photocopy Machines

Head office is equipped with one heavy duty machine and four light duty machines which are in good working condition. But situation is worst at divisional level, as most of the machines are out of order.

(c) Email & Internet

Head office & all sub offices are provided with Email & Internet facilities. Unfortunately these facilities are not appropriately used for engineering purposes.

(d) Latest Equipments

One laptop computer & multy media device are available at the head office. No any additional instruments are given to Engineering staff for their official use.

2.3.4.10. Human Resources Management

Monthly progress review meeting is conducted to review the progress of work & to resolve any other management issues, with the participation of all Divisional Engineers & District Engineers, in the first Friday of each & every month. No any methodology is adopted to review the usage of human resources on weekly basis. As such optimum usage of human resources cannot be seen in Western Provincial Engineering Service.

2.3.4.12. Influences

Significant influences are evident from local politicians as well as parliamentarians. But fortunately no any major interference was happened to the duties of the officials up to

now. Normally, their influences are mainly focused on progress of work and selecting of project proposals.

2.3.4.13. Documentation

The way of maintaining data bases, record keeping systems, files & cupboards etc. are subjected to this analysis. It could be seen that, appropriate data base is not maintained so far by the Engineering Department. The available data base is not updated in time. No uniform record keeping system is adopted. Only in some sub offices files & cupboards are maintained up to an acceptable standard. More over there were so many complaints on late delivery of the mail.

2.3.4.14. Office Arrangements

Head office of the Engineering Department is properly sectioned, partitioned and maintained well. External environment is also in good standard. Recreational facilities for workers are adequate and maintained well. In case of sub offices aforesaid arrangements could be seen with slight variations.

2.3.4.15. Technical Preferences

According to complaints made by some of the staff, the support rendered by design branch is not adequate to cater the rising demand of the technical issues. Service rendered by the quality control unit was praised. In case of any technical problem, involvements of key decision makers are not in to an acceptable level.

2.3.4.16. Training

Local training facilities available for the non Engineering staff are adequate while it for Engineering staff is inadequate. Overseas training facilities, especially for Engineers are very poor. There are large no of Engineers who doesn't have any overseas experience up to now.

2.3.4.17. Drawings

Uniformity or good standard couldn't be seen in the drawings. Even though some drawings are computer based some of those are hands drown. Drawings are neither properly checked nor approved. Notes are given in most of the drawings in acceptable manner. As such as a whole, condition of drawings are unsatisfactory in the particular province.

2.4. Southern Provincial Engineering Services

2.4.1 Establishment of provincial Engineering Service

As per the Government policy on devolution of power, the Southern Provincial Council was established in 1989. Most of the construction activities handled by the central government departments in southern province were handed over to the southern provincial council including its technical staff, related non technical staff and office premises to met with the requirements of 13th amendment. Accordingly, southern provincial engineering services department was established in 1st of Jan 1990 to fulfill this void.

At the inception the provincial engineering services department was attached to the Food, Social services and Co-operative ministry. Deputy Chief Secretary (Eng) post was not available in the provincial engineering services set up at the beginning. As such, Provincial Director of Engineering was the head of the department. He was directly responsible to the Chief Secretary for the satisfactory implementation of all Civil engineering activities pertaining to the Provincial Council apart from roads. From inception no any road work has been entrusted with the provincial engineering services. Provincial Road development Authority, which is empowered with construction and maintenance of class C & D roads, was established in par with the Provincial Engineering Services in 1990. It has been activated under Chairman & Board of Directors. Director Engineering Services is only a Director board member of the Provincial RDA. Provincial Road Development Authority is operating under the purview of Ministry of Highways. Budgetary allocation received from the central government for road improvement works are spent through this Provincial Road Development Authority. A General Manager

headed the PRDA & Chief Engineers & Executive Engineers works in the Authority as middle and junior managers. A Mechanical Engineer was available to run & maintain the work shop.

At the beginning, there were very less no of Engineers in Provincial Engineering Services. Accordingly, the first establishment was focused on a mechanism that can be run with less no of Engineers and allowance has been made for future expansions.

The total minor irrigation works those were entrusted with the Provincial Council was less than 19511 acres and limited to some specified areas. As such management of minor irrigation works were done through chief Engineers attached to the provincial Director office. Design engineers were available in the Provincial Director office for building and irrigation sectors.

At the middle management level District Engineers were appointed to three districts namely Galle, Matara & Hambantota. Separate offices have been established in three districts for district engineers. These three District Engineers implement monitor and supervise all building construction activities within the province. Engineering Assistants were attached to these district offices and they served as divisional engineers, but most important feature was, they had neither separate office nor any office staff directly under control of them. They had to share the district engineer's regular staff for their works. But divisional engineers are supported with technical staff attached to them. While district engineer functioned as the administration hub of the district, divisional engineers performed as the technical hand of the district.

All the administrative works of the provincial engineering department was under control of the Director Buildings. An administrative officer was appointed in this regard. In addition an accountant and a chief architect headed the finance and architect divisions under direct supervision of provincial Director of buildings.

2.4.2. The first amendment to the provincial engineering service

The first amendment to the provincial engineering service was done on 1st of Jan 1994. Under this amendment following changes have been made.

i. Provincial engineering services was taken under direct control of the chief secretary and Deputy Chief Secretary (Engineering Services)was appointed as the head of the institution.

ii. Two provincial Directors were appointed for buildings & irrigation sectors. These posts were nominated as class I posts of Sri Lanka Engineering Service.

iii. Six Chief Engineer posts, class II/I posts in SLES, were created to help provincial Directors in their activities.

iv. A chief engineer has been appointed for Local government related construction activities.

v. A Chief Engineer has been appointed for planning & progress control works.

vi. Three district engineers were appointed for minor Irrigation works in Galle, Matara & Hambantota districts.

2.4.3. The second amendment

After 13 years functioning of the amended engineering services set up, there was a huge demand from the provincial agriculture Ministry to took over the control of Irrigation construction sector under their purview. The political authority ,the provincial Minister to the agriculture Ministry, emphasized the necessity of taking over the irrigation sector as a long lasting demand. Finally, the irrigation sector was separated from the provincial engineering service and attached to the agriculture Ministry on 01st of Jan 2007. The internal arrangements of the irrigation construction department was not altered and attached as a whole. No any other alteration has been made to the prevailing engineering structure. The amended organization structure is annexed as annexure 02.

2.4.4. Important Characteristics of present organization structure

2.4.4.1. Co-ordination

i. Deputy Chief Secretary is the sphere head of the organization and he has direct Co-ordinations with hierarchy such as Chief secretary, Provincial ministry secretaries, Deputy chief secretaries and political authority. But, one of the major set back prevailing in the present structure is lack of Directly responsible person for particular sector such as

school building and health. Even though these subjects are handled by two chief engineers as a whole they are not sector chiefs. Sector chief is a common feature who is named as director (Buildings). As such, indirect co-ordination may be created among line ministries and chief engineers.

ii. As irrigation sector is separated from the engineering organization, now less co-ordination could be seen among irrigation and building sectors. Hence less share and more waste of resources could be expected.

iii. Chief engineers are specialized for particular field of work and divisional engineers are final implementation unit. In addition there are district engineers, an intermediate post which has an equal line of command as same as the chief engineer. It may become a discrepancy in implementation of work.

iv. According to this organizational structure divisional engineers deal with contractors while district engineers deal with clients that may leads to less co-ordination.

2.4.4.2. Common Goal

The common goal of the organization can be defined as implementing development activities for the betterment of the general public in an efficient & satisfactory manner with a higher standard. All the departments & sub departments of the organization adhere to this purpose in same caliber, Even though, departments have their unique proposes to be achieved, those all are within the frame work of the common goal.

2.4.4.3. Division of Labour

i. Building sector

No separate directors have been appointed for health & school building sectors of Southern provincial engineering service. Not only at top management level but also at divisional level it has not been separated. Only chief engineers are separated for health & school buildings sectors. As such job specialization on particular product has been neglected. But functional specialization may be achieved because some functions related to construction activities entrusted with only one level. As a example, divisional engineers are entrusted with all technical matters & certification of payments, but not with any managerial works.

Similarly chief & District engineers do managerial works and no any involvements for payments.

ii. Irrigation sector

For the irrigation sector, separate Provincial Director has been appointed, who entrusted with satisfactory implementation of all minor scale irrigation activities within the province. At the middle level two chief engineers are included who do design and constructions. As such, they have ability to become veterans of the subject. In addition three district engineers are appointed for implementing irrigation works within the province. Separate divisional engineers also were appointed for the irrigation sector. Hence it can be emphasized that the irrigation sector composed of good job specialization.

iii. Division of Labour in other areas

After the reorganization, separate sector has been established for local government activities, headed by chief engineer local government and included three district engineers & a municipal engineer. In addition, a chief engineer has been appointed for planning and progress control as well. Hence perfect job specialization can be expected in this context.

2.4.4.4. Departmentalization

Departmentalization of Southern Provincial engineering service has no any unique feature. It can be considered as partially product base such as building and irrigation & partially functional base such as construction, finance, administration etc. But lack of further departmentalization cripple the main purpose. More over only the irrigation department and Local government sector has customer based departmentalization while other sectors do not have such.

2.4.4.5. Integration

In this organization structure, irrigation department has been separated from the engineering organization and function away from the Deputy Chief Secretary Engineering. As such, any integration cannot be expected from irrigation sector to achieve common

goals of the organization. Planning and progress control works are under direct supervision of the Deputy Chief Secretary(Engineering Services). As such provincial directors may have difficulties in getting this service

2.4.4.6. Span of control

In this organization structure the span of control from Deputy chief secretary to directors are 1:1 and it is considered as inappropriate proportion. Two narrow span of control may be tends to too much of supervision, increased complexity and discourage subordinate, employee autonomy. At the middle level, span of control from provincial director to chief engineers and district engineers are 1:7 a too wide ratio. It may leads to chaos because the superior may not have the time to provide necessary direction and support.

At the lower level ratio in between district engineers and divisional engineers are 3:11 that can be considered as satisfactory ratio.

2.4.4.7. Delegation of Authority

In organization structures, each managerial position is given a place in the chain of command. An unbroken line of authority that extends from the top of the organization to the lowest echelon is called as chain of command.

In this organization structure chief engineer and district engineer are placed in same managerial level. But the authorities delegated to them have significant disparities. Those are not obeyed to chain of command. In case of approving estimates, district engineers are authorized upto Rs. 1.0 million while chief engineers are authorized upto Rs. 2.0 million. It is not clearly mention whether district engineers are responsible to chief engineers pertaining to construction activities.

More over the divisional engineer has authority to approve all part payments but no any other higher level officer has particular authority. It is contradictory to delegation of authority. Because after the delegation, the delegator must have his authorities.

In case of approving estimates the divisional engineer and district engineer has the same level of authority that is up to Rs. 1.0 million which violate the norms of chain of command.

2.4.4.8. Formalization

All the rules and regulations pertaining to new organization structure are clearly defined in following circulars

i. Chief secretaries circular No: 4/3 /5 /04 and dated 01.01.1994 pertaining to reorganization.

ii. Chief secretaries circular No: 7/3/4/5(ii) dated 17/09/1998 on alteration of financial regulation.

iii. Chief secretaries circular No: 7/1/1/1 dated 26.01.2007 on procurement guidelines. Moreover, government financial regulations and establishment code provide necessary guidelines on any other relevant maters.

2.4.4.9. Transport

Vehicles available to the Engineering Department are adequate in number, but conditions of vehicles are not in to an acceptable level. Out of twenty one vehicles available, only eleven vehicles are in good running condition. Balance nine vehicles are more than fifteen years old and only two vehicles, out of this nine, are in good running condition. As such there is a severe shortage of transport facility to technical staff of the Engineering unit.

Money available for supply of fuel & maintenance of vehicles are adequate, but those are not properly utilized. All major repairs are managed by the head office while minor repairs are managed by sub offices.

2.4.4.10. New Technologies

a. Computers

There are thirty four computers available in the Engineering Services Department. Out of it, fourteen computers are equipped in sub offices. Most of the computers available are of latest models with good capacity & speed. All computers are well programmed with latest versions of programmes. Available computers are used for preparing databases & progress reports, estimates, AutoCAD drawings & to run structural design packages.

b. Photocopy Machines.

Even though heavy duty machines are not available, Engineering Department is adequately equipped in this context. There is no any complain on delay of work, due to problems related to photocopiers.

c. Using of Email

All offices are provided with Email facilities. But staff only at the head office uses this facility properly.

d. Provision & latest Equipments

USB pen drives are provided to Engineers. No any multy media or laptop computers are provided to the Engineering Department. In case of presentations they hire those from the provincial ministries or from chief secretaries office. Two digital cameras are available at the head office.

2.4.4.11. Human Resources Management

Excellent usage of Human Resources is evident in the Engineering Department. Senior staff conduct weekly meeting, review all the man power requirement and entrust intended work to the relevant officials. This greatly helps to the optimum utilization of the human resources available.

Monthly progress review meeting, a meeting to review progress of all the construction activities, is conducted in first Friday of each month.

2.4.4.12. Influences

Even though politicians and senior staff are engage with taking policy decisions, no any significant influence is evident on the staff.

2.4.4.13. Documentation

Documentation system available in the Southern Eng. Service is not up to a satisfactory standard. No uniform filing system is available. Maintaining of files, file racks or cupboards are very poor. So many complaints are available on delivery of daily mail. Most of the mail letters are late delivered or lost.

2.4.4.14 Office Arrangements

Good office arrangement was seen in the head office of the Engineering Department. Branches are properly separated with partitions, labeled and senior staff is provided with cubicles, adequate light & ventilation system is available. Similar situation could be seen at divisional level as well.

Office internal & external environment is neat and properly maintained. Recreational facilities for males as well as for females are in good manner. Condition of furniture available is good. Lack of proper store room is one of the major problems that are to be addressed by the senior staff concerned.

2.4.4.15. Technical Preferences

In case of technical issues, decisions are taken as a team of experts. Chief Engineers at head office, District Engineers, Divisional Engineers & Architects work together with a high interaction and Co-ordination to overcome technical problems arises in construction works. But lack of Quality Control Engineer adversely affects to maintain higher quality standards.

2.4.4.16. Training

Neither any overseas training facilities nor local training facilities are available for the staff. Provincial Council rarely arrange training sessions for engineers & other staff that are not adequate to full fill the training needs. In case of overseas training, no any regular

methodology is adopted to select candidates. As such unrest has been generated among Engineers on way of selecting.

2.4.4.17. Drawings & field Documents

AutoCAD packages are used to prepare Drawings. Drawings are well prepared, properly numbered & authenticated by relevant authorities. More over print quality also is up to required standards. Each & Every construction site is instructed to use a log book and daily assessment report that is monitored by the relevant Divisional Engineering Office.

2.5. Sabaragamuwa Provincial Engineering Service

2.5.1. Establishment Of Provincial Engineering Service

As per the 13th amendment to the constitution, construction works pertaining to following departments were handed over to the provincial council including its technical staff & non technical staff. By amalgamating resources received from these departments Provincial Engineering Service was established in 1990.

I. Department of Education.
II. Department of Local Government.
III. Agrarian services department.
IV. Land commissioner department.
V. Rural development department.
VI. Kachcheri – Development section.
VII. Ministry of Highways.

By utilizing resources received from these departments eight Executive Engineers divisions were established to plan & implement all the development activities within the province. Works at local authorities were not been altered, but the services provided by local Government Engineers were entrusted upon Executive Engineers at the provincial council. Provincial Director of Engineering headed the organization. The first provincial director to the organization has come from the Irrigation Department. As such, some specific features of Irrigation department, specially department rules & regulation, formats

etc were commonly use in provincial Engineering service as well. At the beginning there were no Deputy Chief Secretary (Eng) posts in the provincial council. Three Deputy Directors for building, roads and irrigation sectors functioned under the Director of Engineering. The special feature in this organization structure was the inclusion of Road Sector to the provincial engineering organization. There were separate design office & financial division under direct control of the Provincial Director of Engineering. They rendered the service to sector deputy directors & to the organization as a whole.

All roads, buildings & irrigation construction activities within the province were implemented through eight Executive Engineers divisions. Executive Engineer (SLES II/II) officer headed the division. He was entrusted with preparation of estimates, holding tender boards, monitoring of construction activities, certification of bills & maintaining good quality in construction activities. He was responsible for the satisfactory implementation of all construction activities within the division. Territory of the Executive Engineers Division was an amalgamation of territories of few Divisional secretaries divisions.

Authorities and responsibilities entrusted with the technical and managerial staff of the provincial engineering service have been revised by Chief Secretaries 02/94, 03/94, 5/94 financial circulars published in 1994. Certain limits for preparation of estimates have been introduced by 5/94 circular issued on 21st Feb 1994. The important feature in this circular was consideration of technical officers attached to Divisional Secretary Offices as stake holders of the provincial engineering services. Even though they served in the D.S offices their administrative matters were handled by the Deputy Chief Secretary Engineering. According to this circular, all the estimate approving works were vested upon executive engineers/ Divisional Secretaries/ Heads of Local government institutions and Director Engineering Services and Deputy Chief Secretary Engineering Services. In addition new limits, rules and regulations have been defined for estimate sanctioning, allocation of money, tender boards, signing of agreements, paying additional payments, evaluation boards, direct labor system and progress monitoring system by this circular. This can be treated as comprehensive circular issued on engineering matters up to that.

When the work load was grown up gradually, there were huge demand for Junior Engineers who can carryout significant work load in the vision of helping Executive Engineers. But lack of Engineers in the provincial system delayed these appointments. After new engineers were recruited by the Engineering Service Board, they were appointed to divisions in 1993 & 1994. But it has become a chaos in later part of nineties, because neither any responsibility nor authority was entrusted to additional engineers by the rules and regulations of the provincial engineers services. Similar situation has been faced by the project engineers worked under deputy directors. Works entrusted upon additional engineers were depended on the will of their superiors. Finally there was a huge demand for amending the prevailing organization structure by frustrated engineers, large in sum. In addition, remarkable delays in health and education sectors in tendering, evaluation and implementing construction activities enforced the chief secretary to accomplish new organization structure.

More over there were no any intermediate management positions in between top and bottom management levels. As such junior engineers were waiting in the queue to climb up the ladder. But, lack of senior managerial positions obstructs junior engineers to occupy higher posts of the organization. At the end of the last decade the engineering organization was in threshold of changes. After serious of discussions among the chief secretary, secretaries and engineers the first amendment to the organization structure was implemented in 01 of April 2001.

2.5.2. The first amendment to the engineering organization structure in 01st of April 2001

A comprehensive circular was issued by the chief secretary on reorganization of provincial engineering structure and the circular included all the matters pertaining to co-ordination of work ,division of labor, integration, authorities and responsibilities.The major changes carried out under this amendment were

i. Separation of departments based on process of work:The engineering organization of the provincial council was departmentalized to two major departments such that

a) Works department &

b) Research & Development department.

Sri Lanka Engineering Service class I officers were appointed as the head of the departments. All the estimates calling works, checking of estimates, tendering and evaluation works were done by the Research & Development department while contract awarding, signing of agreement and all implement works were done by the works department.

ii. Creating new posts as D.D Local Government and D.E Local government

A new post has been created to look after all local government construction and maintenance activities and it was named as DD local government. In addition, District Engineer local government post was created based on territorial disparities. District Engineer was entrusted with implementing local government activities in Kegalle district under the purview of the Deputy Director (LG).

iii. Health & school Building sectors were seperated

Two deputy directors were appointed to work on health & school building sectors separately. Accordingly, heavy work load on a single director was reduced & he could spent more time on achieving good progress of work and good quality of work in his sector.

iv. Creating new posts as chief engineers

To fill the gap in between top management & bottom management and to allow passage for Junior Engineers to acquire upper level posts these new posts were introduced. Moreover, improving quality of work with close supervision, quick solving of technical problems, improve monitoring of progress and eradicate discrepancies were other expected outcomes from Chief Engineers.

v. Creating new post as chief engineer designs.

A new post was created as CE designs to easy the work of director R & D and enhance more up liftmen in Engineering design sector. In addition, it improved the opportunities of Junior Engineers to come up the ladder.

By an amendment to this circular, bearing No CS01152 and dated 22 April 2002, Director Works authorities in signing of agreement, progress monitoring, & implementation of work were further delegated to Deputy Directors.

2.5.3. The second amendment to the Provincial Engineering Service

Circular No CS057002 Date 2004/08/18

There were serious problems on efficiency of estimating, tendering & evaluation works. Normally few months were taken to award a tender and it adversely affects the progress of work .As contractors were unable to complete the work within particular financial year, unspent money was retained in accounts at the end of the year. Even though implementation sector was responsible for the satisfactory implementation of work ,they were helpless, because initial part of the implementation process were beyond the control of works division. As such there was greater demand for product base departments rather than having process base departments.

In addition the Japanese Bank for International Co-operation (JBIC) agreed to provide assistance on rehabilitation & upgrading of provincial council roads in few provinces in mid of year 2004. One of their major condition imposed by the donors was, to have a separate road department or Authority that is totally responsible for maintenance, repair & upgrading these roads. Even though some provinces had provincial Road Development Authorities at that time, the Sabaragamuwa Provincial council does not have such. It's all the departments were integrated at the bottom management level. As the granters insisted to have a separate road department for granting the donation the Sabaragamuwa provincial council did not have any other alternative other than separating the roads department from the prevailing Engineering organization. After serious of discussions, it has been decided to manage a separate road department under the provincial Engineering

service rather than separating it and having a provincial road development authority. In this context following alterations were done to previous organization structure.

i. Director (works) & Director (Research & Development) posts were abolished and two new senior management posts were created as Director (Roads) & Director(Buildings.)

ii. Road Department has been established under Director (Roads). It comprise of one Deputy Director and two Chief Engineers who were responsible for two districts. In addition four divisions have been established to work on all road maintenance & improvement activities.

iii. Similarly building department was established under Director (Buildings). It comprised of two Deputy Directors for health & school building sectors & two Chief Engineers for two districts. In addition, four divisions have been established for Ratnapura & Kegalle districts. Minor school building construction & maintenance activities were entrusted to technical units in zonal offices under the supervision of D.D. (School works).

