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LABOUR PRODUCTIVITY IN BUILDING CONSTRUCTION INDUSTRY



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**Dissertation submitted in partial fulfillment of the requirements for
the degree of Master of Science in Construction Project Management**

University of Moratuwa



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Declaration

I certify that this dissertation does not incorporate, without acknowledgement, any material previously submitted for a degree or diploma in any university and to the best of my knowledge and belief, it does not contain any material previously published or written by another person except where due reference is made in the text.

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Abstract

The concept of construction productivity began in the early 20th century with a series of time and motion studies to improve bricklaying operations. However, it still remains an interesting and a dominant issue in the construction industry, promising cost-savings, timely delivery and efficient usage of resources. Productivity is directly linked to motivation, and motivation is, in turn dependent on productivity. Suitable motivation is, therefore, a contributor to maximizing workers' productivity. The low motivation of construction workers has contributed significantly to the declining productivity that cannot be determined in the construction industry. The study seeks to unravel the factors that affect construction workers' motivation and the corresponding effect of the identified motivational factors on workers' performance and overall productivity. Fifty six factors which usually affect on motivation and productivity were obtained from preliminary survey and review of literature.

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Purposive sampling was employed to select the class of contractors due to the engagement of large number of workers as well as the volume of works undertaken. The sample size was determined from the research publications and 278 were selected as a representative sample, become on statistical theory of sampling.

A total of 278 questionnaires were administered for the survey. To the above sample out of which 264 responses were obtained representing 94.96% response rate. The survey revealed that, among the top ten critical factors (i.e. medical care, supervision, canteen facilities, on time payments, over time had great effect on motivation as well as impact on productivity. More so communication, love and belongingness, job security, accommodations, were among the critical factors. Considering the research findings, motivational recommendations were made to enhance productivity of workers.

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ABBREVIATIONS AND ACRONYMS

Total Quality Management	(TQM)
Total Quality Control	(TQC)
International Organization for Standardization	(ISO)
Gross domestic product	(GDP)
Construction Monitoring and Visualization Center	(CMVC)



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Chapter 1 INTRODUCTION

1.1 Background

Construction Industry has its own difficulties in improving productivity, as the product or service delivered is not standard according to the publication made on “*A Project Improvement System for Effective Management of Construction Projects*”, Mojahed Shahriyar (2005). Productivity improvement in the construction industry is a deliberate process to improve the capacity and effectiveness of the industry to meet the demand for building and civil engineering products, and to support sustained national economic and social development objectives. However, building construction industry in Sri Lanka, these difficulties and challenges are present alongside a general situation of socio-economic stress, chronic resource shortages, institutional weaknesses and a general inability to deal with the key issues in human resources. There is also evidence that the problems have become greater in extent and severity in recent years. (Sunday Observer, April 17, 2009)

Poor productivity of construction workers is one of the causes of cost and time overruns in construction projects. The productivity of labour is particularly important especially in country like Sri Lanka, where most of the building construction work is still on conventional type. Productivity in the construction industry in Sri Lanka is not only influenced by labour behavioral patterns, but also by other factors such as equipment, materials, construction methods, and site management. Concepts Equipment Management, materials Managements, construction methods, and site management and human recourse managements (Arditi and Mochtar, 2000) Total Quality Management (TQM) and Total Quality Control (TQC) have been implemented to achieve better productivity. Since the publication of the ISO 9000 series of standards in 1987 by the International Organization for Standardization (ISO) 9000, quality management has received attention around the world on an unprecedented scale. Initially, the adoption of ISO 9000 in the construction industry in Sri Lanka was slower than in manufacturing, and even now many small and medium size organizations *have voiced their concerns over the difficulty and cost of*

introducing an ISO quality system. Thus the construction industry preferred to adopt their-own in-house quality systems to increase productivity.

However the need to improve on quality and productivity is felt more and more..In Sri Lanka, very limited work has been done, to study the productivity in the Construction Industry. Nevertheless, it is felt that much has to be done to improve on it.

Construction projects are an important priority in Sri Lankan's national plans. The construction industry generally plays a vital role in a national economy due to the usage of its products such as roads, buildings and dams for the production of goods and services. An enhanced productivity has a positive effect on the gross domestic product (GDP) of every nation. In spite of the immense size and significance of the construction industry to the economies of most nations, its productivity is one of the controversial and least understood factors (Haskell, 2004).

In the global construction industry, site workers account for 40% of direct capital cost of large construction projects and there is the need to maximize the productivity of human resources (Thomas et al, 2004). More so 30% to 50% of workers time is spent directly on the work and, hence, there is the need for proper utilization.

1.2 Significance of Construction in the Sri Lankan Economy

Sri Lanka is a developing country that gained independence from British Colonial rule in 1948. Over the five decades of post independence, the traditional agriculture based economy has slowly been proliferating to a manufacturing based economy. In Sri Lanka, construction has contributed 6-7% to GDP over the past decade and is responsible for more than 50% of the total Gross Domestic Fixed Capital Formation (Central Bank, 2002). Employment generation by construction is about 5-6 % of the total labour force of the country (Sri Lanka Labour Force Survey, 2002). Construction in Sri Lanka, as in many other developing countries, depends mainly on the national plan of each political group in power. In the 1960s, private contractors readily satisfied the demand placed on them. The period from 1970-77 did not regard

construction as a key sector in economic development and there was not sufficient investment for essential infrastructure while housing was regarded as resource absorbing instead of resource producing (Medagedara, 1988). Sri Lankan economy underwent significant changes with the advent of an open market concept in the late 1970s'. Many local and international investments triggered a boom in construction during the post liberalization period. Land prices appreciated mainly due to proliferation of construction activities. All these changes led construction to become an important sector in the economy today.

Table I-1 Main Economic Indicator

	2003	2004	2005	2006	2007	2008	2009
GDP and Components							
GDP at real Prices	1,733	1,827	1,941	2,090	2,232	2,435	2,687
(Rs. / billion)							
GDP at current market prices	1,822	2,091	2,453	2,939	3,578	3,753	3,967
(Rs. / billion)							
GDP growth (%)	5.9	5.4	6.2	7.7	6.8	7.1	7.9
Agriculture, Forestry and Fishing							
% growth	1.7	0	1.8	6.3	3.3	3.6	3.9
Manufacturing Sector							
% growth	3.9	5.2	6.2	5.5	6.4	6.8	6.4
Services Sector							
% growth	7.6	6.7	6.4	7.7	7.1	7.6	7.8
Construction Sector							
% growth	3.7	5.9	9	9.2	9	9.4	9.6

Source of Information: Department of Census & Statistics / Central Bank of Sri Lanka

The construction industry is complex in its nature because it comprises large numbers of parties as owners (clients), contractors, consultants, stakeholders, and regulators. Despite this complexity, the industry plays a major role in the development and achievement of society's goals. However, in Sri Lanka, the construction industry

places a vital role in economical and physical development. Further in Sri Lankan economy, construction is the fourth highest sector after services, manufacturing and agriculture. The construction industry in Sri Lanka constitutes over 09.8 % of the Gross Domestic Product and has witnessed a steady growth for the last years.

In developing countries, building construction consumes about 70% of the construction investment. The situation in Sri Lanka is not different. The majority of construction workers are employed on building sites as civil engineering works are to a large extent mechanized. Hence the emphasis of this research is on labour productivity on building sites. It is assumed that any effort directed to improving productivity will greatly enhance the country's chances to realize its development goals. A number of studies have been conducted to examine factors impacting on project performance in developing countries.

1.3 Problem Statement

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“Labour Productivity is low in Building Construction Industry which can be improved in order to uplift the total productivity to meet the future challenges” Lack of workers’ motivation on construction sites has been identified and this has contributed the high employee turnover (Thomas et al, 2004). This has been a result of the difficulties in emphasizing the positive side of worker motivation. These have generated numerous attempts over the years to enhance workers’ motivation as it is essential to eliminate the negative side of motivation which may be more psychological.

There is therefore the need for craftsmen and other subordinates to be motivated by providing them with the right conditions and opportunity. A correlation exists between worker motivation and performance therefore; there is the need for worker to always feel motivated in order to increase performance.

According to Thomas et al, 2004, an unsatisfactory work environment can have an adverse effect on worker motivation that tends to make minimal effort towards work thereby lowering performance. This has contributed dwindling productivity that has

been a major problem confronting the construction industry today which has led to the declining productivity every year for the past decades. Aggregate productivity measurements and studies have shown long-term decline with little improvement. Another major study revealed that productivity cannot be determined if it has increased, decreased or remained constant (Haskell, 2004). The labour cost component of direct capital cost of large construction projects gives the indication that, there is the need for its maximum utilization so as to be productive.

Further, productivity is difficult to measure because of the heterogeneity of the industry's products and its input. Generally, productivity is stated as a constant, in-place value divided by inputs such as work hours. High productivity is also defined as the intensive and/or *efficient use of scarce resources converting input into output that makes more profit*. Some argue that productivity can be increased by working harder, faster, or longer. In the real world, productivity cannot be achieved only with speed and harder work without adopting better work practices. True productivity gains come from identifying and implementing the most efficient work processes to satisfy the client's needs. Therefore, *it is very much important to find innovative solutions to improve the productivity while mitigating the reasons for declining construction productivity in terms of management, labour or any other external issues to save billions of rupees and make construction a professional and attractive business.*

1.4 Justification of Study

Considering the nature of the industry's needs and problems, and resource constraints, mere formation of an agency does not guarantee the success of construction industry development. An important point worth stressing is that construction industry development is a continuous process. A number of countries at different levels of development have recently formulated long-term plans for improving their construction industries.

The construction industry should be transformed from an industry which is “dirty, dangerous and demanding” to one which is “professional, productive and progressive”. Desired outcomes of a construction industry development initiative are a professional, productive and progressive industry; a knowledge workforce; superior capabilities through synergistic partnerships; integrated process for high build-ability; contributor to wealth through cost competitiveness; and construction expertise as an export industry.

There is therefore the need for craftsmen and other subordinates to be motivated by providing them with the right conditions and opportunity. A correlation exists between worker motivation and performance therefore; there is the need for worker to always feel motivated in order to increase performance.

The construction industry generally plays a vital role in a national economy due to the usage of its end products such as roads, buildings, dams for the production of goods and service. The construction industry further contributes immensely to the gross domestic product (GDP). In Sri Lanka, an overall GDP growth rate of 5.8% and 6.2% were realized compared to targeted figures of 5.8% and 6.0% in the year 2005 and 2006 respectively. This was largely attributed to the boom in construction activities in those years. An increase in an organization’s productivity in this sense leads to an increase in its annual turnover of construction companies which in turn promotes a country’s overall GDP growth.

Generally, a company’s productivity level is a reflection of its success and this depends on the motivation of workers. It has been discovered that labour accounts for up to a third of the total productive or non-productive time on construction site and its cost component has even risen in recent years as employers are always met with demands for higher base pay and increasing fringe benefits (Akindele, 2003). Lim and Alum (1995) productivity studies on issues encountered by Singaporean contractors revealed that, difficulties encountered in recruiting supervisors and workers lead to the low productivity in the country’s construction industry. One could adduce from this finding that the high labour turnover and communication in the construction

industry contributed to the decline in worker motivation and that further impacted negatively on productivity.

Management of the construction industry is, therefore, faced with the task of ensuring that a congenial working environment is established so as to motivate workers to stay and deliver their best. This will eliminate time overrun which is usually accompanied by cost escalation and, hence, the achievement of improved productivity. Furthermore non-empirical evidence indicates that productivity is difficult to measure in Ghana and other parts of the world since management of construction companies are unwilling to furnish researchers with data that enables the determination of productivity. This study is, therefore, to find strategies of motivating workers to improve performance which will, in effect, impact on productivity which contributes to national economic growth.

1.5 Aim and Objectives

The aim of this research is to develop ways of improving productivity through varied motivational strategies. This is as a result of the declining trend of productivity and difficulties in its measurement in the construction industry. In view of this, the research is to look into the problems relating to motivation in construction companies in Sri Lanka. The objectives of the above study include:

- i. To identify and evaluate the most significant factors affecting on productivity in building construction industry
- ii. To Study the effect of labour behavioral pattern for the productivity in building construction industry
- iii. To develop / implement better practices to achieve better construction performance
- iv. Recommendation of strategies to develop highly motivated and satisfied work force at construction sites.

1.6 Research Methods and Design

The methods and design adopted for this work is summarized in below.

1.6.1 Literature review

A thorough review of literature (i.e. publications, trade and academic journals) to identify factors that causes behavioral change and also the factors that influence productivity in the construction industry elsewhere. Various theories of motivation were reviewed to see how they can be related to the structure of the construction industry.