After 2 ½ years functioning of the revised organization structure, several weaknesses were emerged. It was identified as a unsuitable system for implementing rapid development activities within the province. Specially following short comes were encountered in the previous system.

i. As the span of control was very less in top levels, authorities & responsibilities at director & deputy director levels were over lapped. In a circumstances that total responsibility & authorities vested upon deputy directors and they are considered as the basic hub of implementing particular activities the directors role had become null & void.

ii. Span of control in mid level management also was a failure. There were two Chief Engineers for four Divisional Engineers. But most of the authorities & responsibilities were vested upon DD's & chief Engineers role has become worthless.

iii. The majour failure of this organizational structure was taken place at the bottom management level. As per this system Executive Engineer divisions were colossal and site inspection, quality control, monitoring progress was a endeavor. Executive Engineers &

the technical staff happened to travel for very longer distances for such activities vesting more time & money. This territorial controversy became a majour set back for contractors as they also happened to travel longer distances for their works get to done. This was one of the main reason for revising the organization structure.

2.5.4. Present Orgaization Structure (3 rd Ammendment)

The third amendment to the organization structure of the provincial Engineering services was done on 1 st of April 2007. Under this amendment no any changes have been made to the Deputy Chief Secretary post. But following exclusions & inclusions were done to the organization structure.

i. DD (Buildings) post was abolished and DD (School Building) post was promoted as Director School building. Director Road post was kept as it was. Hence the total Authority & responsibility for the satisfactory implementation of work was vested upon three directors of Roads, School Buildings & Other Buildings.

ii. At the middle management level two Deputy Director posts, which are common to all sectors, have been established for Kegalle & Ratnapura districts.

iii. Executive Engineers Divisions are amalgamated & reestablished on territorial basis.

ii. Two new Executive Engineers Divisions have been established.

The present organization structure is annexed as annexure 3.

2.5.5. Important features of present organization structure

2.5.5.1. Co-ordination

In this new organization structure the most important feature related to coordination is appointing of separate director for school building sector and perform a separate department of school works. Even though no any new co-ordination links were generated by this new setup other than that was prevailed with DD school works, the co-ordination gap in between Director Building and DD school buildings has been eradicated. In

addition there were huge gap of co-ordination in between Director Building and DD health buildings. With abolishing DD (health) post and empowering Director Building on this sector all these gaps have been eradicated. More over, appointing of sector directors facilitates clients, contractors and any other stake holders to conduct satisfactory co-ordination links with them.

In the previous setup less co-ordination was seen among the sector directors. Same situation could be seen in new setup as well. In addition, poor co-ordination can be seen among Sector directors and Deputy Directors . Co-ordination at top management level also may be inadequate. But there are good co-ordination between deputy chief secretary and sector directors.

Reasons for less coordination in present setup

Sector Directors deal with executive engineers directly, by passing Deputy directors

i. Less no of Deputy Directors

ii. Deputy Directors are not limited to one category. They are common to all directors. But sector directors are limited to one category. As such less co-ordination is generated.

iii. In this new organization structure no of executive engineer offices have been increased from 8 to 10. Accordingly the territory of a division has been reduced and traveling time could be minimized. As such, executive engineers gained an additional time to develop co-ordination links with stake holders. In addition, less territory cause easy access and improve co-ordination among staff members as well.

2.5.5.2. Common Goal

The common goal of the organization is implementing development activities for the betterment of the general public in an efficient and satisfactory manner with a good quality. All the departments and sub departments of the organization adhere to this

common goal. Especially clients, the beneficiaries out side the organization, grace, sustain and admire efforts make to achieve this common goals.

2.5.5.3. Division of Labour

The most important feature in this organization structure is non uniform division of labour and job specialization. The methodology applied for job specialization in top management level is entirely different from the job specialization at middle and bottom management level.

At the top level job specialization is done on product base. It is basically such as school building sector, health and other building sectors and roads, local government & minor irrigation sector. Each of these departments has its unique features. All the members within each sector engage in same activity such as estimating, tendering, progress monitoring or clerical works pertaining to that particular sector.

At the middle level job specialization is based on process and territory. All implementing works are entrusted with deputy directors at middle management level. They insignificantly involve with tendering, evaluating & sanctioning. In addition, the middle management further categorized according to territorial differentiation such as Kegalle district and Ratnpaura district.

At the bottom management level, the most exposed part of the organization, the division of labour is not based on any categorization such as function, product, process or customer but basically based on territory. Accordingly the Executive Engineer is specialized on all matters pertaining to his division. Increasing of two divisions is caused to reduce the extent of the EE divisions and increase the intensity of supervision.

2.5.5.4. Departmentalization

The special feature in this organization structure is, it does not have unique departments which flows from top management to bottom. At top management level three Directors have been appointed as heads of departments. These departments have their unique features. But when we moved to middle management level they are not within the frame

work of any of these top departments. When we moves further down. The bottom management has features common to all these top departments. As such there are no any acceptable departmentalization which spread from top management to bottom management level. Even though departments have been separately identified at top management level it has been amalgamated at the middle and the bottom.

2.5.5.5. Integration

Integration is defined as combination of different person in an organization to achieve consensual goals of it. Integration at top, middle & bottom management level of this Organization structure is analyzed below.

i. Top management

According to this organization structure, sector directors are responsible to the only one superior, the Deputy chief secretary (Engineering Services) who is class I Officer in SLES. The sector directors are not responsible to the line ministry secretaries of the provincial council. In addition the particular departments are occupied within the same premises of provincial engineering services and common resources are shared. As such, it can be seen that the integration at top management level is satisfactory.

ii. Middle level management.

At the middle management level deputy directors abide to provide their service to all sector directors and executive engineers of the provincial engineering organization. In this context, they should co-ordinate and implement all development activities of departments in relevant executive engineers divisions. They are responsible to the deputy chief secretary engineering services & sector directors. As such good integration could be seen in middle management level as well.

iii. Bottom management level:

As per this organization structure, all executive engineers are responsible to all sector directors and relevant deputy directors of the organization. All EE's division in each

district make as a cluster and took under direct supervision of the deputy director, for post awarding activities, similarly for pretender activities they are direct responsible to sector directors, in case of heavy structural design they are needed to get the assistance from DD designs, if one link of this chain elapsed then the whole system may be subjected to a failure. As such it can be decided that this system consist of satisfactory integration but should further analyses whether it has been exceed limit of integration.

2.5.5.6. Span of control

In this organization structure the span of control at top management level is 1:3, that can be considered as appropriate proportion without having to narrow or too wide span of control. At the middle management level span of control has been varied to 3:2 an abnormal ratio. It is completely other way around of the funnel concept. Considering the no of top management posts, at least six middle management positions should be adopted to maintain 1:2 ratios.

This abnormal condition increases the supervision on deputy director, discourage subordinate employee autonomy, complexity in vertical communication and help to improve abnormal communication links.

At bottom management level the span of control has been increased to 1:6 for Ratnapura district and 1:4 for Kegalle district that can be considered as appropriate ratios at bottom management level.

2.5.5.7. Delegation of Authority

As per the Chief Secretaries circular issued in this context, all the authorities and responsibilities have been clearly identified and delegated. As per the circular all Executive Engineers and Deputy Directors are responsible to the Deputy Chief Secretary (Engineering Services) the head of the institution. In chain of command all these top, middle and bottom management levels are entrusted with certain powers in estimate preparation, estimate approving, tendering, awarding, implementation and variations of works.

But one of the major setback in delegation of authorities is total delegation of authority without retaining that power with the delegater. As a example, in approving of bills the director can approve bills above 5.0M but he is not empowered to approve bills below 5.0M and that lies only with deputy director & EE's.

But as per the techniques in delegation of authority it is something like impairing knowledge that means if you share the knowledge with someone else he will acquire that knowledge while you are not loosing your knowledge too. Any how, all the delegated authorities are clearly mentioned in the circular.

2.5.5.8. Formalization

All the rules and regulations, pertaining to reformed organization structure, are mentioned in the chief secretaries circular to be issued soon on this context. In addition to this circular price escalation are subjected to formula given by the ICTAD. More over other all procurement related activities should be done as per the financial regulations issue by the sabragamuwa provincial council & recent procurement manual. More over institutional chain of work should be done as per the establishment code and circulars issued on this context.

2.5.5.9. Transport

It could be noticed that separate vehicles are provided for senior Engineers such as Directors, Deputy Directors and Chief Engineers. Executive Engineers are provided with two vehicles, but one is in good condition and the spare vehicle is in poor running condition. In most places the good vehicle is used by the Executive Engineer for his field visits. As there are more than five technical officers available in each and every office, they are compelled to use alternative transport means such as busses & bicycles. Moreover they get the help of contractors to fulfill their transport requirements.

Out of twenty one vehicles available in the Engineering Department, only four vehicles one less older than five years. There are seven vehicles, which purchased within

last ten years period. But most of the fleet comprise of vehicles that purchased before ten years period amounting fourteen nos.

At divisional level vehicles are properly maintained, but that couldn't be seen at the head office level. Total no of drivers available in the deportment is twenty four. There is no lack of drivers for vehicles. An annual fuel allocation for the department is provided trough the provincial Budget. It is distributed among all offices as per the requirement. In addition administrative charges of work estimates are also used to purchase fuel for vehicles. Similar methods adopted for vehicle repairs as well. Even though minor repairs are carried out at divisional level, all major repairs are done by the head office. Those repairs are either get done from provincial work shop or, out-sourced to private garages. Since all offices are located in a close proximity to major roads, no any common official transports is evident.

2.5.5.10. New Technologies

a) Computers

Total no of computers available in the Engineering Department is twenty eight. Out of this, eighteen computers are located in the head office while ten computers are in outstations. Each divisional office is provided with a computer. Out of this bunch of computers, only seven computers have been purchased in last two years, another eight computers have been purchased before two years and after five years. All other computers are purchased before five years, amounting thirteen. It is worth to note that computers purchased before five years are outdated and not appropriate for this kind of organizations that heavily use computer packages. Computers available in head office are used for preparing data bases, checking of estimates & bills, preparing final reports of estimates & use for design packages such as Procon etc. In addition those are highly used by Architects & Draftsmen for preparing AutoCAD drawings.

At divisional levels computers are used for preparing data bases, preparing estimates and in some instances for preparing AutoCAD drawings, only if skilled draft man is available in the office.

(b) Photocopy Machines

Only one heavy duly machine and three working condition normal machines are available in the head office. Each divisional office is provided with a photocopier. But out of ten machines at divisional level, only 4 machines are in working order. No any scarcity in papers or toner. But lack of skilled operator for the heavy duty machine is a major setback.

(c) Using of Email

Two years ago email network was provided to all sub offices and to the head office. Unfortunately the system was not used by the Engineers and was disconnected. At present only three internet connections are available at head office.

(d) Provision of Latest Equipments

No any equipment such as USB pen drive, lap top computer or digital camera is provided for the use of Engineers.

2.5.5.11 Human Resources Management

One of the major issues in Sabaragamuwa province was none conducting of a regular meeting for the senior staff in some regular interval. As per the views of most of the Engineers, that caused to prevail problems without solving. In addition, none conducting of progress reviews meetings regularly also caused to leave problems without solving.

2.5.5.12 Influences

There were ample no of complains from Engineers & other staff on higher political influences on transfers, tender activities, implementing of work, approving payment certificates & planning of work etc. In addition, moderate influences from higher officers to junior officers also evident in case of approving payment certificates.

2.5.5.13 Documentation

All files are properly numbered and maintained satisfactorily. It was noticed that ledgers are not maintained properly. There were so many complaints on loosing of letters in the mail, that has become a general problem.

2.5.5.14 Office Arrangements

At the head office of the provincial Engineering organization, office environment both internal & external is very poor. Office premises are not maintained properly. Situation is similar at divisional level as well. It could be noticed that even weeding was not done for a longer period in those offices. Especially no any painting was done to the head office for a longer period. The pathetic situation is poor state of recreational facilities that available for the staff. In addition, no enough light & ventilation is available at the head office, condition of the furniture is poor. Moreover no any proper record room or store room is available within the institution that created so many discrepancies.

2.5.5.15. Technical Preferences

In case of technical matters decisions are not taken as a team of experts. Normally all design works are done by the Design Engineers. In case of problems Design Engineers rarely make joint inspections with implementing engineers.

2.5.5.16 Training

Adequate Local training facilities are evident for Engineering & Non Engineering staff. In the other hand, overseas training facilities for Engineers are insignificant. Random nominating system is adopted for foreign trainings.

2.5.5.17 Drawings & field documents

AutoCAD package is used to prepare drawings. As such higher standard drawings could be seen. But print qualities are not up to satisfactory standard. Log books are also used at sites, but the checklist that was introduced two months ago are not properly maintained or monitored.

2.6 North Western Provincial Engineering Service

2.6.1. Establishment of Provincial Engineering Service

As per the 13 th amendment to the constitution, North – Western Provincial council was established in 1989. Simultaneously North – Western Provincial Engineering Service also was established in 1989. Similar to the other provinces, North – Western Provincial Engineering Service also a composition of several Engineering organizations. Professionals from Building Department, Highways department, Irrigation department & Education department joined provincial Engineering Service at its inception. The first director of the Provincial Engineering department was appointed from Irrigation Department. From its inception all Road, Building & Irrigation construction works of the province was done under the purview of provincial Engineering Service.

At the establishment, there were two Additional Directors under Director of Engineering. They were

01. Additional Director (Consultancy Services)
02. Additional Director (Construction).

Under the Additional Director consultancy services there were Head Quarter Engineers & Architects. All the design, estimating & tendering work was done under the supervision of Additional Director consultancy service.

Additional Director Construction was in charge for two Chief Engineer offices and eleven Divisional Engineering offices. All the construction implementation works were carried out under his supervision. Three Chief Engineers were categorized as roads, irrigation and

they guide all divisional Engineers in implementation of work. Head quarters Engineers were there to assist Chief Engineers. There was Account division, which handled all the payment works of the Engineering offices.

Chief accountant was the head of this division. Administrative officer headed the administration branch. This is one of the provincial Engineering organizations, which last more than a decade without undergoing any major changes. The most important feature in this organization structure was the non-availability of Deputy Chief Secretary as the head of the Department. Here he was considered as member of the chief secretary's carder.

2.6.2. The First Amendment to the provincial engineering service

In year 2003, a project was launched to improve provincial roads in North – Western Province under the patronage of Asian Development Bank. In this circumstance, comprehensive study was done by the ADB on organization structure of provincial Engineering service. The Donor agencies wanted to establish a separate road department to uplift design & construction capabilities of provincial authorities. The rigorous analysis they done on the Engineering organization revealed the necessity for job specialization. Accordingly, establishment of separate Engineering organization for road works were one of the conditions included in donor agreement.

When the implementing stage was taken part, there were heavy resistances from the officials for the amendments. Even though there were some officers in favor of the amendments, majority refused to accept the new organization structure. In this instance, political authorities were in favor of the amendments & finally the amendments were implemented surpassing all the resistances.
Asian Development Bank appointed a team of consultants to analyze the previous organization structure & propose suitable structure for the North Western province Provincial Engineering service.
Majour Amendments Done

01. Instead of Additional Director construction & Additional Director consultancy services, one post has been created as Additional Director. He is empowered to supervise building construction activities only.

02. All the road construction works were separated from the provincial Engineering organization and a Provincial Road Development Authority was established.

03. No. of Chief Engineers were reduced to two. Their role on the subjects were changed. As per the new organization structure, their duties are separated in to two major categories such as,

    1. Health, other departmental works and irrigation.
    2. School works and designs

04. The Architect was subjected to direct purview of the Director.

05. No of Divisions have been reduced to seven.

06. Senior Engineer (Quality control) has been subjected to direct purview of the Director Engineering service.

The amended organization structure is attached as annexure 4

2.6.3. Important Features of Present Organization structure

2.6.3.1. Co-ordination

I. As no of additional directors have been reduced to one, it become a limitation to vertical co-ordination at upper management level. Most important fraction of the organization should co-ordinate only through one path that reduces the efficiency of vertical co-ordination.

II. Improved co-ordination can be expected by having Chief Engineer for school works.

III. Each chief Engineer is having Design Engineers and head quarter Engineers under their direct supervision. This will greatly improve vertical co-ordination.

IV. Senior Engineer quality control is directly under the supervision of the Director. Hence direct vertical co-ordination in between these two levels will help to discharge unique service in quality control.

V. As all the departments are separated and work independently, there may be lack of horizontal co-ordination. The path for horizontal co-ordination is lengthy.

VI. Vertical co-ordination in between Chief Engineers & Divisional Engineers have been improved by subjecting Divisional Engineers for the direct supervision of Chief Engineers

VII. As Architect has been separated from the main stream less horizontal co-ordination can be expected.

2.6.3.2.Common Goal

The common Goal of the organization is defined as implementing development activities within the province for the betterment of the public in an efficient & effective manner in a higher caliber. Even though higher dedication can be expected from the construction departments in fulfilling this common goal, the support render by administrative, Account & Architect branches cannot be ascertained as those branches are out of the main stream.

2.6.3.3.Division of Labour

The term division of labour refers to the process of dividing the total task of an organization in to successively smaller jobs. In an Engineering organization estimating, checking of estimates, tendering, designing, contract administration & implementing can be considered as specialized jobs.

In this organization structure separate Head Quarter Engineer has been appointed for quality control, contracts & training works. He is empowered to play his role in school building, other building & irrigation sectors. Hence good job specialization can be seen in this context. In addition, separate Engineer is available only for quality control as well. Another important feature in this organization structure is all the estimates for the works above one million is prepared by the Head quarter Engineers. As such good job specialization can be expected.

2.6.3.4. Departmentalization

Once jobs are divided in to specialized parts, these need to be grouped together so that common task can be achieved. In this organization structure combination of Functional & product base departmentalization can be seen. Functional base departments in this organization are works, financial & Architectural. Meanwhile product base departments are Health & Irrigation Department & school works department. Each product base

departmentalization in works division has been further departmentalized on process basis such that works, designs, progress control etc. But, major draw back in this organization structure in departmentalization is Senior Engineer designs in school works division is entrusted with carrying out designs for Heath building sector as well.

2.6.3.5. Integration

Different functions performed by different persons in an organization need to be combined together to achieve consensual goal of the organization. In this organization structure drawing office & Architecture division is not under the purview of the Additional Director works. As the sole responsible person for implementing all works carried out within the province, he must have Drawing & Architecture divisions under his purview. More over, works branch also was established under the Director but should come under the Additional Director. Keeping the design engineering division under school works division also may generate problems. It should come under the direct purview of Additional Director for better integration. Divisional Engineers are responsible to chief Engineers in Health & school works sectors, a good aspect in integration.

2.6.3.6. Span of Control

In simple words span of control refers to the number of subordinates/ individuals a manager can effectively supervise. Here it can be seen 1:1 span of control at top management level. There is only one director & an additional director, which may leads to conflicts in top hierarchy. At middle managerial level 1:2 proportions can be seen, that is also an inappropriate proportion. By including the Architect to this periphery it can be evacuated. This organization structure is not following funnel concept. As there are common divisional Engineers features of matrix structure also can be seen.

2.6.3.7. Delegation of Authority

Authority refers to the rights inherent in managerial position to give orders and orders to be obeyed. As per the attached organization structure this authority can be clearly identified. The authority lies with top managerial positions are delegated to lower level by circulars in

government context. In case of North Western Provincial Engineering Service chief Secretaries circular No NWP/CS/2006/5 and dated 2006/03/01 has been issued in this regard. It is a more comprehensive circular which clearly define the authorities & responsibilities of each & every person of the organization.

2.6.3.8. Formalization

All rules and regulation, pertaining to the reformed organization structure are mentioned in the chief Secretaries circular No NWP/CS/2006/5 and dated 2006/03/01 .In addition, all procurement related activities are implemented according to the recent procurement manual. Establishment code & circulars issued in this context are followed in establishment aspects. Ictad guidelines are adopted for construction management.

2.6.3.9. Transport

In the North Western Council Provincial Engineering Organization all the senior staff members are allocated with on official vehicle which in some instances allowed even for their private usage. All Executive Engineers are equipped with two vehicles both are in good running condition. Generally it could be seen that all vehicles are in good running condition as well as interior condition. Most of the fleet comprise of vehicles that purchased within last ten years period.

There is neither lack of drivers nor fuel to the vehicles Executive Engineers are authorized to get all minor repairs done at divisional level. No any common official transport is available for working staff.

2.6.3.10. New Technologies

a) Computers

Total no of computers possessed by the Engineering organization is thirty eight. Apart from this, eight Computers are located in divisional offices while thirty computers are located in the head office. All these computers are recently purchased and having good

capacity & speed. All computers are fully loaded with advanced planning and designing packages such as AutoCAD, MS-Project & Popcorn etc. All the computers at the head office are networked.

b) Photocopy Machines

Two heavy duty machines and three light duty machines are available at the head office. Each divisional office is equipped with a photocopier. All those machines are in good working condition & skilled operators, toners & adequate amount of photocopy papers are available.

c) Email - Internet

Head office & all sub offices are provided with Email & Internet facilities which are used for forwarding & receiving estimates, instructions, specifications, bills etc.

d) Latest Equipments

Senior Engineers of the organization are provided with lap tops. Only one Digital Camera is available at head office for using the field works. Multy media projectors are available for demonstrations. All Engineering staff of the organization is given 2GB pen drives for their official works.

2.6.3.11. Human resources Management

Optimal usage of human resources could be seen in the North Western Engineering organization. Senior staffs of the organization gathered together to plan & review the weekly programme at every Monday morning which is helped to get the optimum utilization of human resources. Progress review meetings for all Engineers are held at first Friday of the every month and all problems, unclear situations are solved. In addition all future works of the month are planned & reviewed.

2.6.3.12. Influences

No any influences from either politicians or any other officer is evident at North-Western provincial Engineering Organization.

2.6.3.13. Documentation

It could be seen that 5-S system was adopted for all documentation works. Cupboards, file racks, files. Etc are neatly prepared and labeled. Mail is distributed quickly among officers.

2.6.3.14. Office Arrangements

Head office of the Engineering organization is located within the provincial council complex. As such no any comment can be done on external environment, but internal environment of the head office is excellent. The office is air conditioned and light is provided adequately. Cubicles and new furniture's are provided to all Engineers & other staff in fascinating manner. Recreational facilities available for the staff as well as service recipients are excellent.

2.6.3.15. Technical Preferences

Chief Engineer Structural Designs provide proper guidance to all field Engineers at Divisional level. In addition Head Quarter Engineers are guided by Directors & Deputy Directors. In addition Architects & Quality Control Engineers assist also obtained where necessary.