1.6.2 Field survey

The research involved the design, development and administration of questionnaire. The sample size was determined through the past research papers. However, distribution of questionnaires was done through random distribution. The questions were developed from information gathered from the review of literature and preliminary survey and from the past experienced I had. Respondents were asked to give their opinion on general level of motivation and productivity in their respective. Furthermore, the factors gleaned from the literature were rated in order of degree of effect on motivation and significance on productivity from the perspective of respondent. The questionnaires were distributed and retrieved personally. Respondents were given two weeks after distribution to complete them.

1.6.3 Analysis of data

The administered questionnaire was gathered and all data received were summarized. A critical analysis of summarized data was conducted by determining influential indices such as frequency, importance and severity on the various reviewed factors rated which enabled the researcher to:

- i. Establish factors that motivate workers.
- ii. Establish the effect the factors have on productivity.
- iii. Recommend workable and suitable strategies that will motivate and enhance productivity improvement in the building construction industry.

Details of the research methods and design can find in Chapter 3.

1.7 Scope and Limitation

Due to limited time availability and busyness of the Projects Managers, Engineers, I have used trades man from representing different trades such as meson, carpenter, welder....etc who are work in ICTD classifications M1 to M5 for the main survey. The questionnaire was prepared basis on the motivational factors to determine the productivity level at the work site. The sample size was determined by the literature survey. The research finding is focused only the workers feels and they are thoughts. The accuracy level of the feelings and thoughts are difficult to measure.

1.8 Organization of Chapters



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The study is organized in five chapters:

- Chapter 1 provides background information about the importance of productivity in the construction industry. This chapter elaborates on the problem statement and the justification of the study. It further highlights on the aims and objectives of the study as well as a brief on the research methods and the scope of the study
- Chapter 2 provides an overview of the construction industry and its contribution to the national economy. It also details the concepts of motivation and productivity, and describes factors that influence motivation and productivity of construction projects, identified by other researchers

- Chapter 3 provides information about the methods and procedure of the study used to achieve the objective. This chapter provides background information of research methodologies and justification for the research method implemented for this research.
- Chapter 4 presents the analysis and interpretation of findings of the survey. It further discusses the findings obtained in the survey.
- Chapter 5 summarizes the procedure and findings of the research, its contribution, and offers recommendations for management action to ensure workers motivation and enhancement in productivity.

1.9 Chapter Summary

This chapter provides an overview of background of the study which is focused to highlight the significance of the construction industry in the Sri Lankan economy base on the main economic indicators while giving the justifications to the research problem statement. Further this chapter is discussed the research aim and objectives. The theoretical framework and research methodology were stated briefly. The study is organized in five chapters.

Chapter 2 LITERATURE REVIEW

2.1 Introduction

Productivity in general has been defined in the Cambridge International and Oxford Advance Learner's dictionaries as "the rate at which goods are produced with reference to number of people and amount of materials necessary to produced it". On the other hand, productivity has been defined as the utilization of resources in producing a product or services (Gaissey, 1993). It has further been defined as the ratio of the output (good and services) and input (Labour, capital or management). The definition of productivity is utilized by economists at the industrial level to determine the economy's health, trends and growth rate whiles at the project level, it applies to areas of planning, cost estimating, accounting and cost control (Mojahed, 2005). This has been given a mathematical expression as follows:

$$\text{Productivity} = \frac{\text{Output}}{\text{Input}}$$

(Heizer and Render, 1999)



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Clearly, it can be seen from the mathematical expression that productivity will increase when output increase with input being constant or decreasing input with output constant. The United States for almost 100years, was able to increase productivity at an average rate of 2.5% per annum and that doubled their wealth every 30years (Heizer and Render, 1999). Productivity improvement can be realized if the following factors can be accomplished.

- (i) Faster set-up of machine tools
- (ii) Better quality control
- (iii) More flexible in changing product specification.
- (iv) Proper material handling

Surely, there exist a positive correlation between productivity and some variables namely: Labour; Material; Capital; and Management. Total factor productivity gives a

more general definition of productivity and it takes into consideration the combination of various input factors and is measured as follows:

$$\text{Total Factor Productivity} = \frac{\text{Total Output}}{\text{Labour} + \text{material} + \text{equipment} + \text{energy} + \text{capital} + \text{management}}$$

Construction productivity carry immense consequences for the national economy as a whole, however it remains one of the least understood subjects in. The Bureau of Labour Statistics maintains productivity indices for all industries of the national economy except for the construction industry due to inadequate data (Haas et al, 1998)

2.2 Factors Affecting Productivity

Several factors affect labour productivity and prominent among them is the basic education for any effective labour force. In addition to the above is the diet of the labour force and social overhead such as transportation and sanitation (Heizer and Render, 1999). Furthermore, motivation, team building, training and job security have a significant bearing on the labour productivity. Coupled with the afore-stated factors, labour productivity cannot be achieved without maintaining and enhancing the skills of labour and human resource strategies. Better utilized labour with stronger commitment and working on safe jobs also contribute to affect labour productivity (Wiredu, 1989).

Improving productivity is a major concern for any profit-oriented organization, as representing the effective and efficient conversion of resources into marketable products and determining business profitability (Wilcox *et al*, 2000). Consequently, considerable effort has been directed to understanding the productivity concept, with the different approaches taken by researchers resulting in a wide variety of definitions of productivity (Lema, 1995; Pilcher, 1997; Oglesby, 2002). Productivity has been generally defined as *the ratio of outputs to inputs*.

Construction projects are mostly labour-based with basic hand tools and equipment, as labour costs comprise 30 to 50 % of overall projects costs (Guhathakurta and Yates, 1993). Therefore, while numerous construction labour productivity research studies have been undertaken, only a few have addressed the productivity issue in developing countries. Lema (1995) observed that labour productivity data were not available from Tanzanian construction established on the basis of actual site observations. Accordingly, on the basis of limited data, it was concluded that labour utilization on construction sites was less than 30 % in Tanzania.

Olomolaiye *et al* (1998) briefly studied labour productivity on construction sites in Nigeria. Their study concluded that there was a need for establishing output figures on various construction sites through time study techniques. It was concluded that method studies and research results should be disseminated not only to large firms but also to small firms so the most productive working methods (or best practices) could be adopted by operatives, resulting in increased output without necessarily increasing physical efforts.



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Lim *et al* (1995) studied factors affecting productivity in the construction industry in Singapore. Their findings indicated that the most important problems affecting productivity were: difficulty with recruitment of supervisors; difficulty with recruitment of workers; high rate of labour turnover; absenteeism from the work site; and communication problems with foreign workers. Olomolaiye *et al* (1996) studied factors affecting productivity of craftsmen in Indonesia, with their findings indicating craftsmen in Indonesia spent 75 % of their time working productively. Five specific productivity problems were identified: ie lack of materials; rework; absenteeism; lack of equipment; and tools.

Although some research has been carried out on factors influencing productivity, there is still a lot to be done even in developed countries. To improve productivity, the impact of each factor can be assessed by statistical methods and attention given to those particular parameters that adversely affect productivity. Previous studies looked

at the construction industry as a whole, yet the majority of the workers are employed on building sites. Most civil engineering projects are mechanized.

Various factors have been identified by different researchers from the time aspect in different construction industries. Lack of materials, incomplete drawings, incompetent supervisors, lack of tools and equipment, absenteeism, poor communication, instruction time, poor site layout, inspection delay and rework were found to be the ten most significant problems affecting construction productivity in Thailand. Kaming et al [3] found out that lack of materials, rework, worker interference, absenteeism, and lack of equipment were the most significant problems affecting workers in Indonesia. Olomolaiye et al [4] found that the five most significant factors in Nigeria are lack of materials, rework, and lack of equipment, supervision delays, absenteeism, and interference. Lack of materials, weather and physical site conditions, lack of proper tools and equipment, design, drawing and change orders, inspection delays, absenteeism, safety, improper plan of work, repeating work, changing crew size and labour turnover were found out to be the most critical factors in Iran [24]. Lim and Alum [2] found that the major problems with labour productivity in Singapore are recruitment of supervisors, recruitment of workers, high rate of labour turnover, absenteeism at the workplace, communication with foreign workers, and inclement weather. Yet Lema [25] through a survey of contractors in Tanzania found out that the major factors that influence productivity are leadership, level of skill, wages, level of mechanization, and monetary incentives. Motwani et al [11] found out through a survey in USA that five major problems that impede productivity are adverse site conditions; poor sequencing of works; drawing conflict/ lack of information; searching for tools, materials, and poor weather. By the literature cited above, there are various factors that affect productivity to different levels in different industries. However, lack of materials comes out as a common problem among the critical ones. The experience of the authors is that most building sites in Uganda normally have stocks of different materials on site and as such may be not the most critical problem.

The construction industry presents a substantial portion of any nation's economic output. Thus developing best practices to improve the economic output of the

construction industry is very important with cumulative benefits to investors, clients, consultants, contractors and the work force.

Construction productivity improvement is one of the key focus areas of the present construction industry in the world. In spite of the construction industry's value of the national economy of nation, the decline in construction productivity across the world has been reported by many reporters and researchers. Given the current construction boom in many nations including Canada, industry stakeholders are desperate to meet demand and minimize escalating costs through improved productivity.

2.2.1 The Role of Management

Mojahed (2005) and Oglesby et al. (1989) defined motivation as inciting unconscious and subconscious forces in people to achieve particular behaviors by them. It is, therefore, important that a motivational climate be developed for workers to perform more efficiently, thereby causing an increase in the construction productivity (Mojahed, 2005). In the classical theory by Taylor, (one of the widely recognized theorists on leadership and management), it is believed that the basis of increasing productivity was more of technology and, therefore, demanded that leaders should enforce pre-established productivity criteria to meet fixed goals. Mayo, on the other hand, postulated the humanist theory and stated that the role of a leader is to attain goals by the provision of opportunities for growth and development for the workers. Productivity improvement would be possible if workers are allowed to contribute their quota in all operations of a company. Leadership, therefore, remains the most single important aspect of enhancing productivity on construction projects. Everyone therefore on a construction project is, therefore, a leader as a result of the role played in different ways at different times whilst working towards the fulfillment of concept of a leader. They, therefore, demonstrate the willingness to react to worker environmental needs which in effect will motivate them to work at their highest level. Democracy, therefore, needs to be practiced to allow for broader participation of team members (Berg and Magnus, 1999; Olabosipo et al 2004). Business Roundtable (1989) edition of motivation in the construction industry reported that foremen are

often unable to motivate the average craftsman today but suggested that craftsmen will motivate themselves given the right conditions and opportunity. Management of construction on site is in this instant said to start from the foremen and can have an impact on the performance of the workforce hence the productivity as a whole. A study conducted on 703 construction workers revealed that foremen have a strong impact on worker motivation, performance and satisfaction (Halligan et al, 1994). The onus, therefore, lies on management to assign qualified foremen from whom subordinates will derive inspiration from their qualities. This will persuade workers to always work productively.

2.2.2 Work Environment

According to Russell (2001) as cited by Mojahed, the elimination of negative attitudes on a job that requires management of perception such as asking questions and getting feedback will foster a motivational and productive environment. Couple with these, Chase (1993) stated that combining training, orientation for new workers, provision of safe environment, encouragement of two-way communication, worker participation in planning and decision making, and individual / team recognition may be utilized to achieve worker satisfaction goal.

Oglesby (1989) in Mojahed (2005) studied individual work situation and pointed out that pay ranked top in importance. It has been generally believed by builders that workers wages become an important motivational factor and incentive compensation has a direct and beneficial effect on productivity; more pay results in more productive work (Mojahed, 2005). Since workers are directly responsible for carrying out construction works, suitable motivation is necessary for maximizing their productivity.

2.2.3 Workers Expectation

Olomolaiye et al (1989) also quoted by Olabosipo et. al (2004) stated that, pay is a lower level motivator and should not be treated as a prime motivator. Mojahed (2005)

in his study into project improvement system for effective management of construction projects cited Lui (2002) research which revealed that workers with more experience and education expect higher pay than those with less experience and education. The findings also elaborated that when workers are underpaid relative to their expectation or to other workers with comparable skills and demographic characteristics, they tend to reduce their effort which in effect impact on productivity negatively. These confirm Adams' equity and Vroom's expectancy theory respectively. In a study of the impact of non-financial incentives on bricklayers' productivity in Nigeria, it was ascertained that non-financial incentive schemes are the preferred methods of motivating operatives and these goes to improve significantly the productive time of operatives between 6% to 26%. Small firms in the above mentioned study were seen to have absolute preference for non-financial incentive schemes that do not have capital outlay due to reasons of affordability (Olabosipo et al, 2004). According to Borcharding (1978) five peculiar motivational problems encountered on large construction projects are: minimal knowledge about the project; lack of participation in decision-making; inadequate communication and coordination between crews and supervisors, detrimental changes in the work, as well as supervision and manpower that reduce learning curve efficiency improvement.

2.2.4 The Role of Foremen

Clarke and Morris (1980) study on of U.S. workers to determine attitudes towards productivity as quoted by Mojahed (2005), it was established that involvement in decision-making, recognition through financial rewards, and job security are important motivational factors for workers to work harder to give out their best. However in the study of impact of non-financial incentives on bricklayers' productivity in Nigeria, job security was assigned the least importance by both management and the bricklayers. The issue of low priority placed on job security might be due to the transient and ad-hoc nature of labour (Olabosipo et al, 2004). Zakeri et al. (1997) in a survey of construction operatives in Iran also revealed that, fairness of pay, incentives or financial rewards, on-time wage payment, good working facilities, and safety were the most important motivational factors.

Kaming et al (1997) on the other hand researched into Indonesian construction operatives and revealed that, fairness of pay, good relation with workmates, overtime payments, bonuses, and good safety programs were the motivational factors that exist on Indonesia projects. Furthermore, disrespect from supervisors, little accomplishment, lack of cooperation among workmates, and unsafe working conditions were seen to be de-motivators (Mojahed, 2005).

Further to the above, research into de-motivating factors influencing the productivity of civil engineering projects in Hong Kong showed that foremen changes and incompetence were rated low. These was because workers took considerable pride in the work they accomplish and having work to be redone can be extremely dissatisfying (Thomas et al, 2003). However, it has been established in the study of relationship between project leadership, team composition that, with the exception of the profession or background of a project leader, qualification, leadership style and team composition were found to correlate positively with the overall project performance (Odunsami et al, 2003).



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It is estimated that 6.5% excess of cost is observed through poor safety practices in construction (Haliigan et. al., 1994). It can be inferred that record more than 6.5% of cost through accidents if safety is not adhered to. Occupational injuries can harm the reputation of firms, decrease productivity and in effect results in huge cost. According to Kazaz and Ulubeyi (2006), the cost of all accidents and work-related illness in the United Kingdom amount to 2- 3% of total gross domestic product of the country. In the research into drivers of productivity among construction workers in Turkey, Kazaz and Ulubeyi (2006) revealed that the construction sector has the highest total accidents on the job with 10.48%. According to Worker Health and Worker Safety Charter of Turkey, a doctor needs to be engaged on site if workers strength of the organization is at least 50 but the principle is generally followed when the number is much greater than 50. Managers, therefore, agree that employing a doctor on site do not only have the legal implication but rather economics as well as workers spend only 10- 15 minutes in on-site consultation than a full day (Kazaz and

Ulubeyi, 2006). Workers working in an environment where accidents or injuries frequently occur will always be extremely cautious at work and this will affect individual performance. There is, therefore, the need for adequate safety plans for workers that will change attitudes on work enhance performance and this will affect overall productivity.

2.3 Motivation in the Construction Industry and Its Effect on Productivity

A definition of motivation is “the set of processes that determine the choices people make about their behaviors. Motivation is an abstract term. It imparts incentives that require a response on part of someone else to achieve a defined goal. In business, motivation is not synonymous with salaries; money is a means for accommodating the economic needs of workers. Motivation means an inner wholesome desire to exert effort without the external stimulus of money. Motivating is the ability of indoctrinating the personnel with a unity of purpose and maintaining a continuing, harmonious relationship among all people. It is a force which encourages and promotes a willingness of every employee to cooperate with every member of the team. To maintain it is to create and perpetuate the climate which brings harmony and equilibrium into the entire work group for the benefit of all who are involved – the company as a whole (Wilbert Scheer 1979). Since the effective motivation comes from within, by motivating others, the manager can do more than create proper conditions that cause people to do their work willingness and enthusiasm.

A person’s motivational, job satisfaction and work performance is determined by the strength of these sets of needs and expectation and the extent to which they are fulfilled. Some people for example may choose to forgo intrinsic satisfaction and social relationships for a short term in return for high economic rewards and others vice versa. This goes to confirm Horlick (nd) assertion that the vast majority of people regard money as an important and a motivator at work but the extent of motivation depends upon the personal circumstances and the other satisfactions they derived from work (Mullins, 2005).

The complex and variable nature of needs and expectations give rise to the following simplistic but useful, broad three-fold classification of motivation to work namely:

- Economic reward- It is an instrumental orientation to work and includes items such as pay, fringe benefits, pension right, material goods and security.
- Intrinsic satisfaction- This is a personal orientation to work and concern with 'oneself'. It is dependent on the individual attitude and varies from person and circumstances. It also varies from jobs and different part within the same the job. It is derived from the nature of the job itself, interest in the job, and personal growth and development.
- Social relationship- It is the relational orientation to work and concerned with the other people. It is an important feature in all set ups. It improves the supportive working relationships and teamwork and comprises friendships, group working and the desire for affiliation, status and dependency.



Figure 2-1 Needs and Expectations of people at work (Mullins, 2005)

Every organization is concerned with what should be done to achieve sustained high levels of performance through its workforce. This means giving close attention to how individuals can best be motivated through means such as incentives, rewards, leadership etc. and the organization context within which they carry out the work

(Armstrong, 2006). The study of motivation is concerned basically with why people behave in a certain way. In general it can be described as the direction and persistence of action. It is concerned with why people choose a particular course of action in preference to others, and why they continue with chosen action, often over a long period, and in the face of difficulties and problems (Mullins, 2005).

Motivation can therefore be said to be at the heart of how innovative and productive things get done within an organization (Bloisi et. al., 2003). It has been established that motivation is concerned with the factors that influence people to behave in certain ways. Enhance the knowledge on the basic motivational theories are highly important in order to prepare a questionnaire for the sample was selected for this research.

2.3.1 Maslow's Hierarchy of Needs Theory

Maslow (1943) made a basic proposition that people want beings. This proposition was based on the way people are always looking for more wants, and their wants are dependent on what they already have. With this he suggested that human needs are arranged in a series of levels, a hierarchy of importance. He identified eight innate needs of man, including the need to know and understand, aesthetic needs, and the need for transcendence. However the hierarchy is usually shown as ranging through five main levels from the lowest need being physiological, through safety needs, love needs and esteem needs to the highest level of needs being self actualization (Mullins, 2005). This theory states that when a lower need is satisfied, it is no longer a strong motivator and hence the demand for the next higher need becomes dominant and the individual's attention is turned towards satisfying this higher need. It states that only unsatisfied needs motivate an individual (Mullins, 2005; Armstrong, 2006). Irrespective of the demand for satisfaction of higher needs, it has been established that self-actualization being the highest level can never be satisfied (Armstrong, 2006).

Physiological needs: - It is the basic need of life. It comprises the need for relief from thirst, hunger, physical drive, oxygen, sexual desire

Safety needs: - This includes safety and security, freedom from pain or threat of physical attack, protection from danger or deprivation, the need for predictability and orderliness.

Love: - It is sometimes referred to as social needs and includes affection, sense of belonging, social activities, friendship, and both the giving and receiving of love.

Esteem: - It is also often referred to as ego and includes self respect which involves the desire for confidence, strength, independence and freedom. In addition is esteem of others which involves reputation or prestige, status, recognition, attention and appreciation.

Self-actualization:- This is the development and realization of one's full potential. Maslow saw this level as what humans can be, they must be, or becoming everything that one is capable of becoming. It is the need for develop potentialities and skills, to become what one is believes one is capable of becoming (Mullins, 2005; Armstrong, 2006; Bloisi et. al., 2003)

Maslow (1943) claimed that the hierarchy is relatively universal among different cultures, but recognizes that there are differences in an individual's motivational content in a particular culture. He further pointed out that a need not be fully satisfied before the arisen on subsequent need and cited about 85% satisfaction in physiological needs, 70% in safety, 50% in love, 40% in esteem needs, and 10% in self-actualization (Mullins, 2005). He suggested that most people have these basic needs in the hierarchical manner and also stated that the hierarchy is not a fixed order as some individuals will have theirs in the reverse way. This he cited examples as:

- Self- esteem may seem to be more important than love to some people and is the most common reversal of the hierarchy. This is because the most loved person is strong, confident or inspires respect.
- For some creative individual, the drive for creativity and self-actualization may arise despite lack of satisfaction of more basic needs.
- People who have experienced chronic unemployment may have higher level needs lost in them since they will continue to be satisfied at lower levels only.

- People deprived of love from childhood may experience the permanent loss of love needs.
- A need which has continued to be satisfied over a long period of time may be undervalued. People who have never suffered chronic hunger underestimate its effect and regard food as unimportant. Therefore people who are dominated by higher-level need, this may assume greater importance than more basic need.
- People with high ideals or values may become martyrs and give up everything else for the sake of their belief (Mullins,2005)



Figure 2-2 Maslow's hierarchy of need model (Mullins, 2005, Bloisi et al, 2003)

Stum (2001) as quoted by Mullins (2005) studied the dynamics between an individual and the organization, and proposed a new worker / employer social contract that enables organizations to improve worker commitment and retention. The five levels of workforce needs hierarchy are shown in performance pyramid:

- **Safety / security:** - The need to feel physically and psychologically safe in the work environment for commitment to be possible.
- **Rewards:** - The need for extrinsic rewards in compensation and benefits.
- **Affiliation:** - The intrinsic need for a sense of belonging to the work team or organization.
- **Growth:** - Addressing the need for positive individual and organizational change to drive commitment.

- Work / life harmony: - The drive to achieve a sense of fulfillment in balancing work and life responsibilities.

2.3.2 Alderfer's Need Modified Theory

Alderfer's (1969) modified need hierarchy theory was developed from Maslow's hierarchy need theory. It condensed the five levels of need in the hierarchy need into three levels: existence; relatedness; and growth which emerged the other name as ERG theory.

- Existence needs: - They are concerned with sustaining human existence and survival, and it covers physiological and safety needs.
- Relatedness needs: - This focused on the relationships with the social environment and it encompasses love, affiliation and a meaningful interpersonal relationships safety and esteem needs.
- Growth needs: - It is concerned with the development of potential, and cover self-esteem and self-actualization.



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Alderfer (1969) suggested that the individual progresses through the hierarchy from existence needs, to relatedness and to growth needs as the lower needs become satisfied. The activated need in his view is more than one and therefore, suggested that individual need is more of continuum than hierarchical. Alderfer postulated a two-way progression and cited a frustration-regression process as the downward trend. He said the lower level needs become the focus of the individual's effort when continuous frustration is experienced in the quest for higher level needs. He further suggested that lower level needs need not to be completely satisfied before the emergence of a higher level. The ERG theory states that an individual is motivated by one or more set of needs. In this sense if a person's quest for a need is blocked, then attention should be focused on the satisfaction of needs at other levels (Mullins, 2005).

2.4 Case Study for Tool time Investigations in Canada

During the case study carried out for the investigation tool time in Canada following observations were made out of 101 workers from 4 construction sites.