2.6.3.16. Training

It was revealed that foreign training exposures to Engineers are insignificant. But local training facilities for Engineers & other staff is in satisfactory level. Further it is noted that, Provincial Council do not adopt any regular methodology for nominating Engineers for foreign training.

2.6.3.17.Drawings & field Documents

AutoCAD is used to prepare structural & architectural drawings. Accordingly good quality drawings could be seen. It is worth to note that, check lists & log books for construction sites are available at each & every site.

2.7. Synthesis Of The Litreature Review

Under the literature review, all four selected Provincial Engineering Organizations were evaluated for chosen factors that affect to the Project Management efficiency of Engineering Organizations. It was found that comparable differences are available for some factors while no any differentiate could be seen among some other factors. For such factors, that are impossible to evaluate only by the literature review, the alternative is to conduct a survey research. Even though significant differentiate could be identified in some factors as mentioned above, those factors also were again subjected to the survey research for vigor's results. Factors that could be differentiated under literature review are given below.

2.7.1. Division of labour

It could be noticed that the North Western Provincial Engineering Department Shows good division of labour while southern & Sabaragamuwa provinces show poor division of labour. Comparative analysis of division of labour in selected four provinces against six fields of job specialization is given below.

Table 2.1

Job Specialization	Western	Southern	Sabaragamuwa	North Western
Design	Yes	Yes	Yes	Yes
Estimation				Yes
Tendering & contracts	Yes			Yes
Implementing	Yes	Yes	Yes	Yes
Quality Control	Yes		Yes	Yes
Progress Review				Yes

As per the afore shown table, excellent job specialization could be seen only in North Western Provincial Engineering Service. Southrn & Sabaragamuwa Provinces show very poor division of labour in all aspects considered.

2.7.2. Departmentalization

As per the results of literature review, process & functional base departmentalization was common to all Provinces, but, product base departmentalization could be seen only in Western Province. Detailed analysis in this context is given below.

Table 2.2

Department	Western	Southern	Sabaragamuwa	North Western
Health Department	Yes			
School Works Department	Yes	Yes		
Road Department	PRDA	PRDA		PRDA
Irrigaton /Local Govt. & Misselenious	Yes			
Design Department	Yes	Yes	Yes	Yes

From the commencement of the provincial council system, some provinces had their own **P**rovincial **R**oad **D**evelopment **A**uthority (PRDA) for the maintenance & rehabilitation of class C & D roads. Mean time some provinces hadn't such a system & they managed within the Provincial Engineering Department. A comparison in this context, in addition to the above table, is given below.

North Western Province - Separate PRDA has been established recently

Western - Separate PRDA is available from the beginning.

Southern - Separate PRDA is available. No any interaction with the Available Engineer Organization.

Sabaragamuwa - No PRDA, all road construction & maintenance activities are done by Executive Engineers in their divisions.

2.7.3. Span of Control

A comparison, on Span of Control at top management level in all four provinces considered, is given below.

Table 2.3

Designation	Western	Southern	Sabaragamuwa	North Western
Deputy Chief Secretary	01	01	01	01
Directors	04	01	03	01

Here it can be noted that, Span of control in Southern & North Western Provinces are too narrow & cannot be considered as acceptable.

2.7.4. Contrary In Designations

Each provincial engineering organization has its unique Ranking system. These ranking systems are analyzed as top management, middle level management and bottom level management and contrary in designations are evaluated. Normally, the general composition or chain of command of an Engineering organization is as follows.

I. Deputy Chief Secretary.

II. Director

III. Deputy Director.

IV. Assistant Director.

V. Chief Engineer/ Chief Design Engineer.Executive Engineer/ Design Engineer/ Head Quarter Engineer/ Divisional Engineer.

VI. Assistant Engineer.

Positions in North Western, Sabaragamuwa, Southern & Western, provinces are compared and following results are obtained.

Table 2.4

	North Western	Sabaragamuwa	Southern	Western
Deputy Chief Secretary	✓	✓	✓	✓
Director	✓	✓	✓	✓
Deputy Director	—	✓	—	—
Assistant Director	—	—	—	—
District Eng./Chief Eng. Design Eng.	✓	—	✓	✓
EE/DE	✓	✓	✓	✓
AE	—	—	—	—

Responsibilities lay with each & every position or designation in each province is compared & it is revealed that for the same authority & responsibility, different levels or positions at chain of command is empowered by respective province. In this context the representation to the technical sub committee, the higher level progress evaluating committee of the ministry of Education & higher Education, has been evaluated. The relevant officers, who represent technical subcommittee from each province, are as follows.

North western Province - Director Building.

Western Province - Director Building.

Southern Province - Chief Engineer (School works.)

Sabaragamuwa Province - Deputy Director (School works)

These designations are pertained to different levels in general chain of command.

2.7.5. Anomalies In Delegation Of Authorities & Responsibilities.

It could be noticed that, delegation of Authorities & responsibilities are also different from one province to another. While some provinces empowered the junior management, in the other way around some provinces empowered the top management. Accordingly there are significant contradictions in delegation of authorities.

Brief Analysis on delegation of authorities to bottom management level in each province is given below.

Table 2.5

Province	Approving of Estimates	Tendering	Approving of payments
North Western	Up to 1.0 million	Up to 0.5 million	All part payments without having any contract limit
Sabaragamuwa	Up to 2.0 million	Up to 2.0 million	All payments for Works up to 2.0 million.
Western	Up to 3.0 million	Up to 3.0 million	Up to 3.0 million
Southern	Up to 1.0 million	No any tendering Authority	All part payments without having any contract limit.

Similar disparities could be seen at middle & top management levels as well.

2.7.6 Continuous Alteration of Organization Structures

During this analysis it could be seen that, the engineering organization structures in each & every province subjected to changes during its life time in several times. Most of the changes have taken place due to changes or modifications done to organization strategy. In addition , provincial engineering organization structures have been changed due to some other external reasons. some of these reasons are listed below.

i. Unsuitable organization structures – Most of the organization structures in provincial engineering services are established without doing any scientific analysis on managerial concepts.As such, unexpected setbacks are unavoidable.

ii. Political Influences - Politicians are a crucial factor in decision making in our country. It was envisaged that, in some instances they need to do some amendments, alterations to Engineering Organizations as per their political necessities.

iii. Innovation strategy - If work implementing strategies are subjected to changes, organization structures also will be changed in par with the strategies.

Detailed analysis on alterations to Provincial Engineering Organization structures are given below.

Table 2.6

Province	Established	1st Amendment	2nd Amendment	3rd Amendment	Total
North Western	1989	2003			01
Sabaragamuwa	1990	2001	2004	2007	03
Southern	1990	1994	2007		02
Western	1989	1993	2007		02

The final outcome of the literature review can be stated as, implementation of development projects in the provinces concerned are take place in different back grounds in the Provinces concerned.

Chapter 3

Research Methodology

3.0 RESEARCH METHODOLOGY

3.1 Introduction

There are several ways In which research stratergies, research methods, and research data can be categorized. The three dimention s of research methodology as depicted in box 1.1

Research stratergies:	Case studies
	Surveys
	Action Research
	Experimental Research
Reaserch methods :	Interviews
	Questionnaires
	Observation
	Documentry Analysis
Data Types	Qualitative
	Semi quantitative
	Quantitative

Figure 3.1 Research stratergies,methods & Data Types

A researcher may use alternatives from the three dimensions in different combinations. What matter is that the research methodology is appropriate for addressing the research questions that define the focus of the research and that the methodology can be demonstrated to give acceptable validity and reliability choices of strategy, methods, and data types depend primarily on the information needs stemming from the research questions

3.2 Research Methodology

The research methodology is the core for successful out comes of a research. It denotes the systemically way of solving the research problem. In research analysis, the most appropriate science and technique should be selected with having knowledge about the logic behind the scene. As such, a quantitative research has been selected in this context.

Following figure illustrates the research methodology adopted to carryout the research.

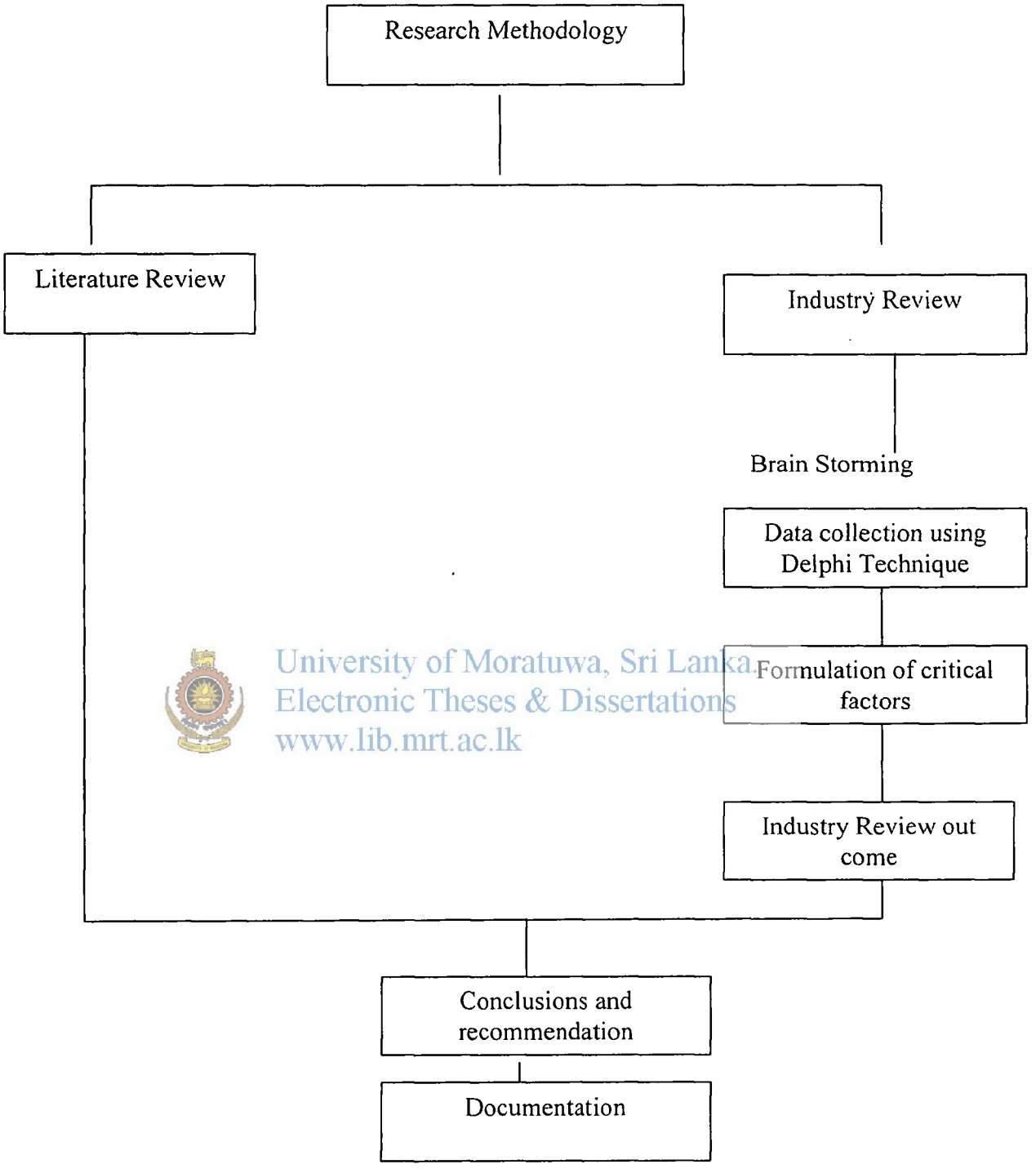

Figure 3.2 Research Methodology

The research methodology adopted for the research consists of two parts. First part of this research consists of details observed through literature review and the latter part includes an industry review. The industry research process consists of Brain storming & Delphi study to collect the data and formulate most affective factors.

3.2.1. Literature Review

The literature study was carried out by referring several sources such as books magazines, articles, circulars, progress reports in relation to the topic to gain the knowledge on factors that effect to the project management efficiency of Engineering organizations in Provincial councils. The literature review was also backed by usage of internet, to study concepts of project management/ organizational behavior.

3.2.2. Industry review

3.2.2.1 Brain Storming

Brain storming is a technique used to uncover the hidden parts of the human brain. Systematic exploration of the human brain actively discharges hidden facts and data. It is a technique of extracting, squeezing or filtering hidden or covered data in to the external environment.

3.2.2.2 The Delphi Technique

Delphi is a technique used to collect data from the industry experts. This technique has the main advantage of reliable data collection. Under this technique, selected expert panels are interviewed for several times to confirm their views on a particular aspect. For this selected panels, experience on the subject concerned is required. The notion is that well-informed individuals, calling on their insights and experience, are better equipped to predict the future than theoretical approaches or extrapolation of trends. Their responses to a series of questionnaires are anonymous, and they are provided with a summary of opinions before answering the next questionnaire. It is believed that the group will converge toward the "best" response through this consensus process. The Delphi

technique overcomes some of the weaknesses found in other forecasting methods (chan et al 2001 cited Linstone and Turoff 1975).

3.2.2.3. Method of Surveying and Sampling

The research strategy used for the industry review was survey research & the research method adopted was questionnaires that contained multiple questions under many categories. A proportionate stratified random sample was selected for this industry review. Data type was both qualitative and quantitative.

Factors that affect to the project management efficiency were identified through brainstorming. A sample of 10 personal from each province has been selected to identify basic factors under brain storming. For the Delphi round one, a sample of 120 well experienced personal from the construction industry has been selected. The purpose of the questionnaire surveys were to collect the data for formulating the most critical factors & evaluate those selected factors in provincial council context. In this circumstance, the Delphi technique was used with the Likert scaling method.

a) Brain storming

A set of industrial experts have been selected from four provinces including 10 personal from each province. The selected panel composed of Engineers, Technical Officers, Administrative Assistants & Development Assistants, who are the core personal of Engineering organizations. Brain storming was used to extract factors that effect to the project management efficiency of engineering organizations in provincial councils. To gain a more reasonable final out come, set of experts are selected equally from each province. Mean time, the significance at excellent stage also was evaluated under brain storming.

b) Delphi Round one

Factors identified through brain storming and literature survey were produced to the selected group of experts in provinces and get their views on the basis of agree or disagree.(The questionnaire is attached as annexure 5). In this context 40 personal from each province were selected that included Engineers Technical Officers, Administrative

Assistants, Development Assistants, Draftsmen, Architects and Quantity Surveyors. Participants were selected from head office and divisional offices in equally sharing basis for a more reasonable survey. The results from Delphi round one were analyzed considering the percentage of agreed factors and selected those for the next round. The percentage gain of a factor to be selected for the next round was considered as 80%.

(Concerning 80% - 20% thumb rule)

Sample size - 120

Duration - 2 weeks

c) Delphi Round Two

The second round was carried out to the same selected group. In this round the questionnaire was prepared using the selected factors of Delphi round one.(For the questionnaire pl. refer the annexure 6). The questionnaire was designed to evaluate selected factors in provincial council context and 1 to 5 likert response scale was used for ranking. After receiving the responses from the experts, the data were analyzed using statistical analyzing procedure which is described in the later chapters.

Table 3.1 Likert Response Scale

Excellent	Satisfactory	Neutral	Unsatisfactory	Poor
5	4	3	2	1

Sample size - 120

Duration - 6 weeks

3.2.3. Comparison of Factors

Factors identified through Delphi round one are the most important factors that effect to the project management efficiency of Engineering Organizations .Those identified factors must go right for the organization to achieve its goals. The advantage of comparing those

factors is, one province can comprehend their weaknesses comparing to other provinces. Hence investigations can be done to find out reasons for any set back ,formulate any strategy to overcome the set back and implement it within the organization and reanalyze the outcome to ascertain whether the drawback is completely eradicated. One-way ANOVA test and Kruskal-wallis test in SPSS software were used to analyze the data.

3.2.3.1 ANOVA Test (Analysis of variance)

Most of the test methodologies, adopted in comparison are applicable only to two independent variables (and so two groups), hence limited to testing only those hypotheses, that involved the comparison of two groups. But in this analysis comparison of four groups simultaneously is to be done. As such in order to analyze data analysis of variance (ANOVA) procedure are selected. It is a parametric test which used to determine whether there is significant variation among groups within the experiment. The Anova procedure produces an F- valve the probability of which enables the researcher to reject or fail to reject the null hypothesis that is, to conclude whether or not an independent variable has an erect on the dependent variable when the test is applied to different groups on the basis of just one variable one way Anova is used. As comparing with other parametric tests, Anova is most appropriately used when the data are interval or ratio level when groups show similar variances and when the data are normally distributed. Moreover following assumptions apply to analysis variance.

1. Normality

There is an assumption that samples are drawn from normally distributed populations. But it is not easy to check this assumption with small samples but the analysis of variance is not critically dependent upon this assumption.

2. Homogeneity of variances

The assumption that variables have equal variances, can be easily checked while using the SPSS one way Anova procedure. The SPSS has the option for calculating the levene statistic. This test is not dependent on the assumptions of normality.

3. Independence

This assumption is concerned with the measurements in the different groups. Selection of one case must not influence the any other case in anyway or be connected with another case.

4. Interval scale measure

Level of measurement are assumed at least to be least interval ie the numbers shall be truly quantitative.

If any of the above assumptions are grossly violated the Kruskal wallies test an equivalent non parametric test can be used for the analysis'

3.2.3.2 Kruskal-wallis Test

The Kruskal- wallis test is most commonly used when there is one nominal variable and one measurement variable, and the measurements variable does not meet the normality assumption of Anova. It is the non parametric analrque of a one way Anova. The Kruskal-wallis test does not make assumptions about normality like most non parametric test it is performed on ranked data so the measurement observations are converted to their ranks in the overall data set. But the loss of information involved in substituting ranks for the original valves can make this test less powerful than an Anova.

The null hypothesis applies to Kruskal-wallis test is that the samples come from populations with identical locations. It means that the mean ranks of samples from the populations are expected to be the same.

Assumptions

1. The Kruskal-wallis test does not assume that data are normally distributed, but assume that the observations in each group come from populations with the same shape of distribution.
2. Random & independent sampling is assumed.
3. Independent observations the response of the subject is not dependent on the response of previous subject.
4. These test assume the data are ordinal or higher

Chapter 4

Results & discussions

4.0 RESULTS & DISCUSSIONS

4.1 Data Analysis

In this research, brain storming was used to evaluate factors that effect to the project management efficiency of engineering organizations in provincial councils. Brain storming means using the brain to storm the problem .In brain storming, the participants should be connected with the problem directly or closely. It is based on the following four basic guide lines.

1. Generate as many ideas as possible.
2. Be creative, freewheeling, and imaginative.
3. Build upon piggy back, extend, or combine earlier ideas.
4. Withhold criticism of others ideas.

During brain storming categorization of factors was also done. More over expertise views on the selected factors were evaluated to ascertain the qualities at maximum performance level. Under the Delphi round one the agree / disagree percentage for each factor have been evaluated from selected panel and most effective factors were identified. These identified factors are tested on the same selected panel to ascertain the effectiveness of these factors on provincial council context.

4.1.1 Evaluation of Data collected in Delphi Round one:

For the Delphi round one 104 factors were identified under 16 categories. The identified factors were directed to panel of expert through a questionnaire to identify most effective factors. The agreed percentage is calculated by having number of experts agreed as a percentage of total number of experts.

$$\text{Agreed percentage} = \frac{\text{Number of experts agreed}}{\text{Total number of experts}}$$

Following table illustrates factors given and percentage of agreed experts for the particular factor.