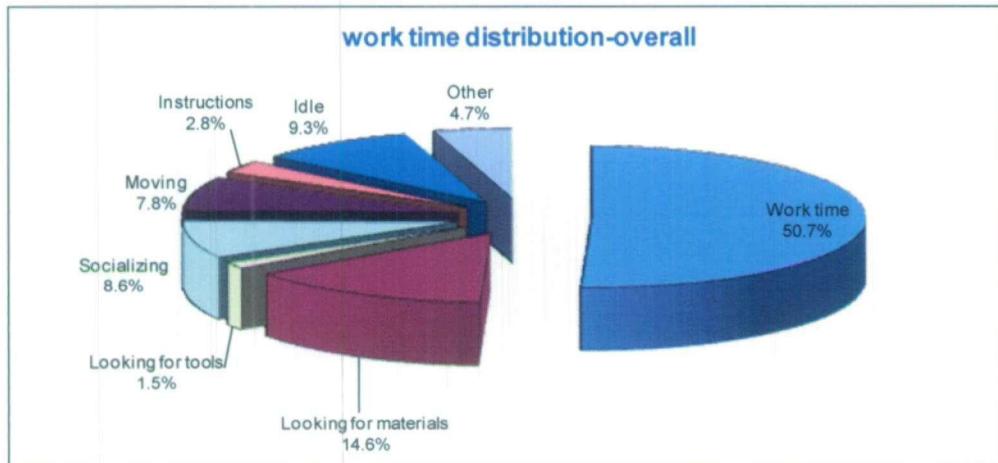


Figure 2-3 Tool time investigation for form work

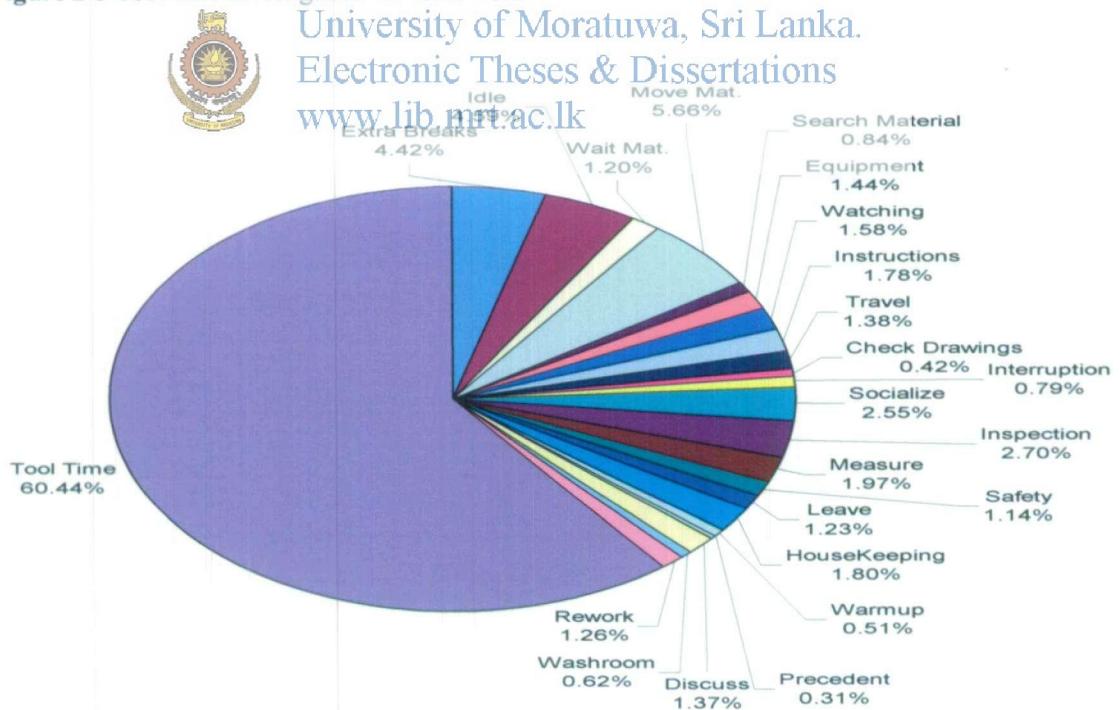


Figure 2-4 Tool time investigation for Slab work

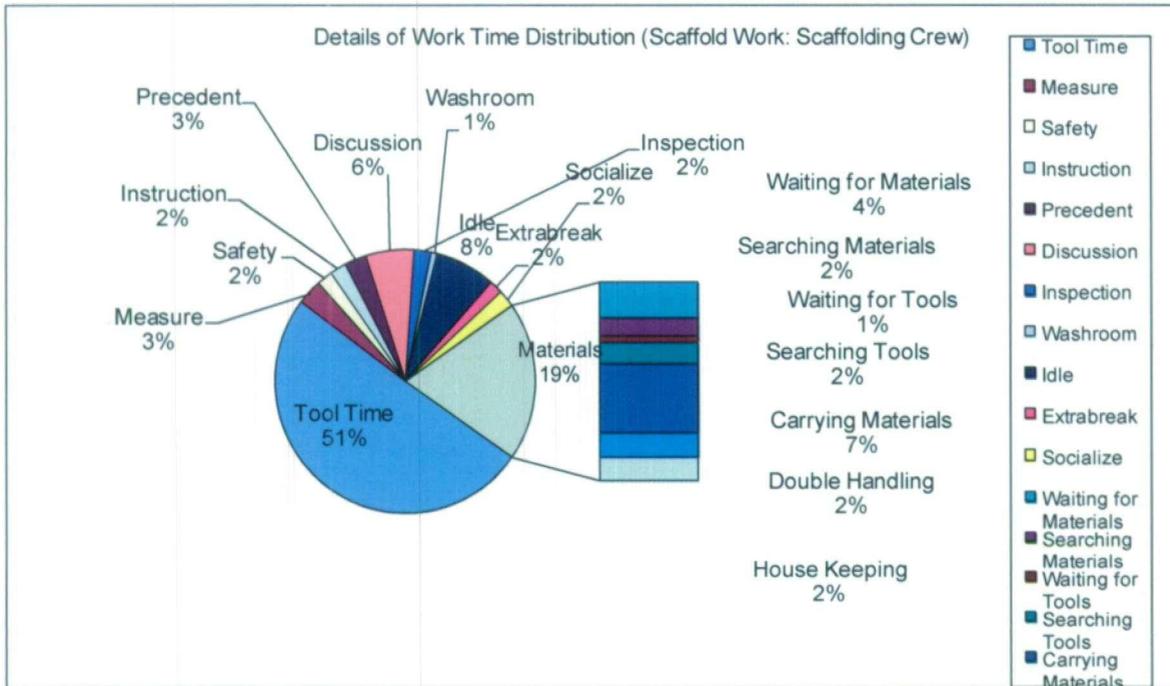


Figure 2-5 Tool time investigation for Scaffolding work


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- 2.4.1 Top Ten Targets for Improving Construction Productivity**
- Highly motivated, and satisfied workforce
 - Best practices model for supervision
 - Better working relationship model between sub-contractors and the main contractor
 - Efficient materials, tools, and equipment management
 - Tool time optimization by adopting best work practices
 - Optimize work practices and workface planning
 - Information technology based on-site communication framework
 - Better integration between site and office management
 - Weather related issues
 - Project stakeholder issues – owner, architect, changes, etc.

2.4.2 Information Booth

The researchers have found that the morning tool box meeting in which foremen communicate the day's planned activities to workers lacks effectiveness and enthusiasm. Some workers pay less attention to the routine nature of the meetings. This happens for a number of reasons. Examples include the foreman's inability to communicate work expectations or to explain the scope of the work. Workers notice that the visual representation of the work is not adequately demonstrated. Some workers also found it difficult to understand the nature of work due to lack of their own technical skills. The researchers also noted that supervisors do not deliver the information in a format that is easily understood by the workers.

As a solution to these problems, the researchers have come up with a communication tool that could save many purposes- A computer information kiosk equipped with important jobsite information called as information booth.

The information booth, which revolutionizes on site communication, provides workers with



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- a. information such as daily and weekly productivity targets
- b. assignments for each worker/crew
- c. special technical information for each worker
- d. updated safety instructions
- e. long term jobsite targets
- f. three dimensional models of the assigned construction work and finished products

A prototype information booth was introduced to construction sites as a pilot project, assisting foremen to effectively deliver tool box meetings, which resulted in numerous benefits.

- a. Increased tool time
- b. Increased productivity
- c. Improved the worker satisfaction

- d. Improved the two- way communication between site management and workers
- e. Motivated foremen for proactive planning
- f. Improved the worker awareness regarding safety and work targets

2.4.3 Ten week Testing Model

The tool time in structural trades of construction projects ranges between 40% to 60% based on the researchers' finding during the last 5 years. The researchers evaluated the amount of time workers spent using tools, conducting supportive activities and engaging in ineffective activities. In order to be productive, the supportive activities like safety meetings and instruction time must be optimized while the ineffective time like interruptions, waiting for materials and unplanned breaks must be reduced.

A concept called the "Ten Week Testing Model" was applied on Calgary construction projects, with the purpose of identifying inefficient areas in material, labour, equipment, and information management, and to develop better practices to eliminate inefficient work procedures. The researchers monitored the construction work and identified several inefficient work practices. They then discussed strategies to improve efficiency with site management. Better practices were develop and implemented with the support of site management.

Base on the findings of this model the researchers concluded that site efficiency could be benefited from an additional layer of supervision to ensure that inefficient work activities are reduced or eliminated. Better work practices benefit projects, as materials are properly organized, extra break are reduced and unskilled workers are given proper direction. Overall, the researchers suggested a series of 52 sites –specific practices that could be improved to increase efficiency.

The outcome of the implementation of the model convinced the researchers to suggest contractors to introduce a new manager, Productivity Improvement Officer / manager to the jobsite. The officers' job would be to assess and refine all jobsite practices, to

ensure each is being conducted as efficiently as possible. This position can be a permanent role or a rotating role of the site management team. The productivity – implement officer’s role was implemented by the researchers for 10-week cycles for two construction projects with many value added benefits.

2.4.4 Work Area Optimization

Operations in the construction work area are affected by a number of disruptions that usually impact the efficiency of the work force and reduce their overall productivity. The causes be broad categories are congestion, work process variability, and lack of proper and timely decisions with regards to resource allocation and usage. Measures to address these problems in a timely fashion to mitigate their adverse effects could lead to higher efficiency and productivity.

A new process planning model suggested by the researchers involves craft workers and sub-trades identifying constrains and planning the activities in the work area in a systematic manner to mitigate congestion. The work area congestion evaluation tool is effective in assisting to quantify the productivity losses and identifying the situations to be mitigated. The modified “look ahead” schedule information gathering from suggested by the researchers identifies resource requirements and conflicts before construction begins. As these suggestions involve the active participation of the sub trades, there is a sense of ownership with the implementation of the construction plan. The application of the process planning model in concert with the suggested best practices produced significant results in the construction work area, in terms of increased tool time and productivity and less work area congestion.

2.4.5 Web Based Materials Management

According to research on tool time done over the last 5 years, materials handling accounts for 14% to 20% of overall tool time. As the cost of material handling is very significant, reducing time spent on inefficient material handing results in numerous benefits. The researchers investigated the root causes and found three interrelated

areas of significance: crane schedule integrated with material delivery, material storage and site positioning, and contractor supplier coordination.

The solution was to create a web-based software application that is accessible to contractor, subcontractors and suppliers.

The model has the functionality of listing material needs for a specific activity, providing inventory and storage areas, generating purchasing orders, scheduling deliveries, and establishing detailed crane schedules. It can also provide real-time visual site information to assist with storage arrangement when connected to a wireless site camera.

Using the detailed crane schedule generated through the model, ineffective time was significantly reduced when the model was partially applied to Calgary Construction Projects, resulting in considerable increases in tool time and productivity.

An effective outcome was the development and implementation of an integrated schedule that would not permit reduction in time allowances or interruption of the trades requiring the crane time due to a sudden delivery of material by a supplier.



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2.4.6 Best Supervision Model

Due to the lack of qualified construction workers to fulfill market needs, supervision of workers has become a key area which needs improvement, to increase the efficiency and the productivity of construction projects.

The researchers grouped construction workers into four broad categories based on technical capability and motivation due to supervision. The research team reasoned that each type of worker would respond best to a particular style of supervision. The first group consists of those workers with strong technical abilities and who are highly motivated by supervision. This group expects direction or delegation from supervisors. The second category comprises of those workers with weak technical

abilities who are highly motivated by supervision. This second group needs a supervisor's style focusing on technical guidance. The third group requires supervisors to provide mentoring as the workers have weak technical skills and are not motivated by supervision. The last group prefers the supervisors to motivate them as they possess strong technical skills but lower motivation due to the current mode of supervision.

The research team then assessed foreman's managerial style and concluded that those styles could significantly influence the average worker's productivity. The researchers proposed to structure the crews to match worker's perceptions and abilities with foreman's managerial styles to improve alignment and cohesiveness which, in turn, increased productivity and workers motivation. This was pilot tested with successful results.

2.4.7 Virtual Supervision

There are many problems in implementing technological systems due to lack of integration between the existing systems. Integration is essential to process and transfer information using protocols understood by the site workers for efficient two way communication.

Better utilization of supervision time is key factor in improving communication in construction projects. Popularity of remote access cameras in the construction industry has increased drastically during the last few years. The concept of virtual supervision is based on information management and a supervision time optimization model. This Virtual Supervision model enables supervisors and other stakeholders of a project to monitor construction activities remotely and address issues by using a surveillance camera system integrated with several other technological tools.

The objective of the Virtual Supervision model is to improve efficiency, communication and workers satisfaction. The virtual supervision model will aid in

efficient information flow among the site office, site, head office, and other stakeholders of a construction projects.

The recently developed Information Booth will be linked with the camera systems and other technological devices to optimize Virtual Supervision and to integrate various processes on construction sites to improve efficiency and productivity.

2.4.8 Automated Tracking

This research is focused mainly on the development of a fully automated system that extracts data from construction worker activities and operations in real time, so that tool time can be measured and worker productivity assessed without any personnel involvement. This system uses signal processing techniques for data extraction from digital video images, audio files and thermal images of construction work activities. This data extraction system was develop to track construction workers and their movements within a given work area.

2.4.9 Optimizing Site Layouts



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Proper construction site layout planning is essential for the success of any project and has a significant impact on the economy, safety and productivity of the project. The objectives of planning a site layout are to determine what temporary facilities (Such as storage, temporary office, welding workshop) are required to accomplish the project and to optimize their location in space and time through out the project. Moreover optimization of the location of temporary facilities can increase labour productivity by improving the work environment. In fact, a well planned site can minimize travel time, decrease time and effort spent on material handling, increase tool time and productivity and improve safety and worker satisfaction. Depending on whether the site is spacious or congested planning of the site layout is a dynamic problem due to the constantly changing nature of a project and various parameters that have to be taken into account for optimizing the location of temporary facilities. The researchers are developing a computer model to assist contractors in planning

efficient site layouts. The model will simultaneously take into consideration the nature of site space (large or congested), uncertainties involved during construction and the factors affecting productivity to deal with the dynamic nature of the construction process.

2.4.10 Multi-Project Management

Construction contractors are required to make continuous and quick decisions to develop their business direction with the given limited resources and economic constraints. Typically a general contractor undertakes several construction projects of different sizes and types at different locations at the same time. The contractor's organization is responsible for performing all projects simultaneously: these projects can start at different times at different locations- but at certain times some projects will require the use of the same limited resources with variable quantities. A multi-projects environment involves the determination of how to allocate resources to, and set a competition time for, a new project when it is added to an existing set of ongoing projects. This requires the development of an efficient and dynamic multi-project scheduling system. The availability of decision-making tool and structured approaches could efficiently deal with the dynamic multi-project environment. Alternatively, lack of tools and proper procedures could result in the selection of the wrong project, project slippage and under/ over utilization of scarce resources.

The researchers are currently working on a decision-making simulation model to assist contractors in optimizing dynamic multi-project environment. The model is capable of analyzing and predicting future problems, assessing cumulative impact and generating valuable statistics and information for quick decision making. The model is expected to integrate with the available scheduling tools and will assist in strengthening the overall planning and execution system for the dynamic multi-project environment.

2.4.11 Predicting Changes

Changes have long been major causes of unplanned cost growth, schedule extension and loss of labour productivity for construction projects. They are also a major source for construction disputes and litigation. There is a strong need for practical tools designed to assist project managers and other project participants in identifying and evaluating potential changes, predicting possible outcomes due to these changes, and implementing corrective actions to mitigate potential negative influences.

The researchers are developing a change management tool for contractors and other project participants to identify and evaluate sources of changes during the bidding and construction stages, and to cope with changes order problems during construction. A conceptual framework for the change management tool, titled “Project Change Prediction and Reduction Tool” has been developed for assessing potential project changes, in terms of project cost, schedule and change management practices. Potential sources of changers and triggers could be identified by the project participants through the tool. Insight for corrective actions will be suggested for mitigating impact on labour productivity. The evaluation process during the construction stage of the project will not only draw the project managers attention to construction problems related to changers but also will generate a series of sources’ index values, through which the project manager can monitor trend.

2.4.12 Motivation Model

Workers have rated the top five factors that impact motivation as safety procedures on site, tools and equipment, chance to learn new things, team dynamics, and supervisor’s direction and support.

The establishing a performance based motivational system to improve workers’ efforts. The factors influencing the performance of construction workers and criteria for evaluation of the performance. The research team is establishing a performance based motivational system to improve workers’ efforts. The factors influencing the

performance of construction workers and the criteria for evaluation of the performance of workers are under development at present. A better understanding of workers' preferences for evaluation criteria could allow managers to have insight to the values of workers. This information would help the management to make the workers more productive and motivated towards the job.

2.4.13 Visualization Centre

The popularity of the remotely accessed cameras in the North American Construction Industry has increased significantly in the last few years. The Construction Monitoring and Visualization Center (CMVC) are a unique facility and the first laboratory of its kind in Canada. CMVC is comprised of state – of –the –arts high resolution remotely accessible cameras, high performance video servers with data archiving facility and redundancy.

2.5 Chapter Summary

Chapter 2 provides more general definitions for the productivity as well as the mathematical expression for the total factor productivity. A literature survey on productivity and factors affecting on productivity in various countries were illustrated in this chapter. The chapter contains identified factors affecting productivity in the construction industry in Nigeria, Singapore, Thailand, and Indonesia. Further, important of Management, Work Environment, Workers Expectation, the Role of Foremen are discusses as the key factors affect on labour productivity in the construction industry. According to the motivational theories Maslow's Hierarchy of Need Theory, Alderfer's Need Modified Theory it was found that the motivation level of the construction workers is significant in order to enhance productivity in the construction industry. In section 2.4 deeply describe techniques used for improve the productivity in Canada as a Case study. The ten strategic areas include motivation, supervision, integration, material management, tool time optimization, work practices, communication, schedule optimization, change prediction, and weather impact. During the last two years, research teams in Canada have developed many tools and practices that have been successfully tested and implemented in the industry. The ultimate goal is to

develop a “Productivity TOOL BOX” from the ten strategic areas to benefit the construction industry. The outcomes of these tools and best practices have impacted improved tool time, productivity, worker satisfaction, motivation and proactive planning.



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Chapter 3 RESEARCH METHODS AND DESIGN

3.1 Introduction

This chapter gives details of the methods and procedure of this study. A list of motivational factors were identified from the review of literature, internet search and preliminary survey and developed into a questionnaire for the main survey. The review of literature also indicated the significance of the motivational factors on productivity and, hence, the survey sought the perceptions of respondents about the relative importance of the selected motivational factors and their significance on productivity.

The methodology used in this study is survey questionnaire which can be categorized as quantitative research. Quantitative approaches are more specific and result oriented and it involves the collection of numerical data in order to explain, predict, and/or control phenomena of interest (Mojaheed, 2005).

3.2 Survey



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The most common survey methods are literature searches, talking with people or focus groups, personal interviews, telephone surveys, mail surveys, email surveys, and internet surveys. Following survey methods were used to collect information and data for this research paper.

A *literature search* involves reviewing all readily available materials. The source of the research was published professional journals, academic works, internet search and other relevant literature such as relevant trade publications, newspapers, magazines and internet articles. A thorough literature survey was undertaken to extract all the available factors that motivate an individual at work and also impact on his / her output when they are present.

Talking with people in an informal way is one of the best ways to get correct information during the initial stages of a research project. It can be used to gather information that is not publicly available, or that is too new to be found in the literature. Although often

valuable, the information has questionable validity because it is highly subjective and might not be representative of the population if not selected correctly.

Personal interviews are a way to get in-depth and comprehensive information. They involve one person interviewing another person for personal or detailed information. Typically, an interviewer will ask questions from a written questionnaire and record the answers verbatim. Sometimes, the questionnaire is simply a list of topics that the research wants to discuss with an industry expert. Personal interviews are generally used only when subjects are not likely to respond to other survey methods.

In this research above three methods is used to identify the influencing factors, to get the shape of the questionnaire and to get respondent's views (data). A survey was then conducted liaisons with the tradesmen were asked to rank the factors according to their relative importance. In addition, the perceptions of the extent to which the identified motivational factors influence productivity were sought. From the outcome, deduction on how to improve productivity without depriving anyone from the factors that will enhance motivation was made.



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3.3 Design of questionnaire

Structured questionnaires which were self-administered were utilized for the survey. (Kaming P.F. et al. (1997), *what motivates construction craftsmen in developing countries? A case study of Indonesia*, Building and Environment). This questionnaire consisted of open-ended questions. The latter required the respondents to indicate their responses in writing. Questions, response format and instructions were designed to facilitate the administration of the survey. In the questioner, Question 1 to 6 helps to identify the **Demographic Variables (Age, Educational level, Skill, Years of experience and terms of employment)** of the sample.

The question number 7 was related to motivation and productivity. (See Appendix- A & B) Construction workers were requested to give their opinion on the motivational level within environment and the general individual productivity within the company. In addition to these, 3-point and 5-point likert scales were employed respectively in

the questions to indicate the degree of effect on motivation and the degree of significance of the selected factors on productivity.

In relation to motivation, “1” represented low, “2” represented medium and “3” represented high. In the case of productivity, “1” represented strongly not significant, “2” represented not significant, “3” represented average, “4” represented significant and “5” represented strongly significant in the case of productivity. Workers were therefore requested, based on opinion or perceptions to tick where appropriate the degree of effect on individual motivation and their significance on individual productivity where the factors existed. (Makulsawtudon A. and Emsley M. (2001), *Factors Affecting the Productivity of the Construction Industry in Thailand: The Craftsmen 'S Perception*)

3.3.1 Sampling Technique and sample sizing

A purposive sampling method was used to select the sample from the contractors who are having ICTD classification M1 to M5. Further, quota sampling technique used to determine the number of element which can conveniently choose from targeted groups according to some predetermined numbers from the past research papers. This sample is confined to the specific type of people who can provide the desired information and I wish to draw conclusion that would be generalizable to the population of interest.

Study the population- The current employment in the construction industry of Sri Lanka is about 525,347 in year 2010 as shown in Figure 3.1. This includes categories of, technical, crafts and machine operators. (*Source of Information: special survey August 2010 – Department of Census & Statistics*)

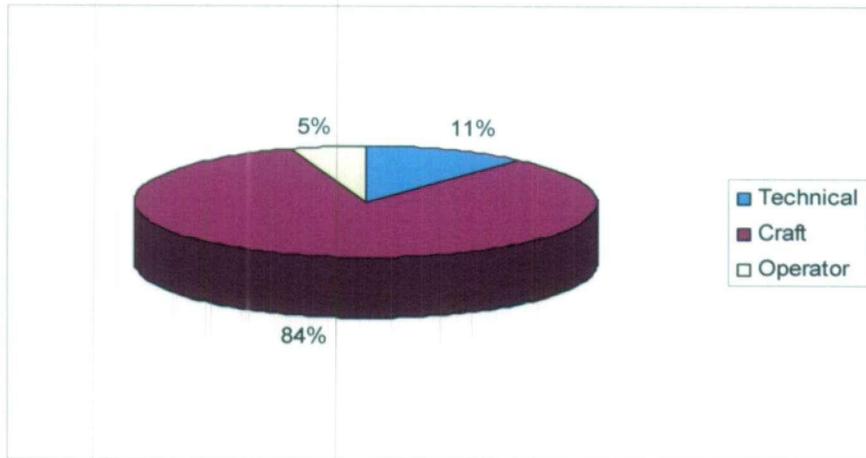


Figure 3-1 Number of questionnaires distributed

Simple Size - Out of 441,291 number of craftsman 278 (Krejcie and Morgan (1970) Cohen(1969) research publications) were selected as a representative sample. .

Tradesmen were on the other hand were asked to give their opinion of the effect of the selected factors on motivation, and the significance these factors have on productivity or output.



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3.3.2 Administering of Questionnaires

The questionnaires were administered to workers and a maximum of three week duration was given to respond to the questions in the questionnaires. All the necessary instructions were given for them which is required to answer the questionnaires and ask to submit duly completed papers to the respective construction site, project managers. Furthermore, in the event where the respondents' educational level was not adequate, assistance was given to answer the questions through their respective site engineers and project managers.

3.3.3 Data analysis tools

Three different analytical tools were used in analyzing the responses the survey. These are Frequency index, Important index, Severity index and co-relational analysis.

3.3.3.1 Index

Frequency index explains the usual occurrence or exhibiting of the characteristics of the factors. The nearer the value of frequency index of the identified motivational factor is to unity (1), the higher the effect on worker motivation. A ranking of frequency indices were done to ascertain the most frequent factors. Kadir et al. (2005) used this method to establish the factors affecting construction labour productivity in Malaysian residential projects hence its adoption

$$\text{Frequency index (F.I.)} = \frac{3n_1 + 2n_2 + n_3}{3(n_1 + n_2 + n_3)}$$



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Where: n_1 –number of respondent answered ‘high’
 n_2 –number of respondent answered ‘medium’
 n_3 –number of respondent answered ‘low’ (Kadir et al, 2005)

Important index facilitate the identification of tactical approaches to increasing productivity. The nearer the value of importance index of the identified factor is to unity (1), the more significant it is to worker motivation and hence, a greater impact on worker productivity. A ranking of importance indices were undertaken to ascertain the most frequent factors. The important index determination was also adopted from Lim and Alum (1995) study construction productivity: issues encountered by contractors in Singapore.

$$\text{Important index (I.I.)} = \frac{5n_1 + 4n_2 + 3n_3 + 2n_4 + n_5}{5(n_1 + n_2 + n_3 + n_4 + n_5)}$$

Where: n1 –number of respondent answered ‘strongly significant’
n2 –number of respondent answered ‘significant’
n3 –number of respondent answered ‘average’
n4 –number of respondent answered ‘not significant’
n5 –number of respondent answered ‘strongly not significant’

Severity index gives the analytical explanation of the critical effect on motivation and significance to productivity. It further gives the aggregate effect and significance to motivation. When a severity index approaches unity (1), it gives the explanation of how severe the factors are to motivation and productivity. Ranking of severity indices were done to ascertain the most critical or severe factors from which a discussion of the first ten factors were made. Finally the severity index was calculated using the formula below.