Table No 3.2

Identified factors and agreed percentages

NO	PRINCIPLE / FACTORS.	AT EXCELLENT STAGE	AGREE %
01	**Leadership Traits**		
	At upper management level		
i.	Developing team work	Build subordinates as a team. Followers are given competence, needs & potential .Provide congenial and healthy working enviornment for his work team	100%
ii.	Representing the team	As and when required, communicate problems and grievences of subordinates to the upper management. Participate in problems solving process	100%
iii	Counselling	When subordinates face technical or emotional problems, guidence and advices are provided.	100%
iv	Managing Time	Optimum time saving, punctual, eager to complete entrusted activities on time.	100%
v	Using proper power	Exersice power and authority as per the requirement.	95%
vi	Rewarding	Effective rewarding system is carriedout to improve efficiency of workmenship.	100%
vii	Delegate Authority	Authorities are properly delegated to subordinates.	100%
viii	Group behaviour	Participation of employees in decision making is apreciated.	100%

NO	PRINCIPLE / FACTORS.	AT EXCELLENT STAGE	AGREE %
02	**Features of Organization structure**		
i	**Departmentalization**		
	a) Functional Departmentalization	Departmentalized such as finance, works, administration etc based on function of particuler department that helps to improve efficiency.	100%
	b) Product base departmentalization	Departmentalized such as health, education, roads etc	100%
	c).Process Departmentalization	Departmentalized such as architechtural, design, quality control etc	100%
ii.	**Co-ordination**		
	a). Vertical Co-ordination	Comprehensive vertical co-ordination is available from bottom level to top management level	100%
	b). Horizontal Co-ordination	Good co-ordination in between same levels. Eg. Executive Engineers, sector Directors etc.	100%
	c). Co-ordination with external Organizations	Good co-ordination is being conducted with clients, contractors and general public.	95%
	d). Informal Co-ordination	Satisfactory dioganal co-ordination (Neither extreem nor very law)	93%
iii.	**Division of Labour: (Job specialization)-**		
	i. Division of labour on product bassis	Roads, health buildings, education works are done seperatly	95%
	ii. Division of labour on process bassis	Rather than entire work is done by one individual it is broken in to steps / parts, each step is completed by separate individual. Eg. Estimating, tendering, designing etc.	96%

NO	PRINCIPLE / FACTORS.	AT EXCELLENT STAGE	AGREE %
iv	Common Goal	All the employees share to achieve common goal of the engineering organization.	100%
v	Integration	All the departments has good co-ordination and get together to achieve common organizational goals.	100%
vi	Span of contral	Top level - 1:3 Middle level - 1:4 Bottom level - 1:8 ~12	90%
vii	Delegation of authority	Unbroken line of authority from top to bottom, in this chain of command each managerial position is given a place that has degree of authority.	100%
iv	**Specific Features**		
i	Formalization	All rules and regulations have been docemented	80%
ii	Provincial road development authority	Having a PRDA considerebly effect to the to the project management efficiency	77%
iii	Engineering Departments attached to provincial Ministries	Having engineering departments in provincial ministries considerebly effect to the project management efficiency	76%
iv	Middle level managerial possitions	Project management efficiency is effected by having middle level managerial positions	70%
v	Amalgamated roads and building offices at divisional level	Road and building works are amalgamated at divisional level. Implementation of works under this enviornment effect to the project management efficiency.	75%
3	**Transport**		
i	Transport facilities available for the officers	Availability of transport facilities effect to the project management efficiency.	90%
ii	Options included to vehicles that are available for Engineers for their duties	A/C, PS & Setup is available	35%
iii	If you are provided with a office vehicle what is the condition of particular vehicle	Vehicles is good in body and running condition. The vehicle is les than 05 years old	60%
iv	Maintanance of vehicles	Vehicles are properly washed, interior is cleaned, routine checkups are done	70%
v	Methodology available for common official transport services	All the staff use common passenger services available for the office staff	35%

NO	PRINCIPLE / FACTORS.	AT EXCELLENT STAGE	AGREE %
vi	Behavior of the drivers		
	a). Reliability	Reliable in all aspects	40%
	b). Obedient	Obey to orders, respect to superiors	50%
	c). Punctuality	All ways come in time get ready in advance	75%
vii	Methodology adopted for providing fuel to vehicle	No delays can get fuel allocations easily	60%
viii	In case of minor repairs the methodology adopted is	Heads of sub offices are allowed to get minor repairs done	65%
ix	In case of major repairs the methodology adopted is	Get the repair done within a shorter period	65%
4	**Using of new technologies**		
i	As computers have become a common feature in all organizations what is your opinion about usage of computers in your	Computers are used for preparation of estimates chacking of estimates preparing progress reports, data bank linked net work of information	95%
ii	What are the conditions of available computers		
	a. Moddle, speed, capacity	Computers with over 1GHz speed 256 Ram and minimum 20 GB hard	95%
	b. Availability of accessories	Freely available	60%
	c. Quality/ usage	Branded computers not older than 5 years	60%
iii	Availability of computers to met with the demand	No que is available for computer usage. No any additional computers are needed	88%
iv	Safety precautions that has been taken for the security of the computers	All computers are well installed with latest version of Anti virous protection	40%
v	Methodologies established for repairs and replacements	Repairs and replacements are done quickly	50%
vii	Availability of relevant programmes	Auto cad, Thibus, Primavera, estimating packages BSR, HSR etc.	65%
viii	Latest equipments are provided to each and every engineer	USB, Lap top, Digital camara	85%

NO	PRINCIPLE / FACTORS.	AT EXCELLENT STAGE	AGREE %
5	**Human Resources Management**		
i	Methodology available for marking attendance	No one can make forge attendance	30%
ii	The ability to raise your problems to your superiors	Superiors are freely available ,You can easily access.	85%
iii	Way of solving administrative problems	Administrative problems are solved quickly, without any bias.	87%
iv	Having group discussions to improve quality of work	Senior staff get together regularly, to discuss matters pertaining to the beterment of the organization.	86%
v	Monthly progress review methodology	Progress of work is reviewed at divisional level first & then brought forward to provincial level.	100%
vi	Holding monthly progress review meetings	Monthly progress review meetings are held regularly ,attendance is essential ,priority is given .	100%
vii	Co-ordination among multiple levels of the channel	Superiors & Subordinates of the same channel has excellent coordination.	100%
viii	Collaboration/ Co-operation	Members of one channel has excellent coordination ,understanding with other channels.	100%
6	**Influences**		
i	Lack of influences from superiors	Subordinates are allways instructed to do the correct thing. No any influences from superiors to do favourations.	75%
ii	Lack of influences from any other officers in provincial council	No any senior officers of the provincial council influence to do favouratons.	75%
iii	Lack of influences from politicians	No any politicians of the provincial council influence to do favourations.	85%

NO	PRINCIPLE / FACTORS.	AT EXCELLENT STAGE	AGREE %
7	**Documentation**		
i	Maintaining files	Files are neatly binded, numbered, labeled and updated	60%
ii	Maintaining file Racks	Files racks and cupboards are neatly placed and numbered	40%
iii	Time taken for receiving regular mail	Mail is received to the relevent officer on the day it self .	85%
iv	Photocopies	Enough no of photocopy machines are available ,well maintained, materials & operators are available.	80%
v	Ledgers and other documents	Neatly numbered, labeled, binded & updated	45%
8	**Office arrangements**		
i	Availability of light and ventilation	Entire office space is air conditioned, Twin tube lights with difuser or CFL bulbs are provided or natural air & natural light is provided.	75%
ii	Office external environment	Neatly landscaped, trees are grown ,flower plants are grown, atrificial springs ,ponds are erected,well painted & paved.	60%
iii	Office internal environment	Neatly arrenged,neatly painted, properly wired, floor is tiled or carpetted, Flower pots are provided.	80%
iv	Separation of branches(Head office only)	Branches are well seperated with easy access .	56%
v	Availability of vehicle parking space	All official vehicles are allocated with covered parking space. Separate parking spaces are provided for workers vehicles & motor cycles.Separate parking space is available for visitors as well.	40%
vi	Recreational Facilities	Sufficient no of toilets & bathrooms are available for the office staff & service receivers.Those are well maintained.	65%

NO	PRINCIPLE / FACTORS.	AT EXCELLENT STAGE	AGREE %
vi	Access Roads	Access Roads are tarred & well maintained.Stairways & foot paths are properly maintained & free of weeding	45%
vii	Condition of recreational facilities	Having adequate no of toilets which are well maintained.Continious water supply is available.	80%
viii	Availability and condition of furniture	Adequate no of modern tables & chairs are provided	66%
ix	Dinning space	Separate dining space is provided for office staff.	34%
x	Separate conference room facilities	Separate conference room is avilable.	65%
xi	Record room	Record room with enough space & good security is avilable.	56%
xii	Store room	Store room with enough space & good security is avilable.	60%
9	**Technical Preference:**		
i	Support rendered by the design branch in case of field work	Interestingly attend for design work. Designs are provided quickly.	76%
ii	Support of the laboratory	Interestingly attend for testing work. Impartial test reports are given.	65%
iii	Involvement of key decision makers	In case of technical problems ,decitions are taken as a team of experts.	86%

NO	PRINCIPLE / FACTORS.	AT EXCELLENT STAGE	AGREE %
10	**Training**		
i	Availability of local training facilities (short term)	Continious carrier development programmes are conducted in each & every year.At least one programme per person per year.	91%
ii	Availability of overseas training facilities for	At least one overseas training for five years working.	74%
iii	Facilities provided by the PC for training needs	All categories are considered	66%
11	**Estimates**		
	At Divisional Level		
i	Quality	Estimates are computerised	65%
ii	Accuracy	Estimates are computerised	70%
iii	Speed	Use computer programmes for preparing and chacking of estimate	79%
iv	Type of sending Pst. Fax/ email/ internet	Use all medias	76%
	At Provincial Level		
i	Quality	Estimates are computerised	65%
ii	Accuracy	Estimates are computerised	70%
iii	Speed	Use computer programmes for preparing and chacking of estimate	78%
iv	Type of sending Pst. Fax/ email/ internet	Use all medias	77%
12	**Agreements**		
i	Agreement used for minor constructions	ICTAD standards are used, nicely printed and binded	70%
ii	Agreement used for major construction	ICTAD standards are used, nicely printed and binded	70%
13	**Tendering & evaluation:**		
i	Way of publishing minor tenders	Tender notice is sent in advance under registered post , to at least five government offices for publishing local tenders.No any influences to qualified bidders.	35%

NO	PRINCIPLE / FACTORS.	AT EXCELLENT STAGE	AGREE %
ii	Way of publishing major tenders	Tender notice is published in news papers.Tender documents are freely available .No any influences to qualified bidders.	38%
iii	Forms used for opening of tenders	Standard forms are used	40%
iv	Forms used for evaluation purposes.	Standard forms are used	45%
14	**Drawings & Other related documents:**		
i	Quality of drawings	Use Auto cad for preparing drawings.Drawings are with less errors,checked & approved.	95%
ii	Prints	Prints are clear. Size & quality are excellent.Blue prints, photocopies, computer printouts are used.	78%
iii	Log books used at sites	Log books are available at each & every site	35%
iv	Check lists used at sites	Check list is obtained before concreting	60%
15	**Progress Reports**		
i	Progress reports prepared at divisional level	Computer programmes are used. Updated daily.Standard formats are used	70%
ii	Progress reports prepared at provincial level	Computer programmes are used. Updated daily.Standard formats are used.	75%
16	**Bills:**		
i	Forms used for measurement sheets	Standard forms are used	60%
ii	Forms used as billing sheets	Standard forms are used	60%

By using simple 80% -20% rule of thumb collected data are evaluated in the first Delphi round. Factors that gained 80% or above agreed percentage were selected for the Delphi round two. Following table illustrates the factors selected for the Delphi round two.

Table no 3.3

Factors Selected for Delphy Round Two

NO	PRINCIPLE / FACTORS.	AT EXCELLENT STAGE	AGREE %
01	**Leadership Traits**		
	At upper management level		
i.	Developing team work	Build subordinates as a team. Followers are given competence, needs & potential .Provide congenial and healthy working enviornment for his work team	100%
ii.	Representing the team	As and when required, communicate problems and grievences of subordinates to the upper management. Participate in problems solving process	100%
iii	Counselling	When subordinates face technical or emotional problems, guidence and advices are provided.	100%
iv	Managing Time	Optimum time saving, punctual, eager to complete entrusted activities on time.	100%
v	Using proper power	Exerside power and authority as per the requirement.	95%
vi	Rewarding	Effective rewarding system is carriedout to improve efficiency of workmenship.	100%
vii	Delegate Authority	Authorities are properly delegated to subordinates.	100%
viii	Group behaviour	Participation of employees in decision making is apreciated.	100%
02	**Features of Organization structure**		
i	**Departmentalization**		
	a) Functional Departmentalization	Departmentalized such as finance, works, administration etc based on function of particuler department that helps to improve efficiency.	100%
	b) Product base departmentalization	Departmentalized such as health, education, roads etc	100%

NO	PRINCIPLE / FACTORS.	AT EXCELLENT STAGE	AGREE %
	c).Process Departmentalization	Departmentalized such as architechtural, design, quality control etc	100%
ii.	**Co-ordination**		
	a). Vertical Co-ordination	Comprehensive vertical co-ordination is available from bottom level to top management level	100%
	b). Horizontal Co-ordination	Good co-ordination in between same levels. Eg. Executive Engineers, sector Directors etc.	100%
	c). Co-ordination with external Organizations	Good co-ordination is being conducted with clients, contractors and general public.	95%
	d). Informal Co-ordination	Satisfactory dioganal co-ordination (Neither extreem nor very law)	93%
iii.	**Division of Labour: (Job specialization)-**		
	i. Division of labour on product bassis	Roads, health buildings, education works are done seperatly	95%
	ii. Division of labour on process bassis	Rather than entire work is done by one individual it is broken in to steps / parts, each step is completed by separate individual. Eg. Estimating, tendering, designing etc.	96%
iv	Common Goal	All the employees share to achieve common goal of the engineering organization.	100%
v	Integration	All the departments has good co-ordination and get together to achieve common organizational goals.	100%
vi	Span of contral	Top level - 1:3 Middle level - 1:4 Bottom level - 1:8 ~12	90%
vii	Delegation of authority	Unbroken line of authority from top to bottom, in this chain of command each managerial position is given a place that has degree of authority.	100%
iv	**Specific Features**		
i	Formalization	All rules & regulations have been documented	80%

NO	PRINCIPLE / FACTORS.	AT EXCELLENT STAGE	AGREE %
3	**Transport**		
i	Transport facilities available for the officers	Availability of transport facilities effect to the project management efficiency.	90%
4	**Using of new technologies**		
i	As computers have become a common feature in all organizations what is your opinion about usage of computers in your	Computers are used for preparation of estimates chacking of estimates preparing progress reports, data bank linked net work of information	95%
ii	Condition of available computers. Moddle, speed, capacity	Computers with over 1GHz speed 256 Ram and minimum 20 GB hard	95%
iii	Availability of computers to met with the demand	No que is available for computer usage. No any additional computers are needed	88%
iv	Latest Equipments are provided to each & every Engineer	USB, Lap top, Digital Camera	85%
5	**Human Resources Management**		
i	The ability to raise your problems to your superiors	Superiors are freely available ,You can easily access.	85%
ii	Way of solving administrative problems	Administrative problems are solved quickly, without any bias.	87%
iii	Having group discussions to improve quality of work	Senior staff get together regularly, to discuss matters pertaining to the beterment of the organization.	86%
iv	Monthly progress review methodology	Progress of work is reviewed at divisional level first & then brought forward to provincial level.	100%
v	Holding monthly progress review meetings	Monthly progress review meetings are held regularly ,attendance is essential ,priority is given .	100%
vi	Co-ordination among multiple levels of the channel	Superiors & Subordinates of the same channel has excellent coordination.	100%

NO	PRINCIPLE / FACTORS.	AT EXCELLENT STAGE	AGREE %
vii	Collaboration/ Co-operation	Members of one channel has excellent coordination ,understanding with other channels.	100%
6	**Influences**		
i	Lack of influences from politicians	No any politicians of the provincial council influence to do favourations.	85%
7	**Documentation**		
i	Time taken for receiving regular mail	Mail is received to the relevent officer on the day it self .	85%
ii	Photocopies	Enough no of photocopy machines are available ,well maintained, materials & operators are available.	80%
8	**Office Arrengement**		
iii	Office internal environment	Neatly arrenged,neatly painted, properly wired, floor is tiled or carpetted, Flower pots are provided.	80%
vii	Condition of recreational facilities	Having adequate no of toilets which are well maintained.Continious water supply is available.	80%
9	**Technical Preferences**		
i	Involvement of key decision makers	In case of technical problems ,decitions are taken as a team of experts.	86%
10	**Training**		
i	Availability of local training facilities (short term)	Continious carrier development programmes are conducted in each & every year.At least one programme per person per year.	91%
14	**Drawings & Other related documents:**		
i	Quality of drawings	Use Auto cad for preparing drawings.Drawings are with less errors,checked & approved.	95%

4.1.2. Evaluation of data collected in Delphi round two

The 54 factors identified through Delphi round one were assessed using 1-5 scaled Questionnaire survey. (For the Questionnaire refer Appendix 3.)SPSS software was used to evaluate the data that collected through Delphi round two. For the Questions no 1, 2,3,4,5,6,7,8 & 11 the one Way ANOVA test was done as those questions meet with the requirements of the One Way ANOVA test. .As Question no 9 &10 do not meet with the Requirements of parametric test One way ANOVA, the Kruskal wallis test , the non parametric equivalent to it, was done.

4.2. Results

In this analysis it could be found that only three factors namely transport, documentation and training, out of the 11 factors considered, have been converged to similar groups. All other factors show higher statistical difference in between groups. (Pl refers to the table no 4.1 given below).

Table 4.1

No	Category	Test	F	Asymp.Sig	Results
1	Leadership Traits	ANOVA	183.595		Statistical higher difference among groups
2	Organization Structure	ANOVA	45.761		Statistical higher difference among groups
3	Transport	ANOVA	10.163		No statistical higher difference among groups
4	Using of New Technologies	ANOVA	94.777		Statistical higher difference among groups
5	Human Resources Management	ANOVA	235.317		Statistical higher difference among groups
6	Influences	ANOVA	167.893		Statistical higher difference among groups
7	Documentation	ANOVA	8.778		No statistical higher difference among groups
8	Office Environment	ANOVA	99.155		Statistical higher difference among groups
9	Technical Preferences	KW		0.03	Samples are from different populations
10	Training	KW		0.134	Samples are from identical populations
11	Drawings	ANOVA	114.783		Statistical higher difference among groups

4.3 Discussions

4.3.1. Leadership Traits

Leadership traits of the top management of the each province were evaluated under eight categories. Respondent's views have been accumulated under Q No 01 and analyzed using SPSS soft ware. Results of the test is annexed as annexure No 7.

As per the test results, it could be seen that the standard deviation within each group is shown approx similar valves. It can be considered that, situation over each province is uniform in leadership traits. Mean value of the Sabaragamuwa Province & North Western Provinces are considerably deviate from the overall mean value that has greater effect on sum of squares between groups. Hence higher mean square could be seen in between groups. As per the results obtained from One Way ANOVA test, large F ratio with a probability less than 0.05 could be seen, that termed statistically higher difference in between groups in leadership traits.

A **post hoc test** was done with **least Significant difference** (LSD), to compare means of each group with other three groups. From this LSD analysis it can be seen that Western & Southern Provinces have significantly higher leadership traits than Sabaragamuwa Province, but low leadership traits than North Western Province. North western province has shown the highest leadership traits than any other province concerned. Significant levels ($P<0.05$) show that each group is significantly different from any other group concerned.

4.3.2 Organization Structure

Organization structure of each province was evaluated under 8 categories. This included 14 questions that open for participants to express their views. All the responses were compiled to Q no 2 & analyzed using SPSS software. Result of the test is annexed as annexure No 8.

As per the test results, significant difference in standard deviation could be seen within groups. Specially Sabaragamuwa Province shows less deviation than other Provinces. Hence it can be stated that, situation applied over the entire province of Sabaragamuwa, over the characteristics of organization structure, is confined to similar figure, while other provinces shows significant variation within its entity . Mean values of Sabaragamuwa & Southern Provinces are considerably lower than the mean values of Western & North Western provinces. Hence higher value of mean square could be seen between groups. This result tends to higher value of F ratio in the One Way ANOVA test. Large F ratio with a probability of less than 0.05 termed statistically higher difference in between groups, in organization structure related aspect.

The post hoc test with LSD revealed that Western & North Western provinces have not shown significant difference in organization structure aspects. As per the results North Western province and western province shows considerable different from Sabaragamuwa and Southern provinces. Sabaragamuwa province shows the poorest aspects in organization structure while north western province achieves the requirement.

4.3.3. Transport

As per the brain storming and Delphy round one, transport aspects also were selected as one of the factor that effect to the project management efficiency of Engineering Organization in Provincial Councils. But, only one factor, that related to transport, has been selected for the Delphy round two. Data was evaluated using One way Anova test as the sample size is more than 30 and meet with the requirements of the particular test. Result of the test is annexed as annexure No 9.

As per the test results, it could be seen that the standard deviation of Western, Southern and North western Provinces are high & similar while Sabaragamuwa Province shows a considerably low value. That makes evidences that the transport facilities in Sabaragamuwa Province are confined to average level all over the area within the province. In addition, mean value of Sabaragamuwa Province considerably lower than the mean value of Western and North Western Provinces. As per the results of One Way

Anowa test, large F ratio with significance level less than 0.05 could be seen that termed statistically higher difference in between groups in transport aspects.

Post hoc test was done to compare means of each group with other three groups. By the **LSD** analysis, it could be seen that Sabaragamuwa Province shows significant different to all other three provinces with low transport level. Southern and North Western Provinces have higher transport level and insignificant difference to each other in transport aspects. Southern Province has significant difference to Sabaragamuwa and North Western Provinces but similar level to Western Province. North western Province has enhanced best transport capabilities.

4.3.4. Using of New Technologies

Using of New Technologies to enhance better project management efficiency was evaluated under four categories. Respondent's views on this context have been evaluated and summarized as Q No.04 One Way ANOVA test in SPSS software was used to evaluate the result. Test results are annexed as annexure No. 10.

As per the test results, highest standard deviation could be seen in the Western Province. But, comparatively low standard deviation could be seen within each group. It reveals that the situation over each province is uniform in context of new technologies. Mean values of each province has not much been deviated from the overall mean value, resulting low mean square between groups. But higher F ratio could be seen with significant level less that 0.05 that termed statistically higher deference in between groups.

The results of **Post Hoc** test with lest significant difference (**LSD**)is shown in annexure 4. From this LSD analysis it could be seen that Western, Southern and North Western Provinces have significantly higher usage of new technologies than the Sabaragamuwa Province. North western province has shown highest usage of technologies than any other province. Evaluated significant level ($P<0.05$) shows that all groups are significantly different from each other.

4.3.5. Human Resources Management

Human resources management concepts and methodologies of the selected four provinces were evaluated according to the expressed views. Seven questions were included under Q No. 05 in this context. Respondent's views have been analyzed using SPSS software and One Way ANOVA test. Results of the test are annexed as annexure No. 11. As per the test results Western Province has shown a considerably higher standard deviation while other provinces have shown a comparatively low std. deviation. This reveals that the human resources management within Western Province shows drastically variation within its periphery.

Mean value of the Sabaragamuwa Province and North Western Provinces are considerably deviated from the overall mean valve that has great effect on sum of squares between groups. As such higher mean square could be seen in between groups. As per the results obtained from One Way ANOVA test, large F ratio with a probability less than 0.05 could be seen. It revealed statistically higher deference in between groups in human resource management.

As per the results of post hoc test, that has been done using LSD method, all the means shows significance difference ($P<0.05$) to each other province. North Western, Southern and Western Province shows higher value in human resource management than the Sabaragamuwa Province. North Western Province shows the highest human resource management capability than any other province.

4.3.6. Influence

By this question, influences of politicians on Provincial Engineering Organizations have been evaluated. One Way ANOVA test in SPSS software has been used to analyze the collected data. Results of the test are annexed as annexture No 12

As per the test results, standard deviation in Western Province ,on the selected aspect, has shown a considerable variation. It means that the situation all over the province is not uniform. But in the other hand, in all other provinces situation is uniform. Less mean in Sabaragamuwa Province reveal high influences from politicians while very high means in southern and North western province reveal very low influences from politicians. In descriptive analyze no any single observation of other provinces has fallen in satisfactory category while all observations in north western province is in satisfactory category. More over higher F ratio with less significant level ($P<0.05$) termed statistically higher difference in between groups.

The post hoc test was done with least significance difference (**LSD**) to compare means of each group with other three groups. From this LSD analysis, it can be seen that western, southern and north western provinces have significantly low influences than the Sabaragamuwa province. North western province has shown the lowest influences from politicians. Evaluated significant levels ($P<0.05$) revealed that each group is significantly different from any other group.