Severity index (S.I.) = Importance index × Frequency Index (Kadir et. al, 2005)

3.3.3.2  **Correlation analysis**
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A Pearson-Moment rank correlation was employed to determine the effect of motivation on productivity. Hence the frequency and importance indices were used to establish the relationship between motivation and productivity. Below is the mathematical determination of Pearson rank coefficient R.

$$R = \frac{S_{xy}}{\sqrt{(S_{xx}S_{yy})}}$$

$$= \frac{\sum (x - \bar{x})(y - \bar{y})}{\sqrt{(\sum (x - \bar{x})^2 \sum (y - \bar{y})^2)}} \text{ (Walpole et. al., 2007)}$$

Where; Sxy = standard deviation of x and y
Sxx = standard deviation of x
Syy = standard deviation of y
x = mean of x
y = mean of y

R ranges between -1 and 1 i.e. $-1 \leq R \leq 1$. The nearer and positive the value of R, the stronger the influence the independent variables (frequency index) have on the dependent variable (important index) positively. On the other hand, the opposite of the above explanation occurs when R is negative. A scatter diagram with a line of best fit was used to illustrate this relation appropriately.

3.4 Chapter Summary

A list of motivational factors were identified from the review of literature, internet search, talking with people in an informal way and personal interviews and all the valuable information and data were developed into a questionnaire for the main survey. The research questions were developed according to the theoretical framework. The appropriate methodology was developed as possible to answer those questions. Further this chapter discussed data collection methods, target sample, methods of data analysis used for the research.



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Chapter 4 FINDINGS AND DATA ANALYSIS

4.1 Introduction

The purpose of this study was to find the significant of factors effecting on productivity in building construction industry and effect of workers motivation in order to enhance the productivity in the construction industry. In order to achieve this, a methodology consisting of a review of literature and an on site survey of construction workers was employed. This chapter presents the findings of the study.

4.2 Survey Findings

A total of 278 questionnaires were administered for the survey. To the above sample out of which 264 responses were obtained representing 94.96% response rate. The Figure 3.1 shows the response rate respectively.

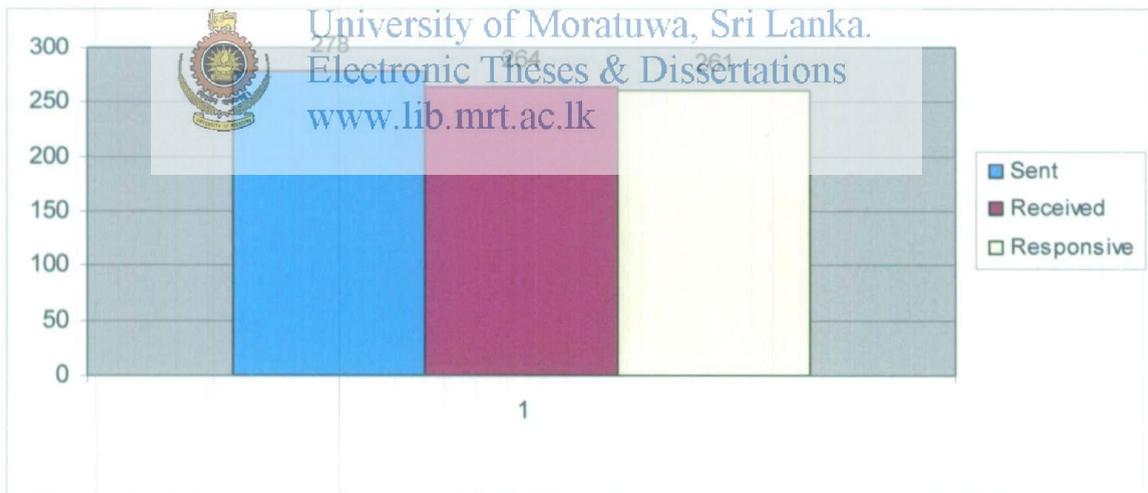


Figure 4-1 Number of sent, received and responsive questionnaires

4.3 Demographic Variables

The responses were further analyzed to determine the demography of respondents. A total of 261 responses were received from worker respondents as shown in Table 4.1. The trade, age, educational level of the worker respondents, skill level, years of

experience, type of job were deeply analyze to justify the sample in addition to the motivational and productivity level of workers were analyzed. Respondents to this effect were asked to give their perception on the effect and significance of the selected factors that affect motivation and productivity.

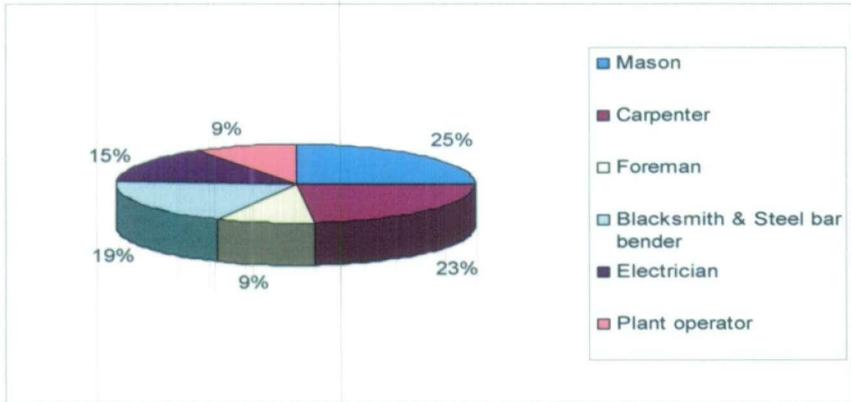


Figure 4-2 Respondents

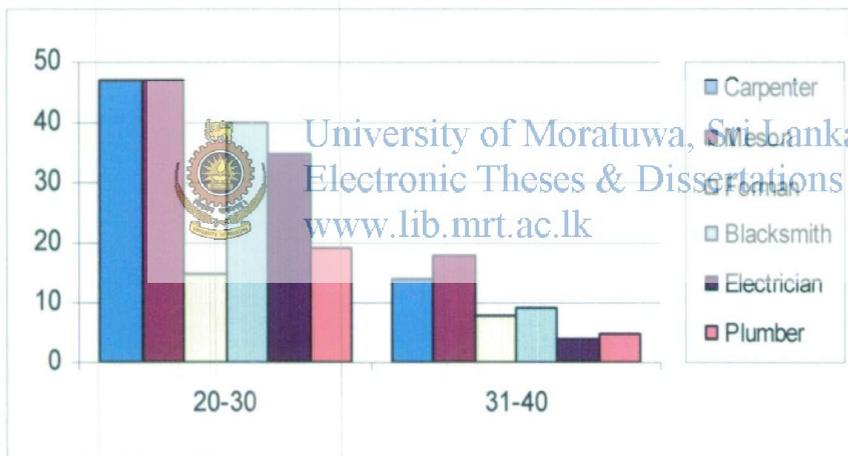


Figure 4-3 Age Level of respondents

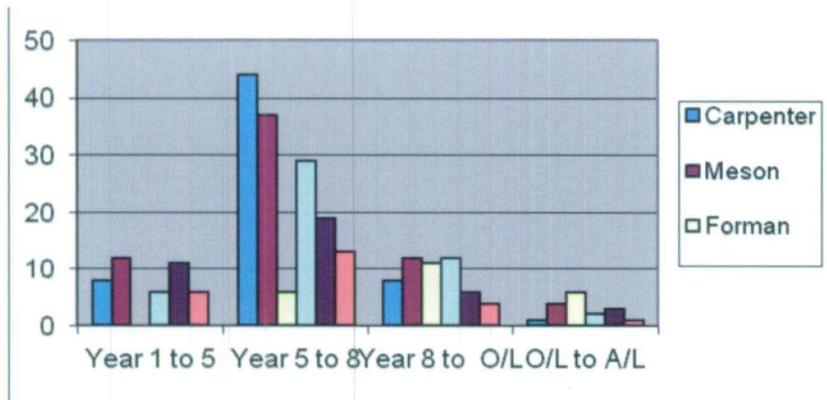


Figure 4-4 Educational Level of respondents

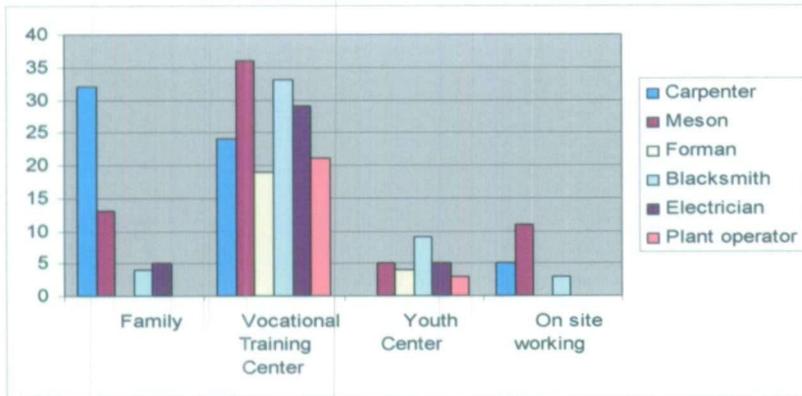


Figure 4-5 Skill Level of respondents

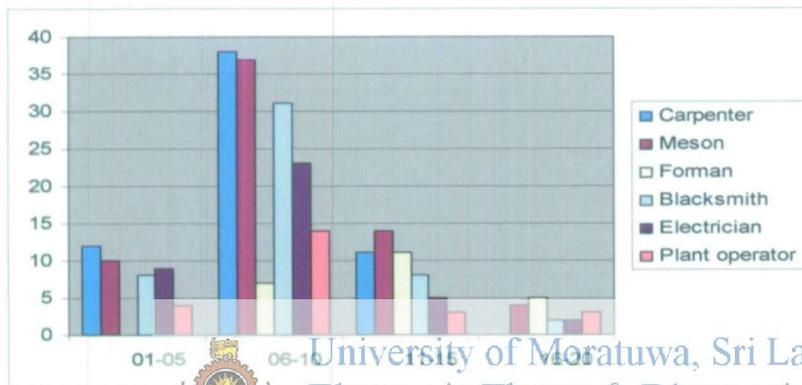


Figure 4-6 Years of experience of respondents



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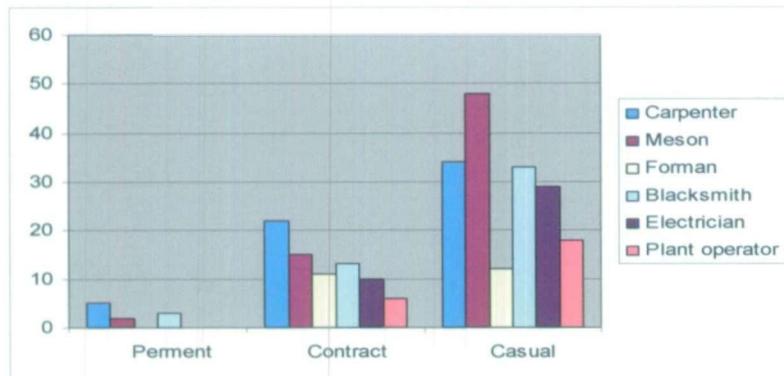


Figure 4-7 Job type of respondents

4.4 Factors affecting motivation and productivity

During the literature review and interviews held with the tradesman, 56 factors were identified, which are directly affected on the labour productivity in the industry. Results were tabulated as follows.

- a. Identify the top ten factors which are affecting on labour productivity considering the frequency index.

Table 4-1 Top Ten Factors affecting on labour productivity (F.I Factors)

S/N	Factors that affect on labour productivity	F.I
01	Medical care (Having a particular hospital to attend in case of illness or subsidizing the cost of hospital bills)	0.92
02	Supervision	0.90
03	Canteen for employee (Good food for free or at a reduced price)	0.90
04	Late payment of interim certificate	0.90
05	Social activity opportunities (Sports & Entertainment)	0.90
06	Job security (Permanent job, Job all the time, payment)	0.88
07	Accommodation (Provision of physical accommodation, package as subsidy to rent apartment)	0.88
08	Relations with workmates; Teamwork (Everyone contributing in the work, all hands on deck)	0.88
09	Communication (Easy flow of information, being well communicated)	0.87
10	Love and belongingness	0.87

- b. Identify the top ten factors which are affecting on labour productivity considering the important index.

Table 4-2 Top Ten Factors affecting on labour productivity (I.I Factors)

S/N	Factors that affect on labour productivity	I.I
01	Medical care (Having a particular hospital to attend in case of illness or subsidizing the cost of hospital bills)	0.82
02	On-time payment	0.87
03	Working in social insurance	0.83
04	Bonus at the end of project or year (showing appreciation at the end of the project and year)	0.81
05	Overtime (Provision of extra money after normal working time)	0.91
06	Social activity opportunities (Sports & Entertainment)	0.85
07	Job security (Permanent job, Job all the time, payment)	0.83
08	Accommodation (Provision of physical accommodation, package as subsidy to rent apartment).	0.82
09	Opportunity to undertake challenging task (Being given goal to work towards it through your own directives)	0.83
10	Love and belongingness	0.81

- c. Identify the top ten factors which are affecting on labour productivity considering the severity index.