4.3.7. Documentation

Only two selected features were evaluated under documentation. Respondents views on those aspects were accumulated under Q No 7 and analyzed using One Way Anova test in SPSS software. Results of the test are annexed as annexure No. 13.

As per the test results, comparatively low standard deviation could be seen only in the southern province. But, as a whole, uniform standard all over each province can be expected. Hence, less value in mean square could be seen within groups. There is no much deviation of provincial means to the total mean value. Hence less value in mean square could be seen between groups. But, finally large F ratio with a significant level less than 0.05 could be seen, that termed statistically higher difference in between groups in documentation.

The post hoc test was done of with least significant difference (**LSD**) to compare means of each group with other three groups' Sabaragamuwa and North western provinces have

higher documentation levels than Western and Southern provinces. Western province shows lowest documentation level while North western province shows the highest. Evaluated significant levels show that no significant difference in between Sabaragamuwa and North western and in between Southern and Western province.

4.3.8. Office environment

Office environment also has been selected as a major factor that effect to the project management efficiency of engineering organizations in provincial councils. The particular property was evaluated under two categories and summated as Q No 8. One Way Anova test in SPSS software was used to analyze the data collected. Test results are annexed as annexure No 14.

As per the test results, low standard deviation could be seen in North western province. Accordingly situation over the entire province with respect to office environment may have more uniformity. As per the descriptive statistics North western province shows higher level of favorable replies. Higher mean difference of Sabaragamuwa Province was a reason for higher mean square value between groups. Accordingly large F ratio with low significant level ($P<0.05$) could be seen, that termed statistically higher difference in between groups.

Post hoc test was done with least significance difference (**LSD**) to compare means of each group with remaining three groups. From this LSD analysis it could be seen that the office environment in Sabaragamuwa Province is in very low level. In the other hand North western province has very high caliber in office environment. There is no significant difference in between western and Southern Provinces ($P>0.05$) in the particular aspect. Except western to southern, all other inter provinces relationships have shown significant difference.

4.3.9. Technical Preferences

Involvement of key decision markers in case of technical problems are evaluated under the question No 09. As the normal distribution is not evident, a non parametric test, the Kruskal wallis test, was used to analyze data by using SPSS software. Result of the test is annexed as annexure No 15.

Following null hypothesis are tested by Kruskal wallis test

Ho – the samples come from identical population

Ha - the samples come from different population

In this analysis we could observe that the right tail probability (asymp. Sig) is lower than the 0.05 significant value. As such Ho is rejected and Ha is accepted. Accordingly it can be decided that each group have different populations.

4.3.10.Training

Availability of short term local training facility to all the staff have been analyzed under this category. As the normal distribution is not evident, a non parametric test, the Kruskal wallis test, was used to analyze the data with the help of SPSS software. Result of the test is annexed as annexure No 16. Same null hypothesis as Q No 09 was tested in this aspect as well.

In this analysis it could be seen that the right tail probability (asymp. sig) is higher than the 0.05 significant value. As such Ha is rejected and Ho is accepted. Accordingly it can be concluded that the groups are form identical populations.

4.3.11.Drawings

Quality of drawings, used in constructions purposes, also have been selected as one of the factor that effect to the project management efficiency of Engineering Organizations. One

Way ANOVA test in SPSS software was used to evaluate the data. Result of the test is annexed as annexure. 17.

As per the test results, comparatively high standard deviation could be seen only for the Sabaragamuwa Province. Dispersion in western southern and north western provinces are comparatively low. According to the descriptive statistics, views of North western Province confined only to satisfactory level. As per the test result of ANOVA, large F value with low significant value(0.000)could be seen. It terms significant difference in between groups.

As per the test result of post hoc test with least significant difference (**LSD**), Sabaragamuwa Province has no much difference with respect to Western province (P=0.714). Similarly, Southern province hasn't much difference with respect to North western province (P=0.855). But Sabaragamuwa and western provinces have significant difference to Southern & North western provinces.

Chapter 5

Conclusions & Recommendations

5.0 CONCLUTIONS & RECOMMENDATIONS

5.1. Conclusions

Even though provincial councils were established as a solution to ethnic problem in Sri Lanka, it was unable to achieve its main targets significantly even after two decades of establishment. At present this system has become an inevitable factor in implementing development activities in Sri Lanka. More than 70% of the development activities of the provinces are implemented through Provincial Councils. Unfortunately, only one comparison on Engineering Organizations of Provincial Councils was done for this longer period. More over, there were no any evidence of implementing recommendations of the analysis.

With the elapse of time provincial Engineering Organizations have become isolated entities, which do not have any inter province relationships. They adopted their own ways & methods in implementing development activities. As such, systems, rules, regulations & methodologies adopted are limited to the particular province. Until this research has been carried out, no any scientific comparison has been done on Engineering Organizations in provincial councils. In this analysis organization structure of the four provinces were thoroughly analyzed and their weaknesses were found. In addition significant differences in between Provincial Engineering Organizations have been found on selected dactors. In this context, eleven major factors, which are extracted by Delphi Technique, have been selected for the final round of evaluation that has grater effect on project management efficiency of Engineering Organizations. These major factors included 42 sub factors that covered vast area in this context.

As per the test results, it can be concluded that, implementing projects in provinces took part in entirely different backgrounds, which may tend to create abnormalities in final out come. More over strengths and weaknesses of each and every factor of the aforesaid categories can be evaluated for any of the provincial engineering organization.

Accordingly relevant provincial authorities can pay special attention in this regard; to identify the reasons for such drawbacks and to introduce any mitigate measures. By analyzing the results of this analysis, provincial engineering authorities can ascertain their position in the arena of civil engineering field.

Even though the island is comprised of nine provinces, only four provinces were selected for this research. If there were possibility to do the research in all these nine provinces more general and more important findings could be done. Further more, this analysis excluded the staff of Provincial Road Development Authorities. This was mainly due to non availability of PRDA in some provinces.

5.2.Recommendations

01. As it was discussed earlier, this research has limited to four provinces only. But, a comprehensive research should be done on the same aspects covering all these nine provinces. Findings of such a research will be exclusively important for the improvements of Provincial Engineering Organizations. By this research comprehensive study was done about the evolvement of engineering organization in four provinces. This can be extended to all provinces, as it will be important for future purposes.

02. By this research, weaknesses as well as strengths of Engineering Organizations have been evaluated for selected most important factors. Further studies should be carried out to micro level to analyze these weaknesses, to identify shortfalls and to make suitable remedial actions. Similarly factors affecting to enhance strengths should be analyzed and such factors should be promoted in provinces which show poor performance.

03. One of the major drawbacks found in this research was lack of proper co-ordination among Provincial Engineering Organizations. Therefore methodologies, practices, rules & regulations adopted in one province are not known to other provinces. When some practice implement in a province, correction measures to be adopted are found. But, when the same practice adopt in some other province in latter period, they

adopt the original practice, even though there is a possibility of having corrected practices. The reason is lack of co-ordination. It is obvious that, some uniformity can be attained among Engineering Organizations by improving co-ordination.

04. Standards used by Provincial Engineering Organizations pertaining to some factor also shown significant differences. When some provinces use modern technologies, management concepts, modern facilities.... etc, some provinces adopt dilapidated procedures, technologies, concepts ...etc. Hence, lots of anomalies were seen. Lack of similar standards will be greatly affected to the project management efficiency of Engineering Organizations. As such, special concern should be paid over this issue, to enhance equal standards among all Provincial Engineering Organizations.

5.3. Further Research

Improving project management efficiency of engineering organizations is one of the most important aspects of the Provincial Authorities. To acquire this important target, analyzing the behavior of factors identified is very important. Accordingly further research can be done to analyze the effect of these factors on the project management efficiency of Engineering Organizations in each province.

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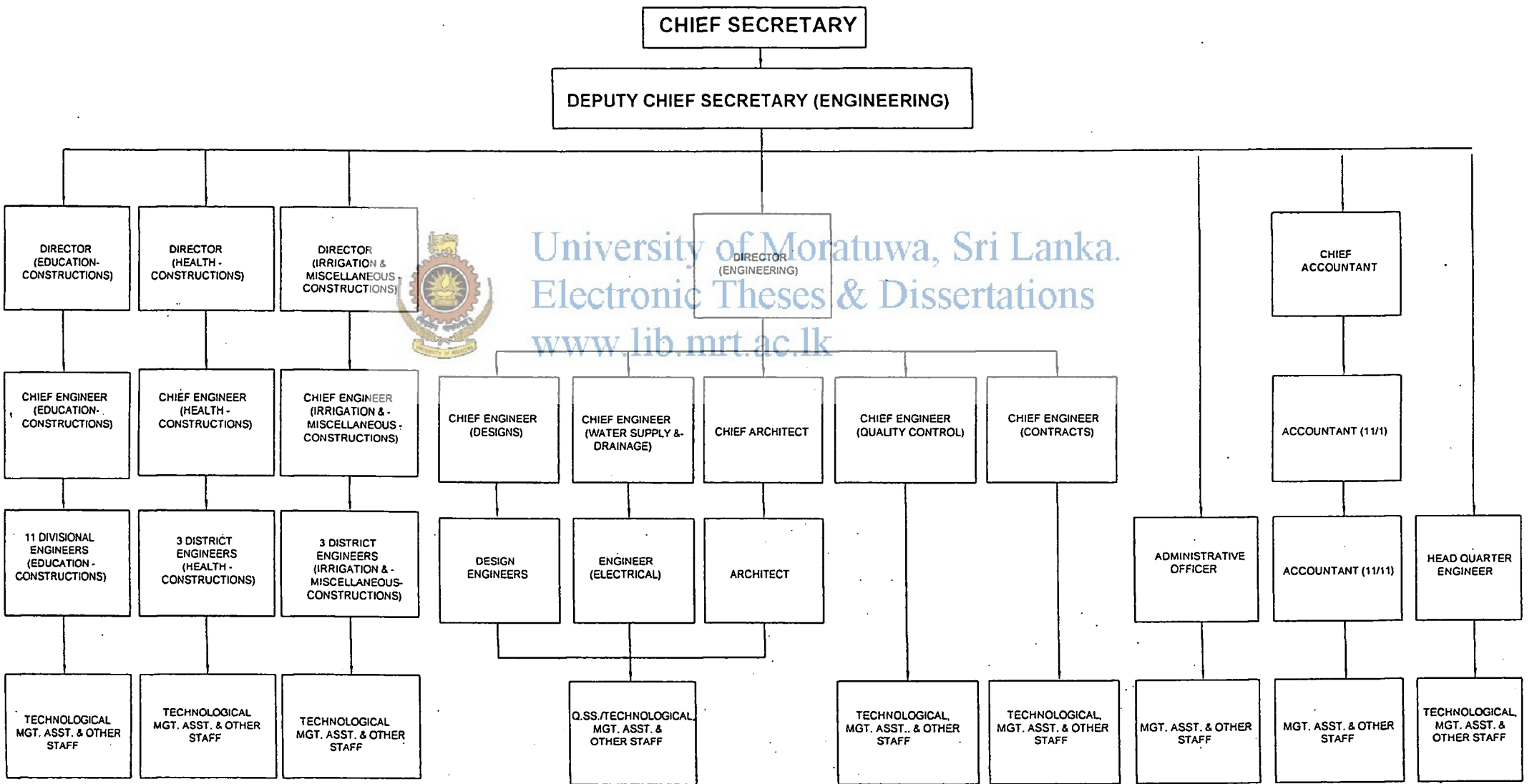
Annexures

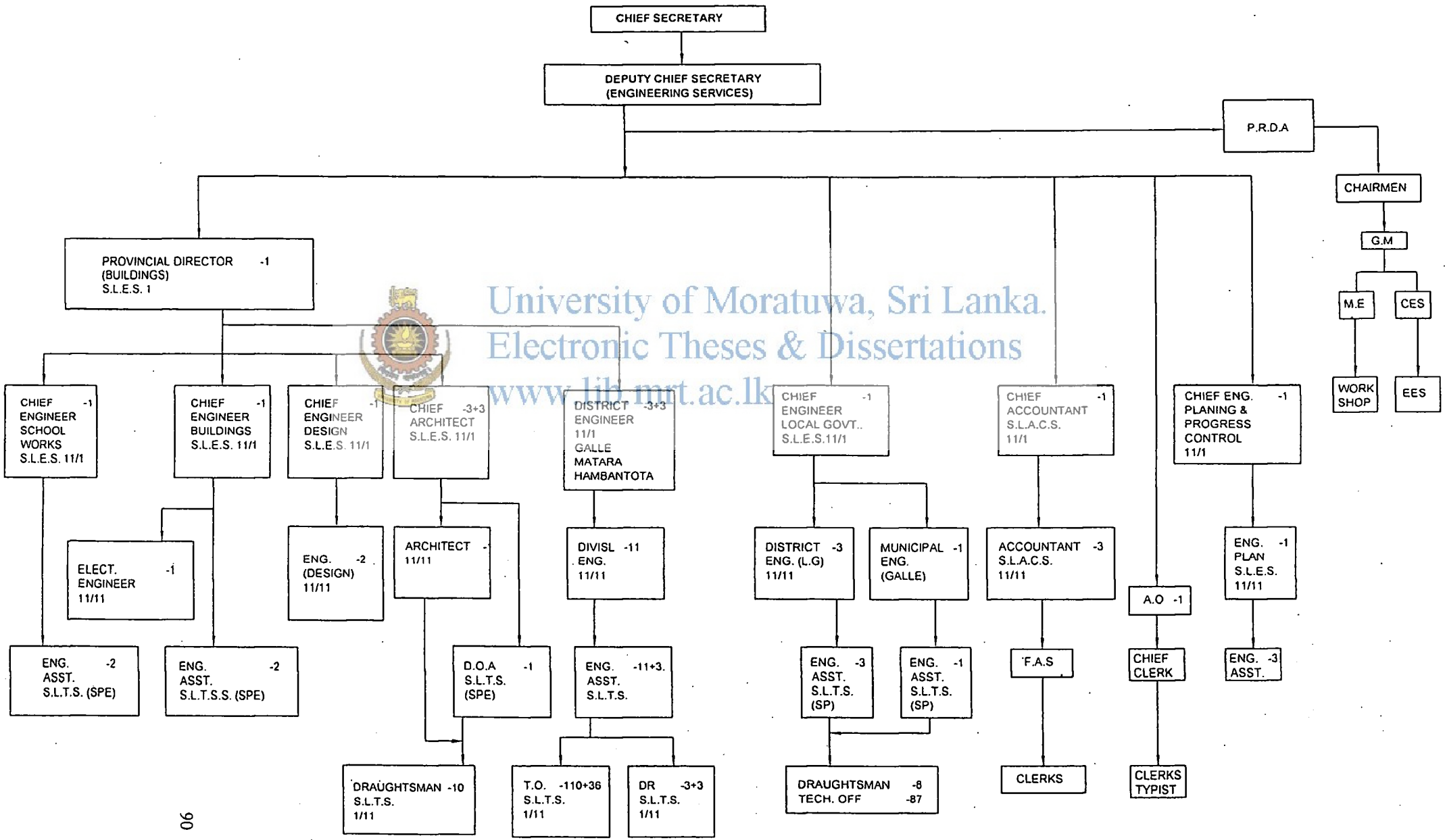
Annexure 1

ORGANIZATION CHART OF WESTERN PROVINCIAL COUNCIL ENGINEERING ORGANIZATION



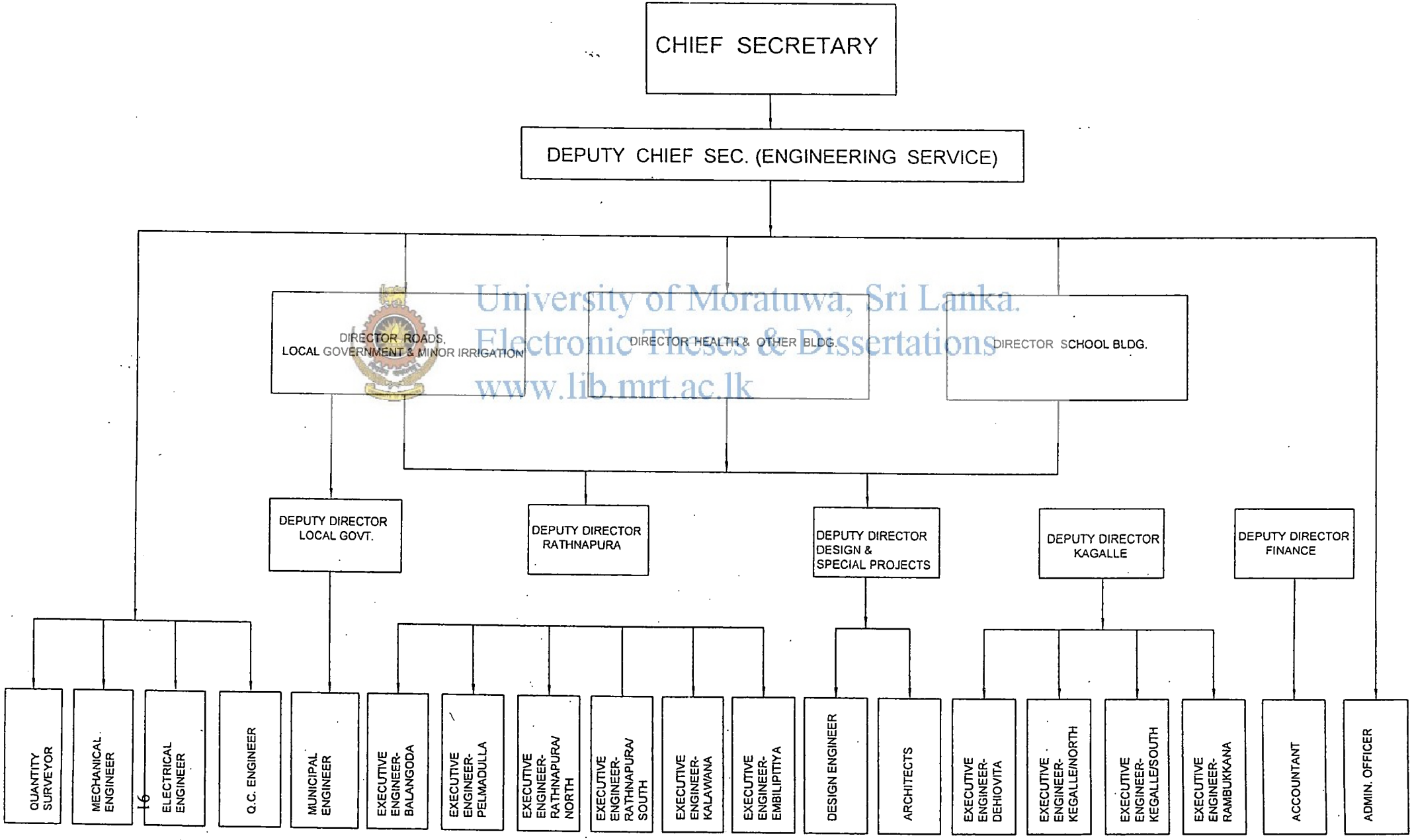
Annexure 2

ORGANIZATION CHART OF
SOUTHERN PROVINCIAL COUNCIL ENGINEERING ORGANIZATION



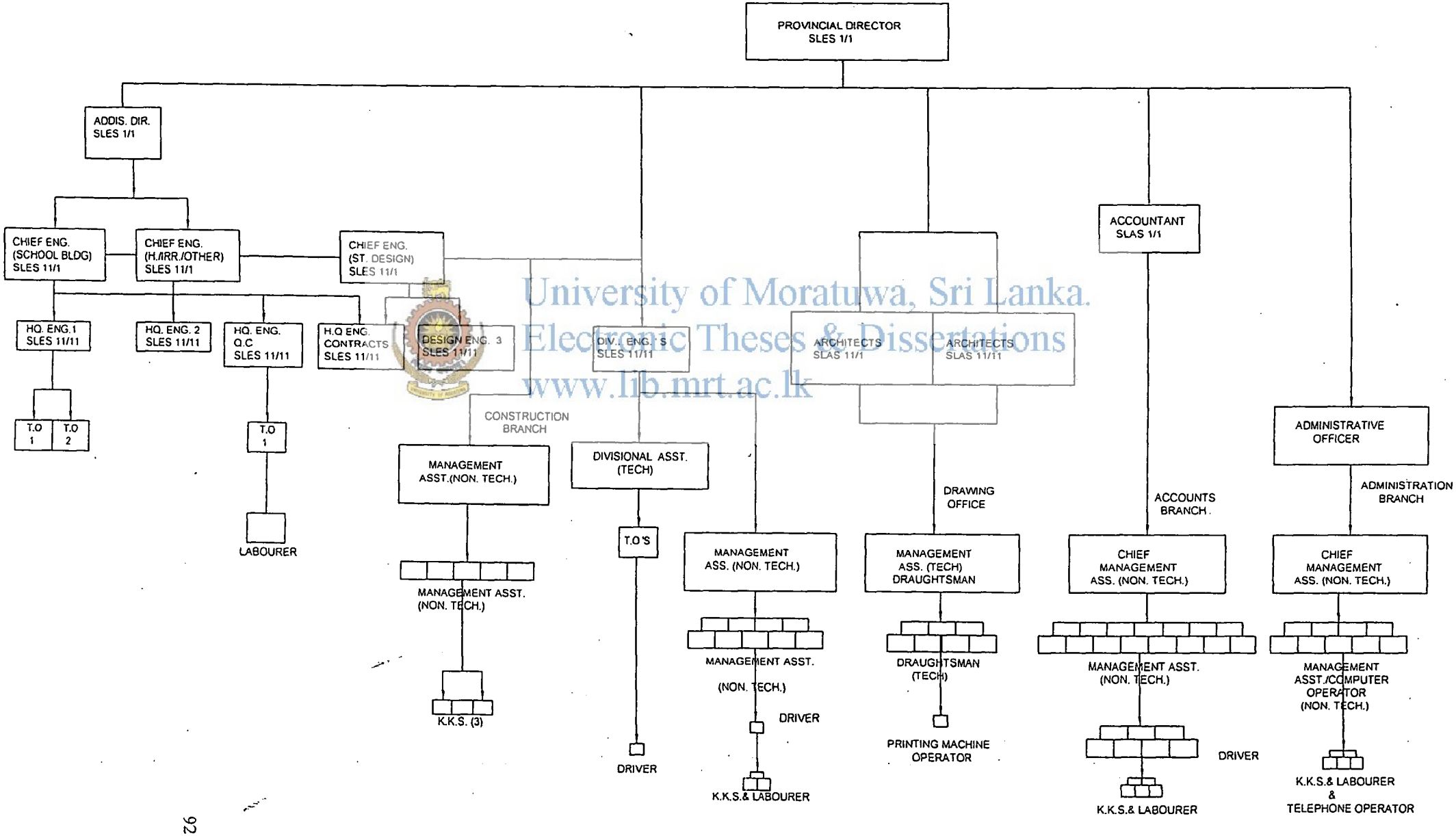
Annexure 3

ORGANIZATION CHART OF
SABARAGAMUWA PROVINCIAL COUNCIL ENGINEERING ORGANIZATION



Annexure 4

ORGANIZATION CHART OF
NORTH WESTERN PROVINCIAL COUNCIL ENGINEERING ORGANIZATION



Appendix 05

Questionery Survey

DELPHI ROUND 01

Research Topic : Factors affecting Engineering project management efficiencies in Provincial Councils

Aim : Enhance Knowledge, in ways of improving Project Management efficiency in Provincial Engineering organizations, to the construction professionals in Provincial Councils.