Table 4-3 Top Ten Factors affecting on labour productivity (S.I Factors)

S/N	Factors that affect on labour productivity	S.I
01	Medical care (Having a particular hospital to attend in case of illness or subsidizing the cost of hospital bills)	0.75
02	Supervision	0.72
03	On-time payment	0.73
04	Overtime (Provision of extra money after normal working time)	0.78

05	Canteen for employee (Good food for free or at a reduced price)	0.73
06	Social activity opportunities (Sports & Entertainment)	0.76
07	Job security (Permanent job, Job all the time, payment)	0.74
08	Accommodation (Provision of physical accommodation, package as subsidy to rent apartment)	0.72
09	Communication (Easy flow of information, being well communicated)	0.71
10	Love and belongingness	0.71

4.5 Analysis of Top Ten factors: Severity Index with the Workers Trade and Age Group Demographic variables

The identified top ten factors which are affect on labour productivity considering the severity index was further analysis with the workers demographic variables age group and trade as follows.

4.5.1 Medical Facilities

Provisions of medical facilities were ranked as the top ten severe factors with severity indices of 0.75 with F.I of 0.92 & I.I of 0.82. According to the results calculated considering F.I and I.I, they have clearly stated that the importance of the medical facilities for the construction workers.

Workers in a construction site are always exposed to various hazardous substances and physical agents, e.g. asbestos, lead, silica dust, organic solvents, sewer gases, welding fumes, radiation, noise and vibration. Excessive exposures to these substances/agents may result in acute injury, chronic illness, permanent disability or even death. Loss of concentration at work and fatigue arising from poor health conditions may increase the risk of accidents. These features would further increase the health risks of workers. Working in hazardous environment it is no surprise that construction workers are particularly susceptible to illness and injury. According to the information gathered from the workers, they are highly unsafe and most

vulnerable section of the society. One of the biggest problems is that many construction workers cannot afford to pay for treatment.

Irrespective of the craftsman trade irrespective of their age group, in the opinion of the respondents, job performance and productivity can be increased through health promotion programmes, providing medical facilities in the workplace.

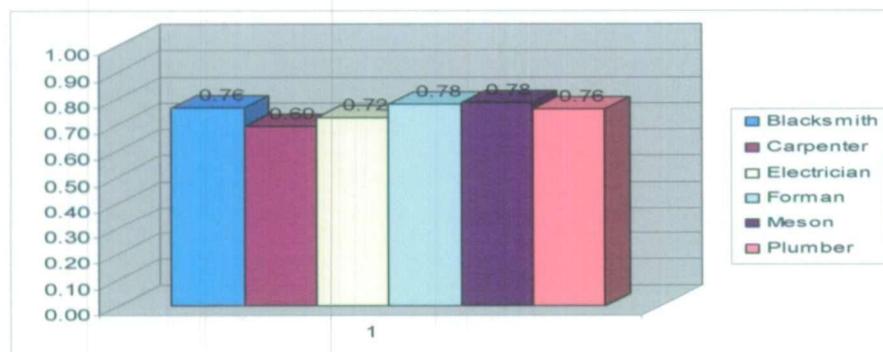


Figure 4-8 Severity Index variations with the Trade of Workers (Medical Facilities)

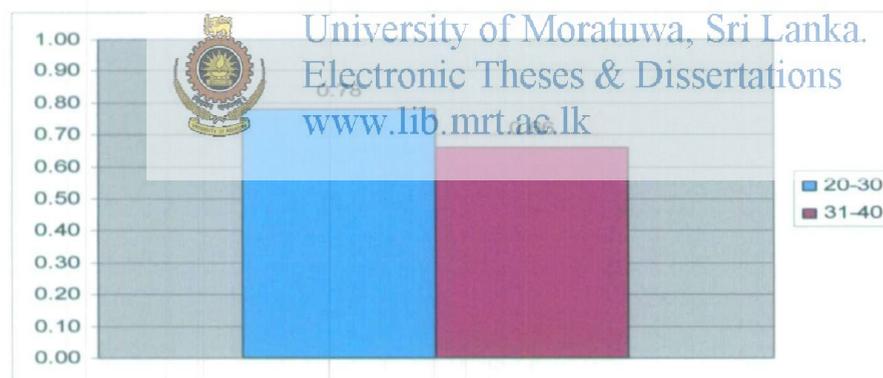


Figure 4-9 Severity Index variations with the Workers Age Group (Medical Facilities)

4.5.2 Supervision

Supervision was ranked within the Top Ten Severe Factor with frequency and severity indices of 0.9 and 0.72 respectively. Leadership has been shown to be an important factor in successful project execution in a number of studies (Odusami et al, 2003). It is not necessarily getting the requisite tool with which to work which motivates but being with subordinates to partake in solving work problems and ensure

that the right thing is accomplished without always issuing instructions. This motivates supervisors or superiors and subordinates.

In a research into bricklayer's motivation and productivity, good supervision was found to be the most significant variable influencing rate of bricklaying (Olomolaiye, 1990). This indicates that whenever a leader sets good example or workers feel supervisors are part of them based on the supervisor's involvement in some of the daily work schedule, they will have the motivation to work harder and this will boost their performance and hence increase productivity. Odusami et al (2003) stated that the best leadership style in terms of overall performance was found to be consultative autocracy. This type of leadership absorbs information input or contribution from team-mates but takes the ultimate decision. Workers in this instance will be excited when the ultimate decision taken by the leader happens to be their input or contribution. Furthermore in the study of de-motivating factors influencing the productivity of civil engineering projects, it was found that inexperienced supervisors had little authority and even minor questions had to be answered by engineers in the respective offices (Thomas et al, 2004). Supervisors should therefore be knowledgeable in the roles assigned them and be involved in solving problems by which subordinates will have confidence in them and, hence, be motivated.

Further , survey analysis illustrate that irrespective of the craftsman trade irrespective of their age group, in the opinion of the respondents, job performance and productivity can enhance through the better supervision in the workplace.

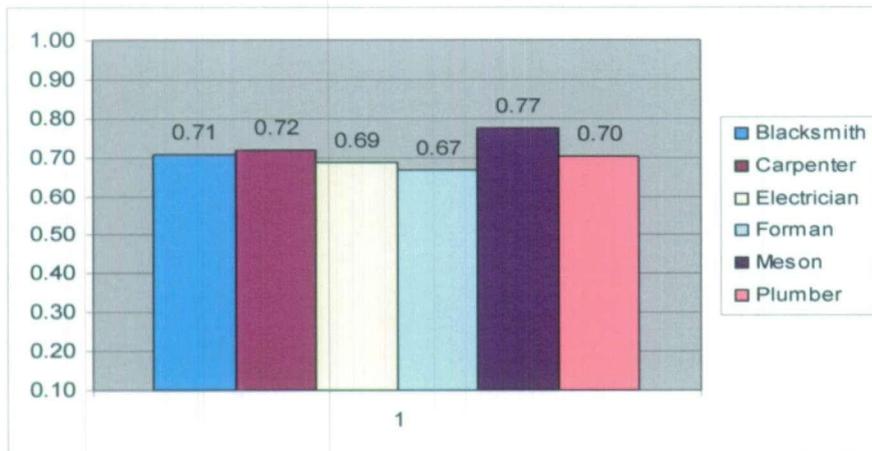


Figure 4-10 Severity Index variations with the Trade of Workers (Supervision)

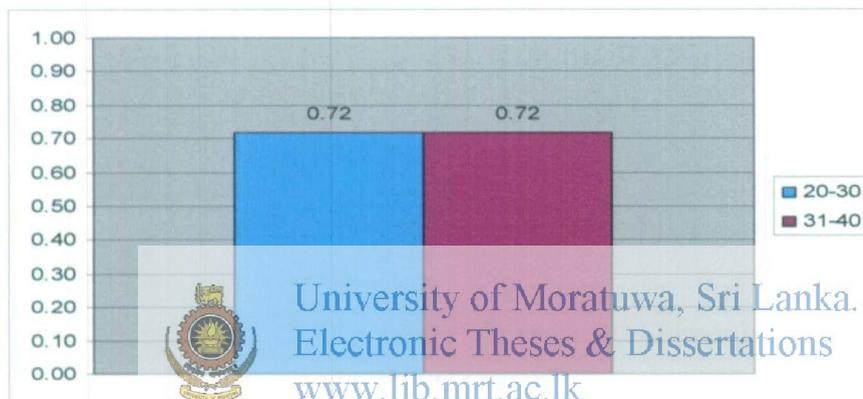


Figure 4-11 Severity Index variations with the Workers Age Group (Supervision)

4.5.3 On-time payment

On time payment was ranked as the top ten most severe factors with severity indices of 0.73. Late payment of interim certificate affects cash flow of contractors which in effect influences payment to workers at the on time. This can be associated with the hindrances associated with the progress of work. Further vendors will therefore retain any service to be provided until a full payment is received which will result in shortage of materials on site, inability to repair breakdown equipment, hence, workers will have less resources to work with compared with projected resources to be used. This reduces productivity. Workers will not be motivated to work assiduously due to the unavailability of resources to work with and also delay in wages and salaries. The

late payment of interim certificate will also cause detrimental effects on workers' motivation and suppliers' creditability and, hence, reduce productivity. Construction works are known to be capital intensive and therefore when capital lock-up is experienced all financial related activities cannot be undertaken which will cause distortion in progress thereby impacting on overall performance.

Following graph also illustrate that irrespective of trade and age group all the respondents are in the opinion that job performance and productivity can enhance if they are paid their wages and salaries at time.

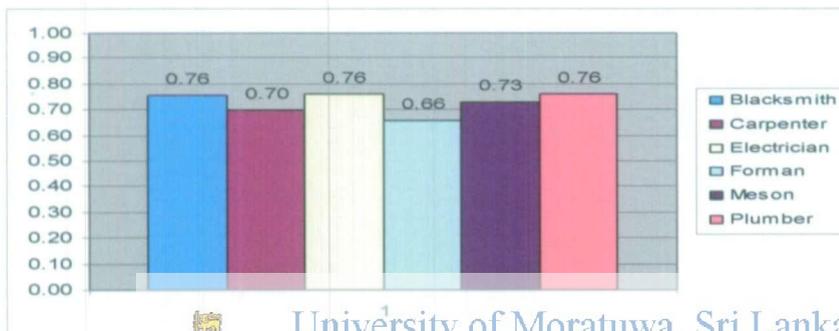


Figure 4-12 Severity Index variations with the Workers Trade (On-time payment)



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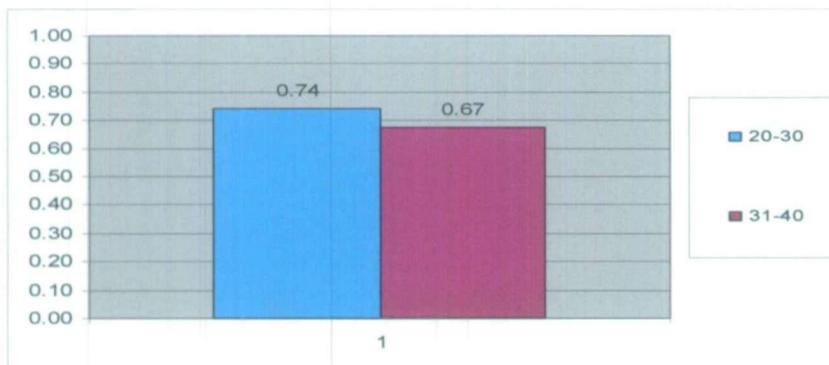


Figure 4-13 Severity Index variations with the Workers Age Group (On-time payment)

4.5.4 Overtime (Provision of extra money after normal working time)

Overtime was evaluated as top ten severe factors on motivation and productivity with a severity index of 0.78. Workers' stated that, salaries are inadequate but they have to be content with whatever is given them. This might have contributed to overtime

being one of the ten most severe factors among the identified factors. This implies workers will always feel motivated whenever there is the element of overtime in a day's task. Overtime will normally set in if the day's target is not met at the normal closing hours of the day or a programme needs to be completed. Overtime tasks usually are less stressful than working period tasks. This enable workforce to exert less force but can achieve a reasonable target. Workers will always be happy and motivated when working on overtime tasks. This is as a result of overtime allowance that will be accrued to daily or monthly wages or salaries. Workforce will, therefore, work assiduously to increase output and in effect increase productivity. Continuous introduction of reasonable overtime tasks will go a long way to motivate workforce at work places and contribute to productivity enhancement irrespective of their trade and age group as shown in following figures.