Objectives :

01. Identify factors which critically affect the project management efficiency of Engineering Organizations in Provincial Councils.
02. Comparison of Engineering Organizations in Provincial Councils.
03. Recommend ways & means of improving the efficiency of these organizations in implementing projects

Purpose of Questionnaire:

This questionnaire is focused on evaluating factors, that affecting to the project management efficiency of Engineering Organizations in Provincial Councils it is designed to carryout among the selected stakeholders of provincial engineering services. Please be kind enough to provide following details before filling the questionare.

Name of Respondent -
(Not essential)

Province -

Organization

With the consultation of experts in provincial construction industry factors affecting to the project Management efficiency of Engineering organizations in Provincial Councils have been evaluated and given in this questionnaire. Please, be kind enough to notify whether you agree or not to these factors

1 **Please mark your decision in the cage provided below**

PART A: QUESTIONNAIRE FOR ALL STAFF

NO	PRINCIPLE / FACTORS.	AT EXCELLENT STAGE	AGREE	NOT AGREE
01	**Leadership Traits**			
	At upper management level			
i.	Developing team work	Build subordinates as a team. Followers are given competence, needs & potential .Provide congenial and healthy working enviornment for his work team		
ii.	Representing the team	As and when required, communicate problems and grievences of subordinates to the upper management. Participate in problems solving process		
iii	Counselling	When subordinates face technical or emotional problems, guidence and advices are provided.		
iv	Managing Time	Optimum time saving, punctual, eager to complete entrusted activities on time.		
v	Using proper power	Exersice power and authority as per the requirement.		
vi	Rewarding	Effective rewarding system is carriedout to improve efficiency of workmenship.		
vii	Delegate Authority	Authorities are properly delegated to subordinates.		
viii	Group behaviour	Participation of employees in decision making is apreciated.		
02	**Features of Organization structure**			
i	**Departmentalization**			
	a) Functional Departmentalization	Departmentalized such as finance, works, administration etc based on function of particuler department that helps to improve efficiency.		
	b) Product base departmentalization	Departmentalized such as health, education, roads etc		
	c).Process Departmentalization	Departmentalized such as architechtural, design, quality control etc		

NO	PRINCIPLE / FACTORS.	AT EXCELLENT STAGE	AGREE	NOT AGREE
ii.	**Co-ordination**			
	a). Vertical Co-ordination	Comprehensive vertical co-ordination is available from bottom level to top management level		
	b). Horizontal Co-ordination	Good co-ordination in between same levels. Eg. Executive Engineers, sector Directors etc.		
	c). Co-ordination with external Organizations	Good co-ordination is being conducted with clients, contractors and general public.		
	d). Informal Co-ordination	Satisfactory dioganal co-ordination (Neither extreem nor very law)		
iii.	**Division of Labour: (Job specialization)-**			
	i. Division of labour on product bassis	Roads, health buildings, education works are done seperatly		
	ii. Division of labour on process bassis	Rather than entire work is done by one individual it is broken in to steps / parts, each step is completed by separate individual. Eg. Estimating, tendering, designing etc.		
iv	Common Goal	All the employees share to achieve common goal of the engineering organization.		
v	Integration	All the departments has good co-ordination and get together to achieve common organizational goals.		
vi	Span of contral	Top level - 1:3 Middle level - 1:4 Bottom level - 1:8 ~12		
vii	Delegation of authority	Unbroken line of authority from top to bottom, in this chain of command each managerial position is given a place that has degree of authority.		
iv	**Specific Features**			
i	Formalization	All rules and regulations have been docemented		
ii	Provincial road development authority	Having a PRDA considerebly effect to the to the project management efficiency		
iii	Engineering Departments attached to provincial Ministries	Having engineering departments in provincial ministries considerebly effect to the project management efficiency		

NO	PRINCIPLE / FACTORS.	AT EXCELLENT STAGE	AGREE	NOT AGREE
iv	Middle level managerial possitions	Project management efficiency is effected by having middle level managerial positions		
v	Amalgamated roads and building offices at divisional level	Road and building works are amalgamated at divisional level. Implementation of works under this enviornment effect to the project management efficiency.		
3	**Transport**			
i	Transport facilities available for the officers	Availability of transport facilities effect to the project management efficiency.		
ii	Options included to vehicles that are available for Engineers for their duties	A/C, PS & Setup is available		
iii	If you are provided with a office vehicle what is the condition of particular vehicle	Vehicles is good in body and running condition. The vehicle is les than 05 years old		
iv	Maintanance of vehicles	Vehicles are properly washed, interior is cleaned, routine checkups are done		
v	Methodology available for common official transport services	All the staff use common passenger services available for the office staff		
vi	Behavior of the drivers			
	a). Reliability	Reliable in all aspects		
	b). Obedient	Obey to orders, respect to superiors		
	c). Punctuality	All ways come in time get ready in advance		
vii	Methodology adopted for providing fuel to vehicle	No delays can get fuel allocations easily		
viii	In case of minor repairs the methodology adopted is	Heads of sub offices are allowed to get minor repairs done		
ix	In case of major repairs the methodology adopted is	Get the repair done within a shorter period		

NO	PRINCIPLE / FACTORS.	AT EXCELLENT STAGE	AGREE	NOT AGREE
04	**Using of new technologies**			
i	As computers have become a common feature in all organizations what is your opinion about usage of computers in your	Computers are used for preparation of estimates chacking of estimates preparing progress reports, data bank linked net work of information		
ii	What are the conditions of available computers			
	a. Moddle, speed, capacity	Computers with over 1GHz speed 256 Ram and minimum 20 GB hard		
	b. Availability of accessories	Freely available		
	c. Quality/ usage	Branded computers not older than 5 years		
iii	Availability of computers to met with the demand	No que is available for computer usage. No any additional computers are needed		
iv	Satety precautions that has been taken for the security of the computers	All computers are well installed with latest version of Anti virous protection		
v	Methodologies established for repairs and replacements	Repairs and replacements are done quickly		
vii	Availability of relevant programmes	Auto cad, Thibus, Primavera, estimating packages BSR, HSR etc.		
viii	Latest equipments are provided to each and every engineer	USB, Lap top, Digital camara		
05	**Human Resources Management**			
i	Methodology available for marking attendance	No one can make forge attendance		
ii	The ability to raise your problems to your superiors	Superiors are freely available ,You can easily access.		
iii	Way of solving administrative problems	Administrative problems are solved quickly, without any bias.		
iv	Having group discussions to improve quality of work	Senior staff get together regularly, to discuss matters pertaining to the beterment of the organization.		
v	Monthly progress review methodology	Progress of work is reviewed at divisional level first & then brought forward to provincial level.		

NO	PRINCIPLE / FACTORS.	AT EXCELLENT STAGE	AGREE	NOT AGREE
vi	Holding monthly progress review meetings	Monthly progress review meetings are held regularly ,attendance is essential ,priority is given .		
vii	Co-ordination among multiple levels of the channel	Superiors & Subordinates of the same channel has excellent coordination.		
viii	Collaboration/ Co-operation	Members of one channel has excellent coordination ,understanding with other channels.		
06	**Influences**			
i	Lack of influences from superiors	Subordinates are allways instructed to do the correct thing. No any influences from superiors to do favourations.		
ii	Lack of influences from any other officers in provincial council	No any senior officers of the provincial council influence to do favouratons.		
iii	Lack of influences from politicians	No any politicians of the provincial council influence to do favourations.		
07	**Documentation**			
i	Maintaining files	Files are neatly binded, numbered, labeled and updated		
ii	Maintaining file Racks	Files racks and cupboards are neatly placed and numbered		
iii	Time taken for receiving regular mail	Mail is received to the relevent officer on the day it self .		
iv	Photocopies	Enough no of photocopy machines are available ,well maintained, materials & operators are available.		
v	Ledgers and other documents	Neatly numbered, labeled, binded & updated		
08	**Office arrangements**			
i	Availability of light and ventilation	Entire office space is air conditioned, Twin tube lights with difuser or CFL bulbs are provided or natural air & natural light is provided.		
ii	Office external environment	Neatly landscaped, trees are grown ,flower plants are grown, atrificial springs ,ponds are erected,well painted & paved.		
iii	Office internal environment	Neatly arrenged,neatly painted, properly wired, floor is tiled or carpetted, Flower pots are provided.		

NO	PRINCIPLE / FACTORS.	AT EXCELLENT STAGE	AGREE	NOT AGREE
iv	Separation of branches(Head office only)	Branches are well seperated with easy access .		
v	Availability of vehicle parking space	All official vehicles are allocated with covered parking space. Separate parking spaces are provided for workers vehicles & motor cycles.Separate parking space is available for visitors as well.		
vi	Access Roads	Access Roads are tarred & well maintained.Stairways & foot paths are properly maintained & free of weeding		
vii	Condition of recreational facilities	Having adequate no of toilets which are well maintained.Continious water supply is available.		
viii	Availability and condition of furniture	Adequate no of modern tables & chairs are provided		
ix	Dinning space	Separate dining space is provided for office staff.		
x	Separate conference room facilities	Separate conference room is avilable.		
xi	Record room	Record room with enough space & good security is avilable.		
xii	Store room	Store room with enough space & good security is avilable.		
9	**Technical Preference:**			
i	Support rendered by the design branch in case of field work	Interestingly attend for design work, Designs are provided quickly.		
ii	Quality of drawings provided	Drawings are neatly drawn, well printed & authenticated.		
iii	Support of the laboratory	Interestingly attend for testing work. Impartial test reports are given.		
iv	Involvement of key decision makers	In case of technical problems ,decitions are taken as a team of experts.		
10	**Training**			
i	Availability of local training facilities (short term)	Continious carrier development programmes are conducted in each & every year.At least one programme per person per year.		

NO	PRINCIPLE / FACTORS.	AT EXCELLENT STAGE	AGREE	NOT AGREE
ii	Availability of overseas training facilities for	At least one overseas training for five years working.		
iii	Facilities provided by the PC for training needs	All categories are considered		
11	**Estimates**			
	At Divisional Level			
i	Quality	Estimates are computerised		
ii	Accuracy	Estimates are computerised		
iii	Speed	Use computer programmes for preparing and chacking of estimate		
iv	Type of sending Pst. Fax/ email/ internet	Use all medias		
	At Provincial Level			
i	Quality	Estimates are computerised		
ii	Accuracy	Estimates are computerised		
iii	Speed	Use computer programmes for preparing and chacking of estimate		
iv	Type of sending Pst. Fax/ email/ internet	Use all medias		
12	**Agreements**			
i	Agreement used for minor constructions	ICTAD standards are used, nicely printed and binded		
ii	Agreement used for major construction	ICTAD standards are used, nicely printed and binded		
13	**Tendering & evaluation:**			
i	Way of publishing minor tenders	Tender notice is sent in advance under registered post , to at least five government offices for publishing local tenders.No any influences to qualified bidders.		
ii	Way of publishing major tenders	Tender notice is published in news papers.Tender documents are freely available .No any influences to qualified bidders.		

NO	PRINCIPLE / FACTORS.	AT EXCELLENT STAGE	AGREE	NOT AGREE
iii	Forms used for opening of tenders	Standard forms are used		
iv	Forms used for evaluation purposes.	Standard forms are used		
14	**Drawings & Other related documents:**			
i	Quality of drawings	Use Auto cad for preparing drawings.Drawings are with less errors,checked & approved.		
ii	Prints	Prints are clear. Size & quality are excellent.Blue prints, photocopies, computer		
iii	Log books used at sites	Log books are available at each & every site		
iv	Check lists used at sites	Check list is obtained before concreting		
15	**Progress Reports**			
i	Progress reports prepared at divisional level	Computer programmes are used. Updated daily.Standard formats are used		
ii	Progress reports prepared at provincial level	Computer programmes are used. Updated daily.Standard formats are used.		
16	**Bills:**			
i	Forms used for measurement sheets	Standard forms are used		
ii	Forms used as billing sheets	Standard forms are used		

17 If you consider that there are some other factors that would effect to project management efficiency of your organization other than the factors mentioned in this questioniere, please, specify those fact below.

1 ----------
2 ----------
3 ----------
4 ----------
5 ----------
6 ----------

Appendix 06

Questionery Survey

DELPHI ROUND 02

Research Topic : **F**actors affecting Engineering project management efficiencies in Provincial Councils

Aim : Enhance Knowledge, in ways of improving Project Management efficiency in Provincial Engineering organizations, to the construction professionals in Provincial Councils.

Objectives :

01. Identify factors which critically affect the project management efficiency of Engineering Organizations in Provincial Councils.
02. Comparison of Engineering Organizations in Provincial Councils.
03. Recommend ways & means of improving the efficiency of these organizations in implementing projects

Purpose of Questionnaire:

This questionnaire is focused on evaluating factors, that affecting to the project management efficiency of Engineering Organizations in Provincial Councils. It is designed to carryout among the selected stakeholders of provincial engineering services. Please be kind enough to provide following details before filling the questionare.

Name of Respondent -
(Not essential)

Province -

Organization -

With the consultation of experts in provincial construction industry factors affecting to the project Management efficiency of engineering organizations in Provincial Councils have been evaluated and given in this questionnaire. Effect of each factor relevant to your Provincial Engineering organization concerned is needed to be evaluated. Please, be kind enough to express your interest in the attached table accordingly.

1 **Please mark your decision in the cage provided below**

NO	PRINCIPLE / FACTORS.	AT EXCELLENT STAGE	EXCELLENT	SATISFACTORY	NEUTRAL	UNSATISFACTORY	POOR
01	**Leadership Traits**						
	Questions I to VIII is applicable to behaviour of top management of your Organization						
i.	Developing team work	Build subordinates as a team. Followers are given competence, needs & potential .Provide congenial and healthy working enviornment for his work team					
ii.	Representing the team	As and when required, communicate problems and grievences of subordinates to the upper management. Participate in problems solving process					
iii	Counselling	When subordinates face technical or emotional problems, guidence and advices are provided.					
iv	Managing Time	Optimum time saving, punctual, eager to complete entrusted activities on time.					
v	Using proper power	Exersice power and authority as per the requirement.					
vi	Rewarding	Effective rewarding system is carriedout to improve efficiency of workmenship.					
vii	Delegate Authority	Authorities are properly delegated to subordinates.					
viii	Group behaviour	Participation of employees in decision making is apreciated.					

NO	PRINCIPLE / FACTORS.	AT EXCELLENT STAGE	EXCELLENT	SATISFACTORY	NEUTRAL	UNSATISFACTORY	POOR
02	**Organization structure**						
i	**Departmentalization**						
	a) Functional Departmentalization	Departmentalized such as finance, works, administration etc based on function of particuler department that helps to improve efficiency.					
	b) Product base departmentalization	Departmentalized such as health, education, roads etc					
	c).Process Departmentalization	Departmentalized such as architechtural, design, quality control etc					
ii.	**Co-ordination**						
	a). Vertical Co-ordination	Comprehensive vertical co-ordination is available from bottom level to top management level					
	b). Horizontal Co-ordination	Good co-ordination in between same levels. Eg. Executive Engineers, sector Directors etc.					
	c). Co-ordination with external Organizations	Good co-ordination is being conducted with clients, contractors and general public.					
	d). Informal Co-ordination	Satisfactory dioganal co-ordination					
iii.	**Division of Labour: (Job specialization)-**						
	a) Division of labour on produce bassis	Roads, Health buildings, Education works are done seperatly					
	b). Division of labour on process bassis	Rather than entire work is done by one individual it is broken in to steps / parts, each step is completed by separate individual. Eg. Estimating, tendering, designing etc.					

NO	PRINCIPLE / FACTORS.	AT EXCELLENT STAGE	EXCELLENT	SATIS FACTORY	NEUTRAL	UNSATIS FACTORY	POOR
iv	Common Goal	All the employees share to achieve common goal of the engineering organization.					
v	Integration	All the departments has good co-ordination and get together to achieve common organizational goals.					
vi	Span of contral	Top level - 1:3 Middle level - 1:4 Bottom level - 1:8 ~12					
vii	Delegation of authority	Unbroken line of authority from top to bottom, in this chain of command each managerial position is given a place that has degree of authority.					
iv	**Specific Features**						
i	Formalization	All rules and regulations have been docemented					
3	**Transport**						
i	Transport facilities available for the officers	All vehicles are in good condition.Vehicles are easily available					
4	**Using of new technologies**						
i	As computers have become a common feature in all organizations what is your opinion about usage of computers in your organization	Computers are used for ,preparation of estimates ,Checking of Estimates, Preparing progress reports, Data bank, Linked net work of information.					
ii	condition of available computers, Moddle, speed capacity	Computers with over 1GHz Speed,256 Ram & minimum 20 GB Hard					
iii	Availability of computers to met with the demand	No que is available for computer usage. No any additional computers are needed.					
iv	Latest equipments are provided to each & every engineer	USB, Lap top, Digital Camara					

NO	PRINCIPLE / FACTORS.	AT EXCELLENT STAGE	EXCELLENT	SATIS FACTORY	NEUTRAL	UNSATIS FACTORY	POOR
4	**Human Resources Management**						
i	The ability to raise your problems to your superiors	Superiors are freely available ,You can easily access.					
ii	Way of solving administrative problems	Administrative problems are solved quickly, without any bias.					
iii	Having group discussions to improve quality of work	Senior staff get together regularly, to discuss matters pertaining to the beterment of the organization.					
iv	Monthly progress review methodology	Progress of work is reviewed at divisional level first & then brought forward to provincial level.					
v	Holding monthly progress review meetings	Monthly progress review meetings are held regularly ,attendance is essential ,priority is given .					
vi	Co-ordination among multiple levels of the channel	Superiors & Subordinates of the same channel has excellent coordination.					
vii	Collaboration/ Co-operation	Members of one channel has excellent coordination ,understanding with other channels.					
6	**Influences**						
i	Lack of influences from politicians	No any politicians of the provincial council influence to do favourations.					
7	**Documentation**						
i	Time taken for receiving regular mail	Mail is received to the relevent officer on the day it self .					
ii	Photocopies	Enough no of photocopy machines are available ,well maintained, materials & operators are available.					

NO	PRINCIPLE / FACTORS.	AT EXCELLENT STAGE	EXCELLENT	SATIS FACTORY	NEUTRAL	UNSATIS FACTORY	POOR
8	**Office Enviornment**						
i	Office internal environment	Neatly arrenged,neatly painted, properly wired, floor is tiled or carpetted, Flower pots are provided.					
ii	Condition of recreational facilities	Having adequate no of toilets which are well maintained.Continious water supply is available.					
9	**Technical Preference:**						
i	Involvement of key decision makers	In case of technical problems ,decitions are taken as a team of experts.					
10	**Training**						
i	Availability of local training facilities (short term)	Continious carrier development programmes are conducted in each & every year.At least one programme per person per year.					
11	**Drawing**						
i	Quality of drawings	Use Auto cad for preparing drawing. Drawings are with less errors, checked and approved					

Thank You

Eng. H.D.S.N. Premasiri
T.P. 071 3035745

Oneway

Descriptives

Q1

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
Sabaragamuwa	30	21.1333	2.19299	.40038	20.3145	21.9522
Western	30	24.2667	2.09981	.38337	23.4826	25.0507
Southern	30	29.3333	2.52345	.46072	28.3911	30.2756
North western	30	34.6000	2.68585	.49037	33.5971	35.6029
Total	120	27.3333	5.65140	.51590	26.3118	28.3549

Descriptives

Q1

	Minimum	Maximum
Sabaragamuwa	16.00	26.00
Western	21.00	29.00
Southern	26.00	36.00
North western	28.00	39.00
Total	16.00	39.00

ANOVA

Q1

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	3139.467	3	1046.489	183.595	.000
Within Groups	661.200	116	5.700		
Total	3800.667	119			

Post Hoc Tests

Multiple Comparisons

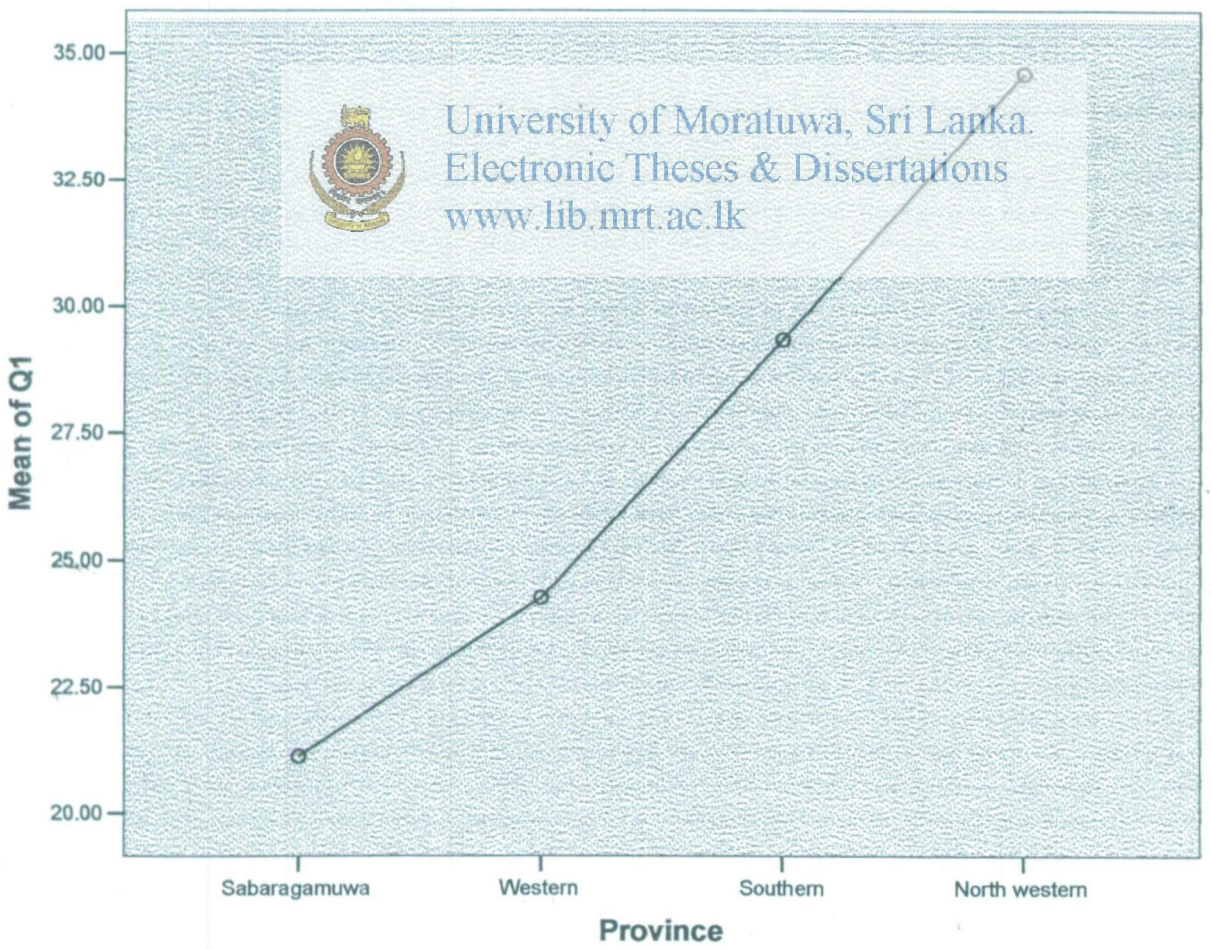
Dependent Variable: Q1

LSD

(I) Province	(J) Province	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Sabaragamuwa	Western	-3.13333*	.61644	.000	-4.3543	-1.9124
	Southern	-8.20000*	.61644	.000	-9.4209	-6.9791
	North western	-13.46667*	.61644	.000	-14.6876	-12.2457
Western	Sabaragamuwa	3.13333*	.61644	.000	1.9124	4.3543
	Southern	-5.06667*	.61644	.000	-6.2876	-3.8457
	North western	-10.33333*	.61644	.000	-11.5543	-9.1124
Southern	Sabaragamuwa	8.20000*	.61644	.000	6.9791	9.4209
	Western	5.06667*	.61644	.000	3.8457	6.2876
	North western	-5.26667*	.61644	.000	-6.4876	-4.0457
North western	Sabaragamuwa	13.46667*	.61644	.000	12.2457	14.6876
	Western	10.33333*	.61644	.000	9.1124	11.5543
	Southern	5.26667*	.61644	.000	4.0457	6.4876

*. The mean difference is significant at the .05 level.

Means Plots



Oneway

Descriptives

Q2

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
Sabaragamuwa	30	48.0667	3.08426	.56311	46.9150	49.2183
Western	30	64.0000	8.15370	1.48865	60.9554	67.0446
Southern	30	53.1667	7.40030	1.35110	50.4034	55.9300
North western	30	66.5333	8.42710	1.53857	63.3866	69.6801
Total	120	57.9417	10.36177	.94590	56.0687	59.8146

Descriptives

Q2

	Minimum	Maximum
Sabaragamuwa	44.00	56.00
Western	56.00	104.00
Southern	43.00	69.00
North western	58.00	108.00
Total	43.00	108.00

ANOVA

Q2

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	6925.092	3	2308.364	45.761	.000
Within Groups	5851.500	116	50.444		
Total	12776.592	119			

Post Hoc Tests

Multiple Comparisons

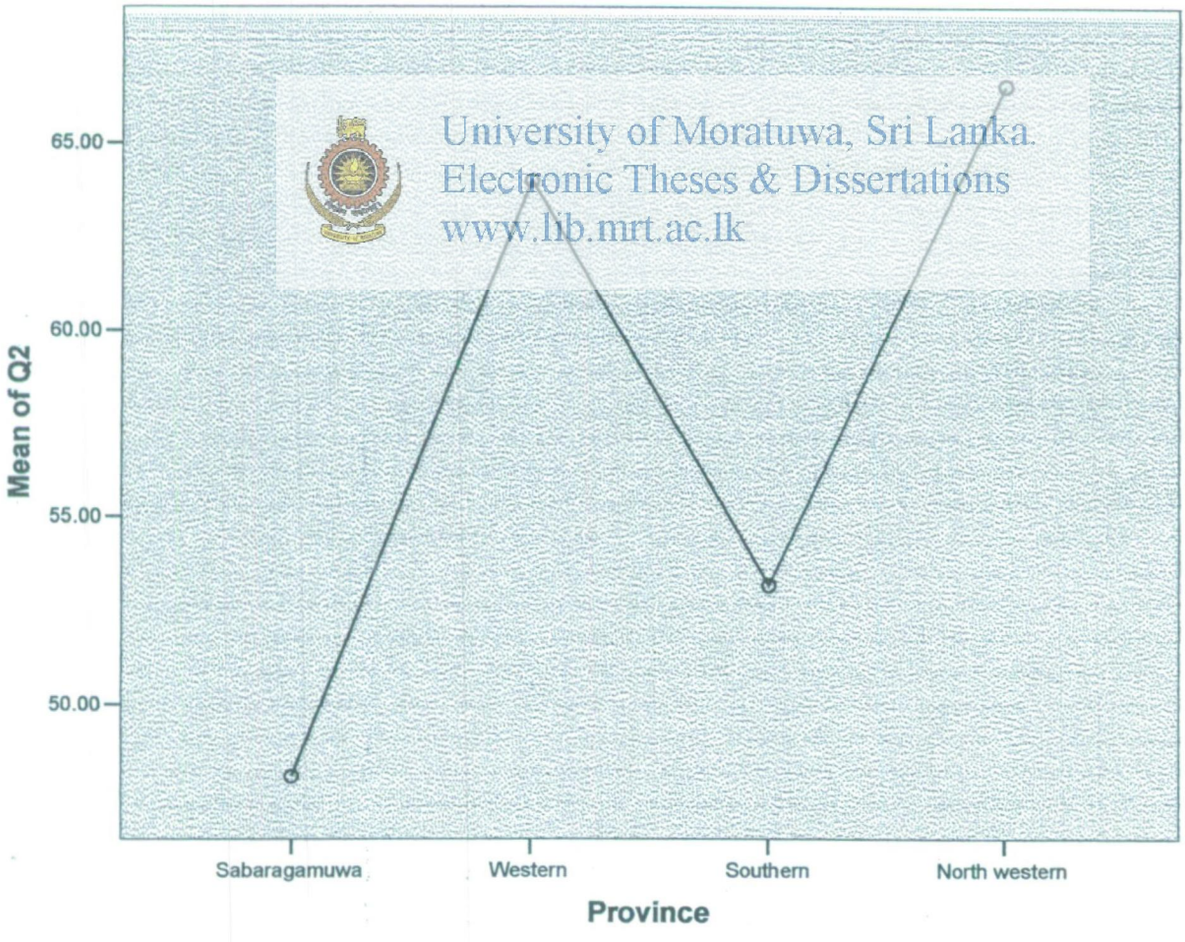
Dependent Variable: Q2

LSD

(I) Province	(J) Province	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Sabaragamuwa	Western	-15.93333*	1.83383	.000	-19.5655	-12.3012
	Southern	-5.10000*	1.83383	.006	-8.7321	-1.4679
	North western	-18.46667*	1.83383	.000	-22.0988	-14.8345
Western	Sabaragamuwa	15.93333*	1.83383	.000	12.3012	19.5655
	Southern	10.83333*	1.83383	.000	7.2012	14.4655
	North western	-2.53333	1.83383	.170	-6.1655	1.0988
Southern	Sabaragamuwa	5.10000*	1.83383	.006	1.4679	8.7321
	Western	-10.83333*	1.83383	.000	-14.4655	-7.2012
	North western	-13.36667*	1.83383	.000	-16.9988	-9.7345
North western	Sabaragamuwa	18.46667*	1.83383	.000	14.8345	22.0988
	Western	2.53333	1.83383	.170	-1.0988	6.1655
	Southern	13.36667*	1.83383	.000	9.7345	16.9988

*. The mean difference is significant at the .05 level.

Means Plots



Descriptives

Q3

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
Sabaragamuwa	30	1.8667	.77608	.14169	1.5769	2.1565
Western	30	3.2333	1.38174	.25227	2.7174	3.7493
Southern	30	2.6333	1.32570	.24204	2.1383	3.1284
North western	30	3.4000	1.19193	.21762	2.9549	3.8451
Total	120	2.7833	1.32325	.12080	2.5441	3.0225

Descriptives

Q3

	Minimum	Maximum
Sabaragamuwa	1.00	4.00
Western	1.00	5.00
Southern	1.00	5.00
North western	1.00	5.00
Total	1.00	5.00

ANOVA

Q3

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	43.367	3	14.456	10.163	.000
Within Groups	165.000	116	1.422		
Total	208.367	119			

Post Hoc Tests

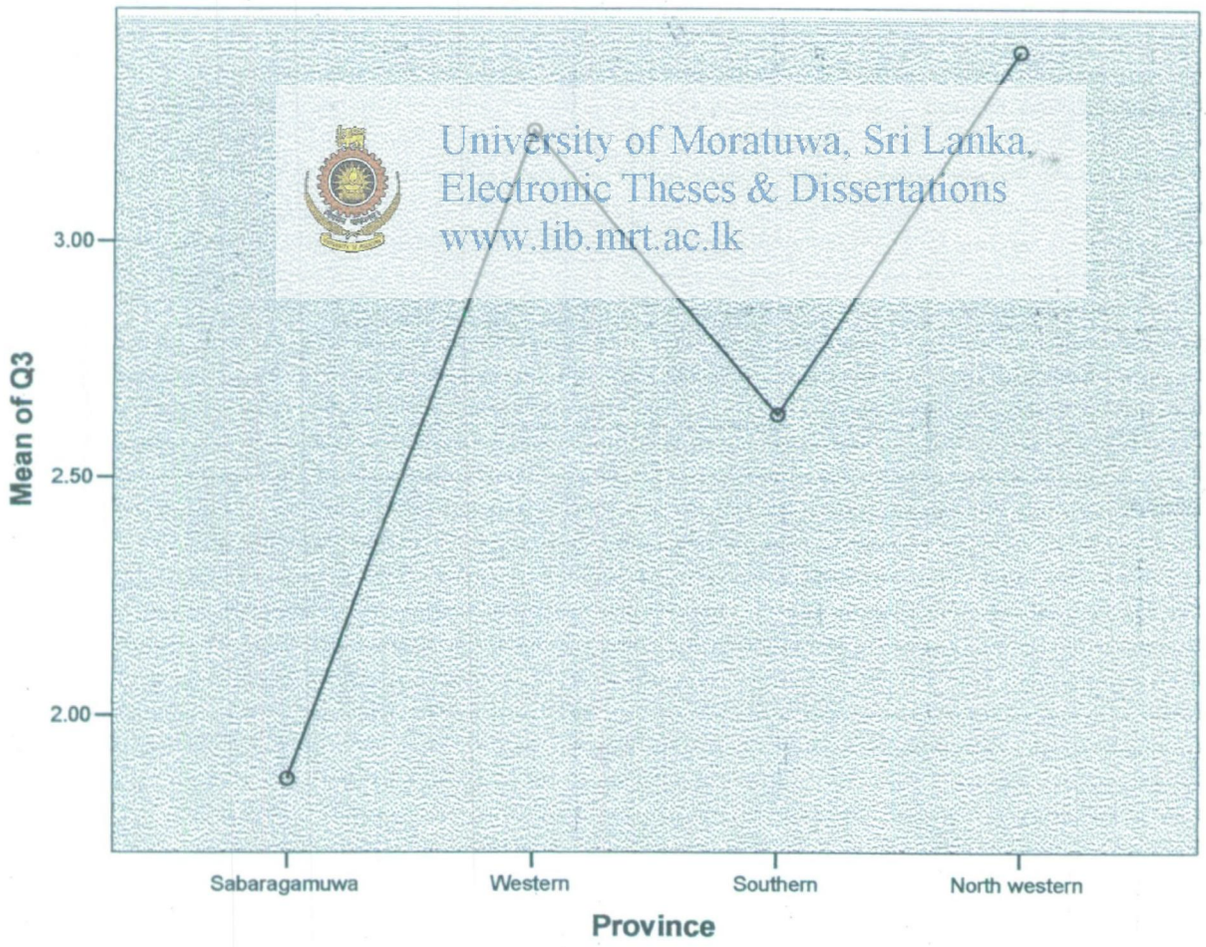
Multiple Comparisons

Dependent Variable: Q3
LSD

(I) Province	(J) Province	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Sabaragamuwa	Western	-1.36667*	.30794	.000	-1.9766	-.7568
	Southern	-.76667*	.30794	.014	-1.3766	-.1568
	North western	-1.53333*	.30794	.000	-2.1432	-.9234
Western	Sabaragamuwa	1.36667*	.30794	.000	.7568	1.9766
	Southern	.60000	.30794	.054	-.0099	1.2099
	North western	-.16667	.30794	.589	-.7766	.4432
Southern	Sabaragamuwa	.76667*	.30794	.014	.1568	1.3766
	Western	-.60000	.30794	.054	-1.2099	.0099
	North western	-.76667*	.30794	.014	-1.3766	-.1568
North western	Sabaragamuwa	1.53333*	.30794	.000	.9234	2.1432
	Western	.16667	.30794	.589	-.4432	.7766
	Southern	.76667*	.30794	.014	.1568	1.3766

*. The mean difference is significant at the .05 level.

Means Plots



Oneway

Descriptives

Q4

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
Sabaragamuwa	30	12.5667	1.59056	.29040	11.9727	13.1606
Western	30	14.0000	2.10090	.38357	13.2155	14.7845
Southern	30	16.8667	1.71672	.31343	16.2256	17.5077
North western	30	19.1333	1.00801	.18404	18.7569	19.5097
Total	120	15.6417	3.02870	.27648	15.0942	16.1891

Descriptives

Q4

	Minimum	Maximum
Sabaragamuwa	10.00	16.00
Western	9.00	18.00
Southern	13.00	20.00
North western	16.00	20.00
Total	9.00	20.00

ANOVA

Q4

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	775.292	3	258.431	94.777	.000
Within Groups	316.300	116	2.727		
Total	1091.592	119			

Post Hoc Tests

Multiple Comparisons

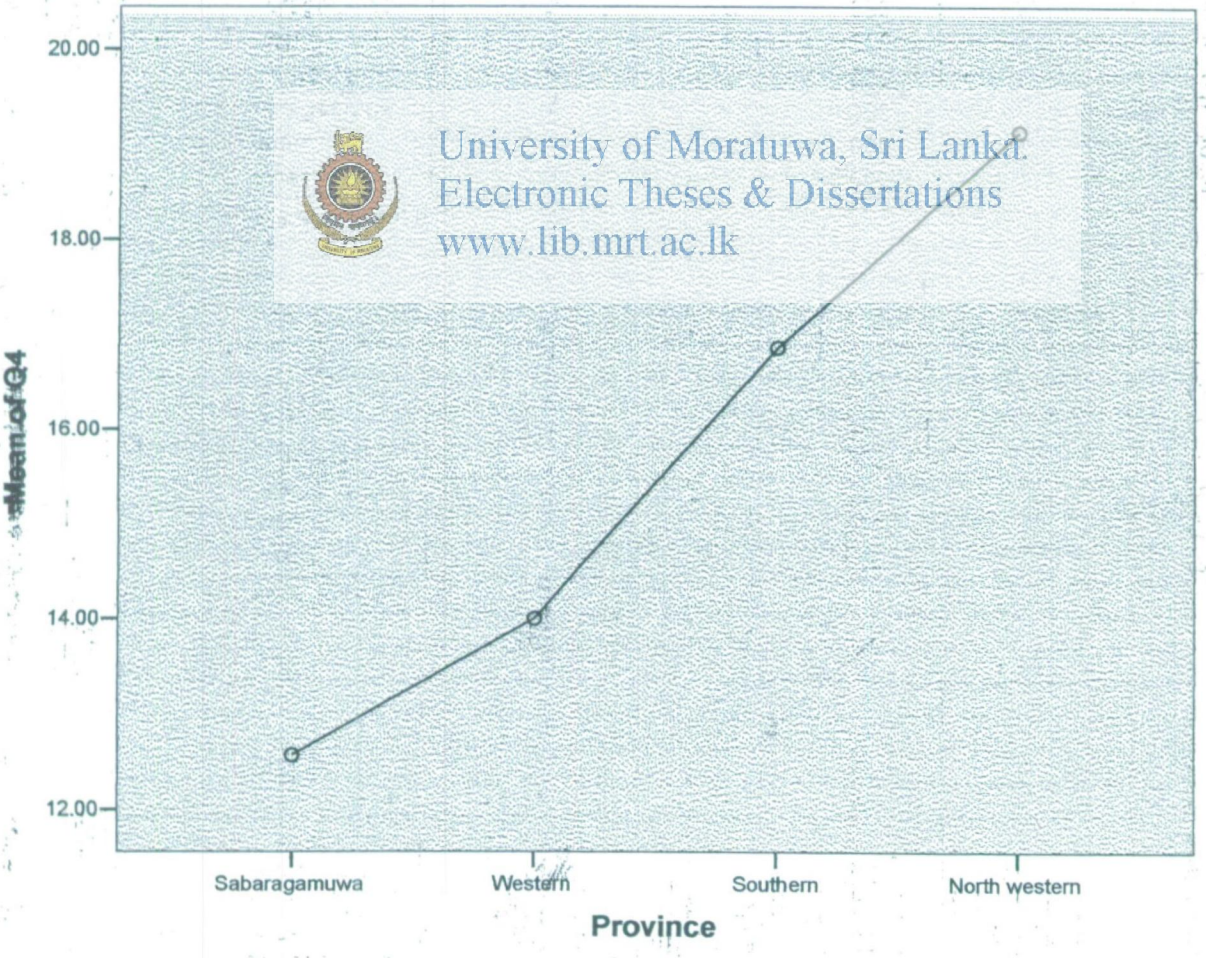
Dependent Variable: Q4

LSD

(I) Province	(J) Province	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Sabaragamuwa	Western	-1.43333*	.42636	.001	-2.2778	-.5889
	Southern	-4.30000*	.42636	.000	-5.1445	-3.4555
	North western	-6.56667*	.42636	.000	-7.4111	-5.7222
Western	Sabaragamuwa	1.43333*	.42636	.001	.5889	2.2778
	Southern	-2.86667*	.42636	.000	-3.7111	-2.0222
	North western	-5.13333*	.42636	.000	-5.9778	-4.2889
Southern	Sabaragamuwa	4.30000*	.42636	.000	3.4555	5.1445
	Western	2.86667*	.42636	.000	2.0222	3.7111
	North western	-2.26667*	.42636	.000	-3.1111	-1.4222
North western	Sabaragamuwa	6.56667*	.42636	.000	5.7222	7.4111
	Western	5.13333*	.42636	.000	4.2889	5.9778
	Southern	2.26667*	.42636	.000	1.4222	3.1111

*. The mean difference is significant at the .05 level.

Means Plots



Oneway

Descriptives

Q5

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
Sabaragamuwa	30	10.7333	1.50707	.27515	10.1706	11.2961
Western	30	21.4333	6.52678	1.19162	18.9962	23.8705
Southern	30	29.6000	2.06113	.37631	28.8304	30.3696
North western	30	33.3333	1.42232	.25968	32.8022	33.8644
Total	120	23.7750	9.39736	.85786	22.0764	25.4736

Descriptives

Q5

	Minimum	Maximum
Sabaragamuwa	8.00	14.00
Western	15.00	52.00
Southern	24.00	32.00
North western	30.00	35.00
Total	8.00	52.00

ANOVA

Q5

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	9025.825	3	3008.608	235.317	.000
Within Groups	1483.100	116	12.785		
Total	10508.925	119			

Post Hoc Tests

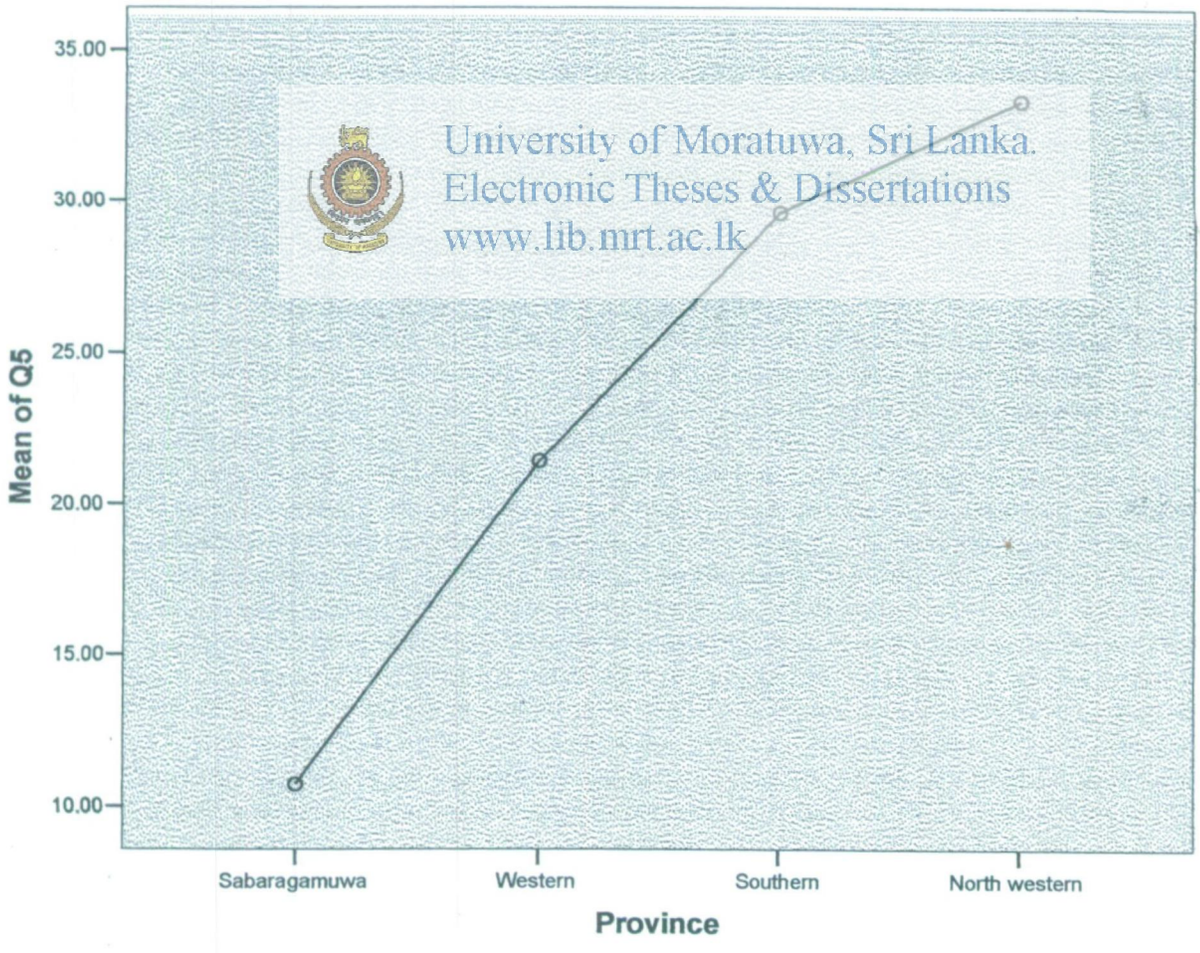
Multiple Comparisons

Dependent Variable: Q5
LSD

(I) Province	(J) Province	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Sabaragamuwa	Western	-10.70000*	.92323	.000	-12.5286	-8.8714
	Southern	-18.86667*	.92323	.000	-20.6952	-17.0381
	North western	-22.60000*	.92323	.000	-24.4286	-20.7714
Western	Sabaragamuwa	10.70000*	.92323	.000	8.8714	12.5286
	Southern	-8.16667*	.92323	.000	-9.9952	-6.3381
	North western	-11.90000*	.92323	.000	-13.7286	-10.0714
Southern	Sabaragamuwa	18.86667*	.92323	.000	17.0381	20.6952
	Western	8.16667*	.92323	.000	6.3381	9.9952
	North western	-3.73333*	.92323	.000	-5.5619	-1.9048
North western	Sabaragamuwa	22.60000*	.92323	.000	20.7714	24.4286
	Western	11.90000*	.92323	.000	10.0714	13.7286
	Southern	3.73333*	.92323	.000	1.9048	5.5619

*. The mean difference is significant at the .05 level.

Means Plots



Descriptives

Q6

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
Sabaragamuwa	30	1.3000	.65126	.11890	1.0568	1.5432
Western	30	3.2333	1.04000	.18988	2.8450	3.6217
Southern	30	4.5000	.57235	.10450	4.2863	4.7137
North western	30	4.9333	.25371	.04632	4.8386	5.0281
Total	120	3.4917	1.57179	.14348	3.2076	3.7758

Descriptives

Q6

	Minimum	Maximum
Sabaragamuwa	1.00	3.00
Western	1.00	5.00
Southern	3.00	5.00
North western	4.00	5.00
Total	1.00	5.00

ANOVA

Q6

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	238.958	3	79.653	167.893	.000
Within Groups	55.033	116	.474		
Total	293.992	119			

Post Hoc Tests

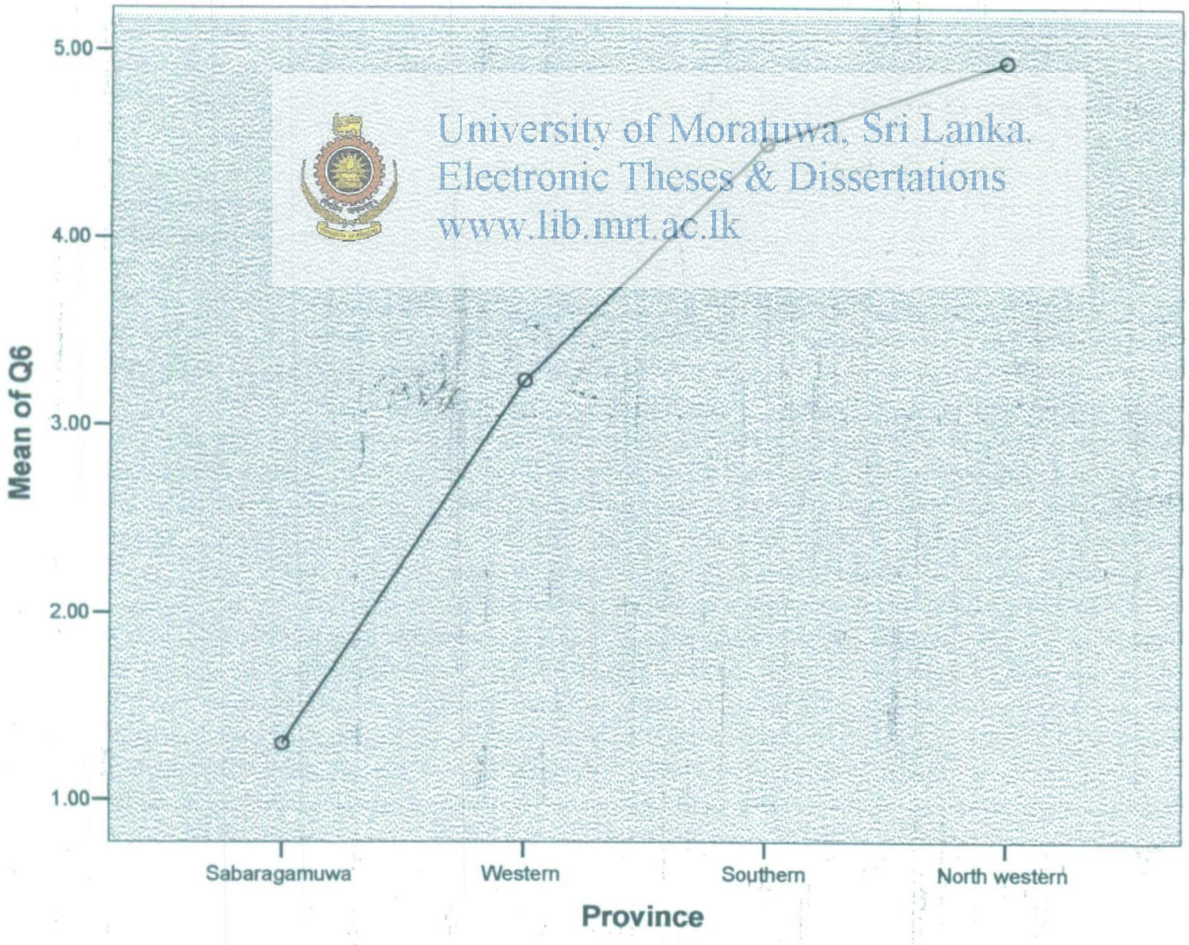
Multiple Comparisons

Dependent Variable: Q6
LSD

(I) Province	(J) Province	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Sabaragamuwa	Western	-1.93333*	.17784	.000	-2.2856	-1.5811
	Southern	-3.20000*	.17784	.000	-3.5522	-2.8478
	North western	-3.63333*	.17784	.000	-3.9856	-3.2811
Western	Sabaragamuwa	1.93333*	.17784	.000	1.5811	2.2856
	Southern	-1.26667*	.17784	.000	-1.6189	-.9144
	North western	-1.70000*	.17784	.000	-2.0522	-1.3478
Southern	Sabaragamuwa	3.20000*	.17784	.000	2.8478	3.5522
	Western	1.26667*	.17784	.000	.9144	1.6189
	North western	-.43333*	.17784	.016	-.7856	-.0811
North western	Sabaragamuwa	3.63333*	.17784	.000	3.2811	3.9856
	Western	1.70000*	.17784	.000	1.3478	2.0522
	Southern	.43333*	.17784	.016	.0811	.7856

*. The mean difference is significant at the .05 level.

Means Plots



Oneway

Descriptives

Q7

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
Sabaragamuwa	30	7.1000	2.26442	.41342	6.2545	7.9455
Western	30	5.5333	1.43198	.26144	4.9986	6.0680
Southern	30	5.8333	.94989	.17343	5.4786	6.1880
North western	30	7.6000	2.31338	.42236	6.7362	8.4638
Total	120	6.5167	2.00413	.18295	6.1544	6.8789

Descriptives

Q7

	Minimum	Maximum
Sabaragamuwa	3.00	10.00
Western	3.00	8.00
Southern	4.00	8.00
North western	4.00	10.00
Total	3.00	10.00

ANOVA

Q7

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	88.433	3	29.478	8.778	.000
Within Groups	389.533	116	3.358		
Total	477.967	119			

Post Hoc Tests

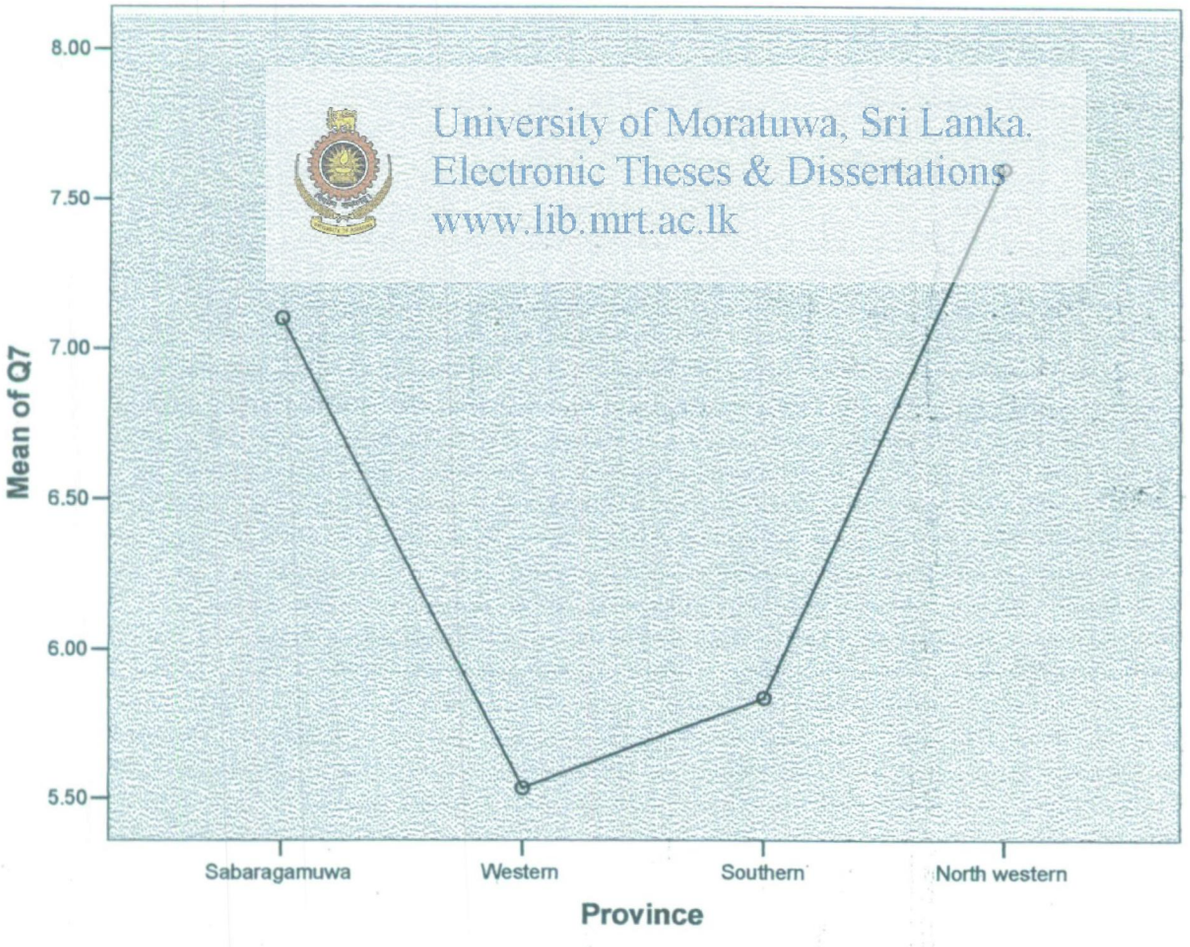
Multiple Comparisons

Dependent Variable: Q7
LSD

(I) Province	(J) Province	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Sabaragamuwa	Western	1.56667*	.47315	.001	.6295	2.5038
	Southern	1.26667*	.47315	.009	.3295	2.2038
	North western	-.50000	.47315	.293	-1.4371	.4371
Western	Sabaragamuwa	-1.56667*	.47315	.001	-2.5038	-.6295
	Southern	-.30000	.47315	.527	-1.2371	.6371
	North western	-2.06667*	.47315	.000	-3.0038	-1.1295
Southern	Sabaragamuwa	-1.26667*	.47315	.009	-2.2038	-.3295
	Western	.30000	.47315	.527	-.6371	1.2371
	North western	-1.76667*	.47315	.000	-2.7038	-.8295
North western	Sabaragamuwa	.50000	.47315	.293	-.4371	1.4371
	Western	2.06667*	.47315	.000	1.1295	3.0038
	Southern	1.76667*	.47315	.000	.8295	2.7038

*. The mean difference is significant at the .05 level.

Means Plots



Oneway

Descriptives

Q8

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
Sabaragamuwa	30	4.2667	1.50707	.27515	3.7039	4.8294
Western	30	7.9000	1.24152	.22667	7.4364	8.3636
Southern	30	8.5000	1.59201	.29066	7.9055	9.0945
North western	30	9.7667	.62606	.11430	9.5329	10.0004
Total	120	7.6083	2.41944	.22086	7.1710	8.0457

Descriptives

Q8

	Minimum	Maximum
Sabaragamuwa	2.00	8.00
Western	5.00	10.00
Southern	4.00	10.00
North western	8.00	10.00
Total	2.00	10.00

ANOVA

Q8

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	501.158	3	167.053	99.155	.000
Within Groups	195.433	116	1.685		
Total	696.592	119			

Post Hoc Tests

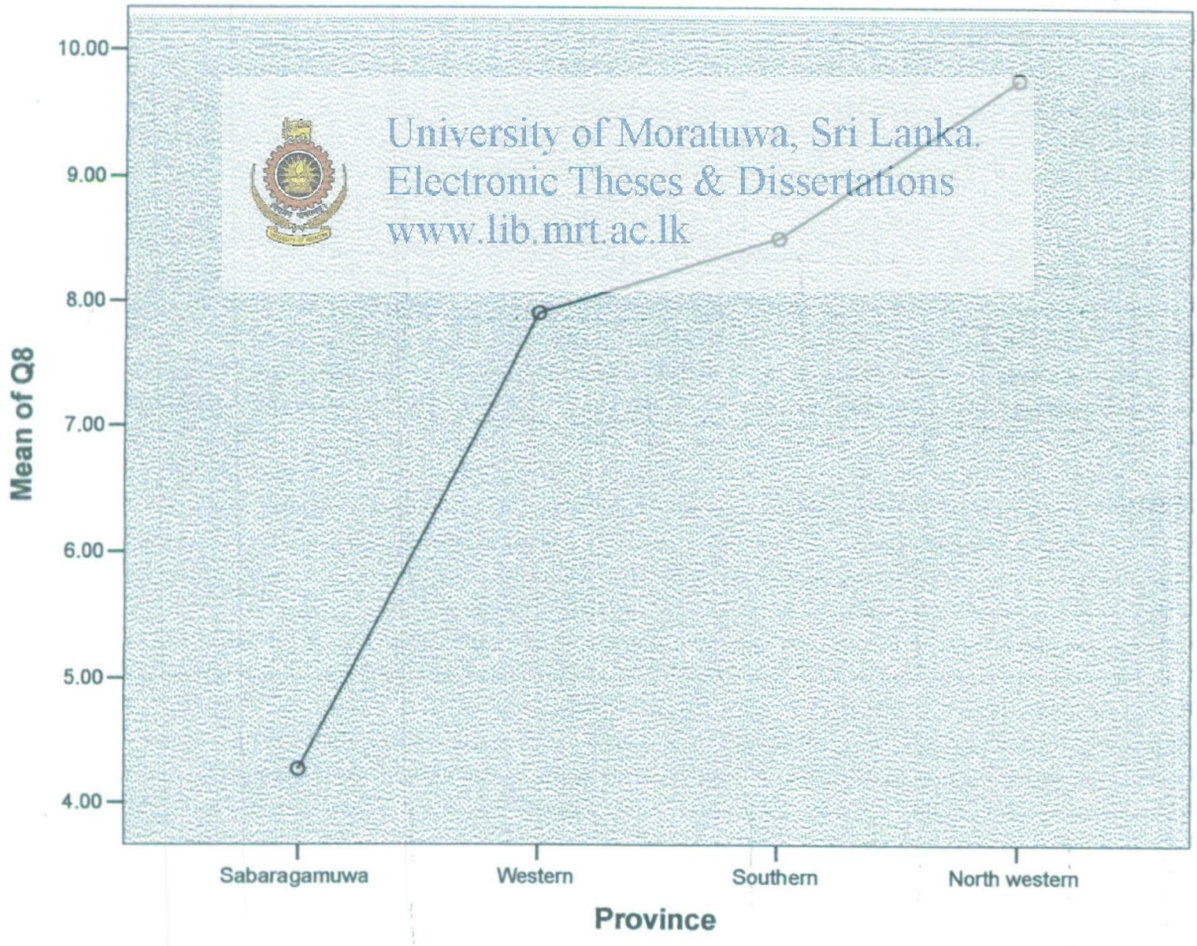
Multiple Comparisons

Dependent Variable: Q8
LSD

(I) Province	(J) Province	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Sabaragamuwa	Western	-3.63333*	.33514	.000	-4.2971	-2.9695
	Southern	-4.23333*	.33514	.000	-4.8971	-3.5695
	North western	-5.50000*	.33514	.000	-6.1638	-4.8362
Western	Sabaragamuwa	3.63333*	.33514	.000	2.9695	4.2971
	Southern	-.60000	.33514	.076	-1.2638	.0638
	North western	-1.86667*	.33514	.000	-2.5305	-1.2029
Southern	Sabaragamuwa	4.23333*	.33514	.000	3.5695	4.8971
	Western	.60000	.33514	.076	-.0638	1.2638
	North western	-1.26667*	.33514	.000	-1.9305	-.6029
North western	Sabaragamuwa	5.50000*	.33514	.000	4.8362	6.1638
	Western	1.86667*	.33514	.000	1.2029	2.5305
	Southern	1.26667*	.33514	.000	.6029	1.9305

*. The mean difference is significant at the .05 level.

Means Plots



NPar Tests

Descriptive Statistics

Appendix 15

	N	Mean	Std. Deviation	Minimum	Maximum
Q9	120	4.4500	.79758	1.00	5.00
Province	120	2.5000	1.12272	1.00	4.00

Kruskal-Wallis Test

Ranks

	Province	N	Mean Rank
Q9	Sabaragamuwa	30	62.82
	Western	30	46.75
	Southern	30	63.52
	North western	30	68.92
	Total	120	

Test Statistics[a,b]

	Q9
Chi-Square	8.912
df	3
Asymp. Sig.	.030

a. Kruskal Wallis Test

b. Grouping Variable: Province

NPar Tests

Descriptive Statistics

	N	Mean	Std. Deviation	Minimum	Maximum
Q10	120	4.0417	.88304	2.00	5.00
Province	120	2.5000	1.12272	1.00	4.00

Kruskal-Wallis Test

Ranks

	Province	N	Mean Rank
Q10	Sabaragamuwa	30	62.68
	Western	30	58.73
	Southern	30	50.68
	North western	30	69.90
	Total	120	

Test Statistics[a,b]

	Q10
Chi-Square	5.576
df	3
Asymp. Sig.	.134

a. Kruskal Wallis Test

b. Grouping Variable: Province

Oneway

Descriptives

Q11

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
Sabaragamuwa	30	2.5000	1.07479	.19623	2.0987	2.9013
Western	30	2.5667	.77385	.14129	2.2777	2.8556
Southern	30	4.9000	.40258	.07350	4.7497	5.0503
North western	30	4.9333	.25371	.04632	4.8386	5.0281
Total	120	3.7250	1.38396	.12634	3.4748	3.9752

Descriptives

Q11

	Minimum	Maximum
Sabaragamuwa	1.00	5.00
Western	2.00	4.00
Southern	3.00	5.00
North western	4.00	5.00
Total	1.00	5.00

ANOVA

Q11

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	170.492	3	56.831	114.783	.000
Within Groups	57.433	116	.495		
Total	227.925	119			

Post Hoc Tests

Multiple Comparisons

Dependent Variable: Q11
LSD

(I) Province	(J) Province	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Sabaragamuwa	Western	-.06667	.18168	.714	-.4265	.2932
	Southern	-2.40000*	.18168	.000	-2.7598	-2.0402
	North western	-2.43333*	.18168	.000	-2.7932	-2.0735
Western	Sabaragamuwa	.06667	.18168	.714	-.2932	.4265
	Southern	-2.33333*	.18168	.000	-2.6932	-1.9735
	North western	-2.36667*	.18168	.000	-2.7265	-2.0068
Southern	Sabaragamuwa	2.40000*	.18168	.000	2.0402	2.7598
	Western	2.33333*	.18168	.000	1.9735	2.6932
	North western	-.03333	.18168	.855	-.3932	.3265
North western	Sabaragamuwa	2.43333*	.18168	.000	2.0735	2.7932
	Western	2.36667*	.18168	.000	2.0068	2.7265
	Southern	.03333	.18168	.855	-.3265	.3932

*. The mean difference is significant at the .05 level.

Means Plots