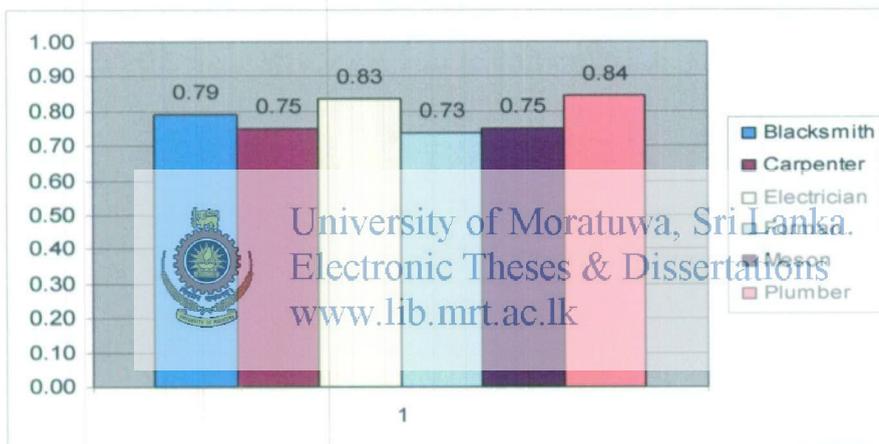


Figure 4-14 Severity Index variations with the Trade of Workers (Overtime)

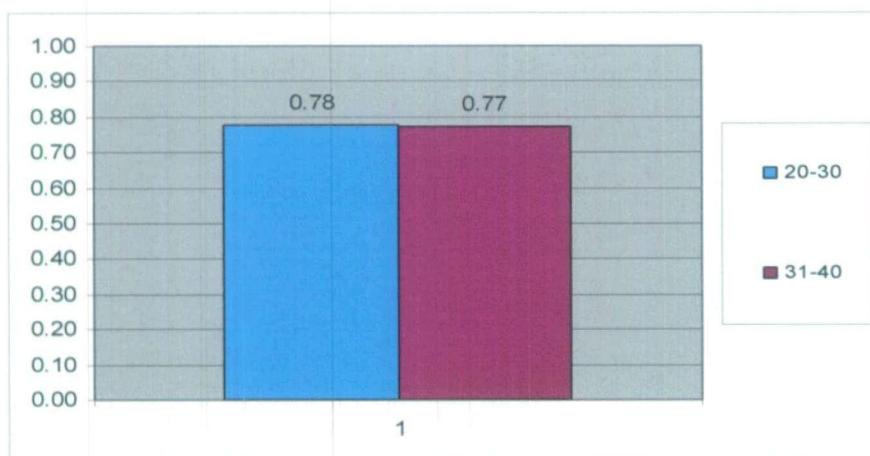


Figure 4-15 Severity Index variations with the Workers Age Group (Overtime)

4.5.5 Canteen Facilities for employee (Facilities for supplying food and drink, and eating meals)

Provisions for good meals or nutrition diet and pure water for drinking at location where they can access at a site is ranked as the top ten most severe factor with severity indices of 0.73. Facilities for supplying food at construction work sites can be particularly important when sites are located in remote areas. Remoteness, together with inadequate temporary housing which lacks cooking facilities, may give rise to considerable problems for workers in the availability and regularity of hygienically prepared and nutritious meals. There should be accommodation with tables and seats, protected from the weather, where one can eat food in comfort. It should be situated away from workstations to minimize contact with dirt, dust or dangerous substances. Availability of this facility at the site is paramount all the construction workers irrespective of their trade and age.

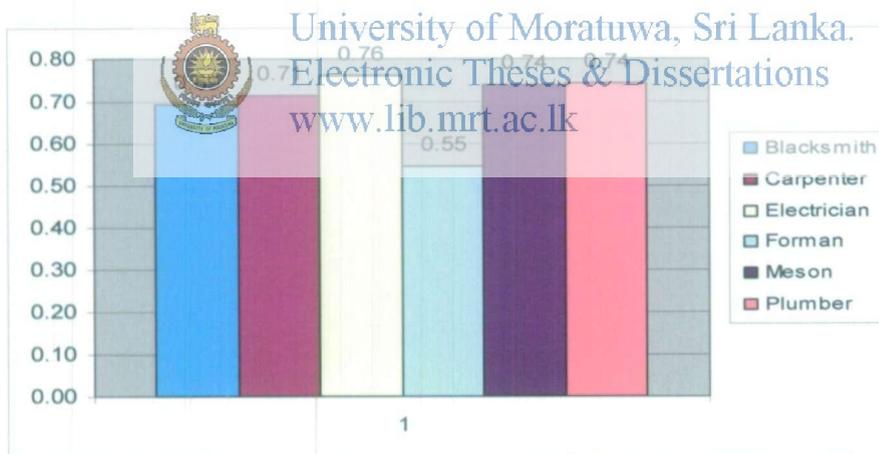


Figure 4-16 Severity Index variations with the Trade of Workers (Canteen Facilities)

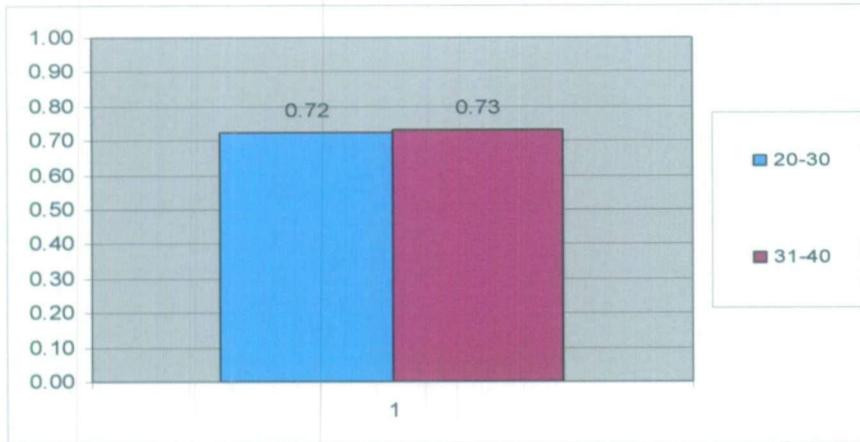


Figure 4-17 Severity Index variations with the Workers Age Group (Canteen Facilities)

4.5.6 Opportunities for Social Activities (Sports & Entertainment)

Opportunities for the Social Activities are very much needed at the construction site because it will help to maintain well balance mentality apart from their daily tasks. They have a mentality that they are the most vulnerable sector in the society due to the various problems in their living conditions and. This is the second most sever factor according to the analysis of this survey, severity factor of 0.76. On the other hand this will facilitate to develop teamwork culture too. Social activity generates friendship among workmates outside working hours. It enables workmates to share ideas, thoughts difficulties and find solutions to problems encountered on a task assigned should it recur. Irrespective of their trade and age group above factor is strongly effect on the productivity and performance of the workers.

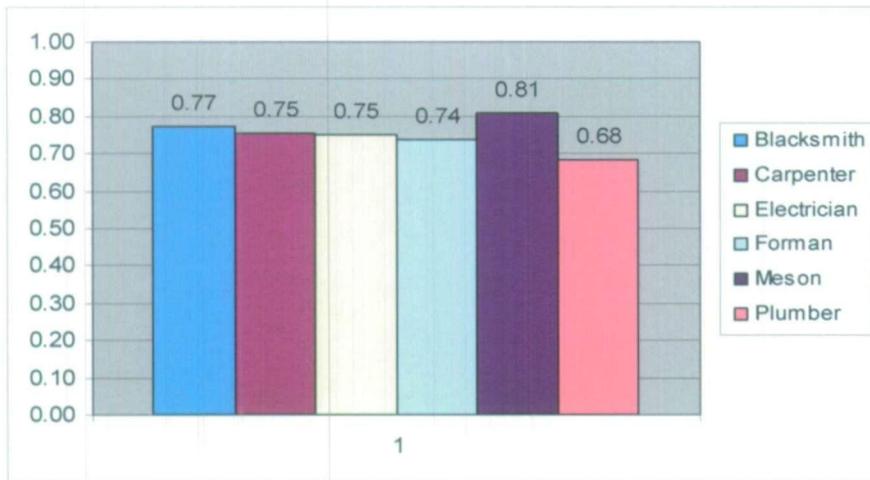


Figure 4-18 Severity Index variations with the Trade of Workers (Social Activities)

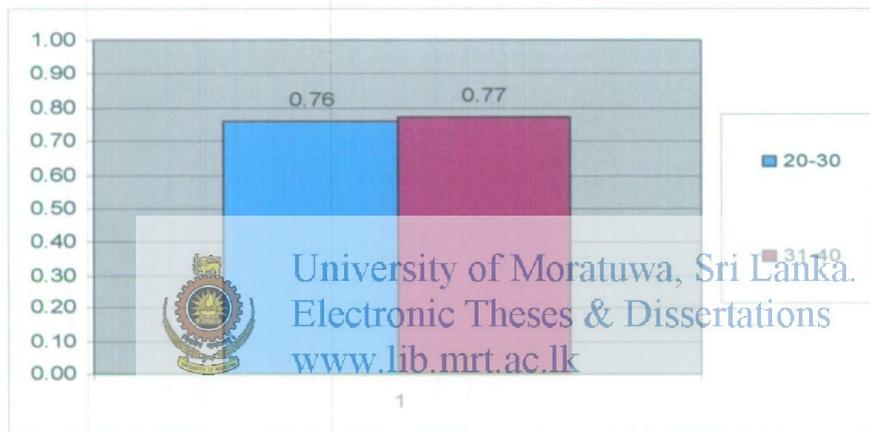


Figure 4-19 Severity Index variations with the Workers Age Group (Social Activities)

4.5.7 Job security (Permanent job, Job all the time, payment)

According to information gathered from the survey group it was revealed that they are highly worried and stress because of insecurity in their job. On the other hand they are in opinion that the only source of income that they can generate to look after families.

Job security was ranked as the top ten severe factors with severity indices of 0.74 with F.I of 0.88 & I.I of 0.83. According to the results calculated considering F.I and I.I, they have clearly stated irrespective of their trade and age group the importance of the job security as a motivation factor for the construction workers in order to enhance the productivity and performance of the outcome.

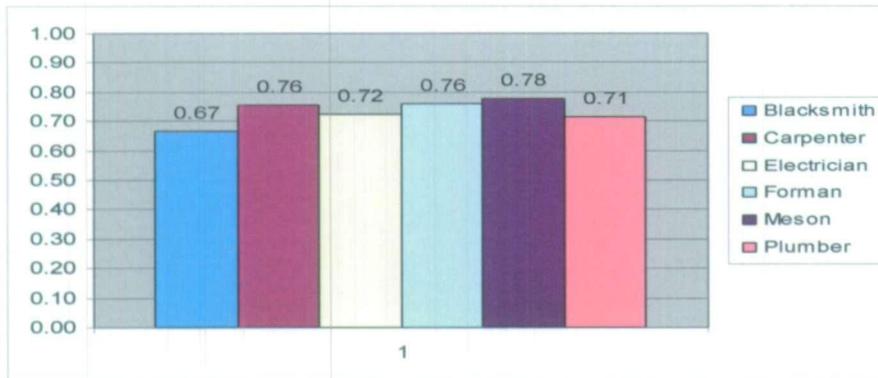


Figure 4-20 Severity Index variations with the Trade of Workers (Job security)

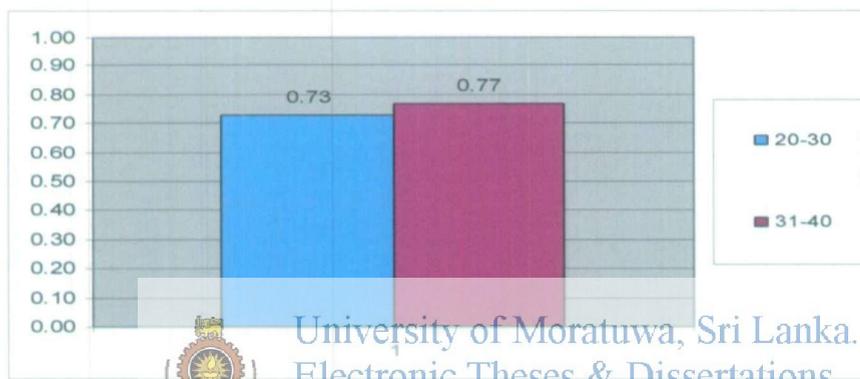


Figure 4-21 Severity Index variations with the Workers Age Group (Job security)



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4.5.8 Accommodation (Provision of physical accommodation, package as subsidy to rent apartment)

Accommodation facilities at the work site will facilitate comfortable life within the working environment for the workers. Good and safe area for sleeping, changing rooms facilities to changing from street clothes into work clothes, provision for drying wet clothes, provision of adequate seats, mirrors and rubbish bins, Sanitary facilities, washing facilities greatly assist workers with their personal hygiene.

Construction workers begin work at early. They start their day alert and productive but their activity level decreases as the day passes. Fatigue develops gradually before it begins to have marked effects. If they have good place for rest before show signs of being really tired, recovery is much faster. Short breaks taken frequently are much better than infrequent long breaks. Productivity improves with frequent rest breaks.

Workers are not just idle during rest breaks, but are recovering from fatigue and preparing for continued productive work. Getting away from a noisy or polluted workplace helps to relax and recover from fatigue. It was ranked top ten frequent and severe factor with F.I=0.88 and S.I=0.72 respectively.

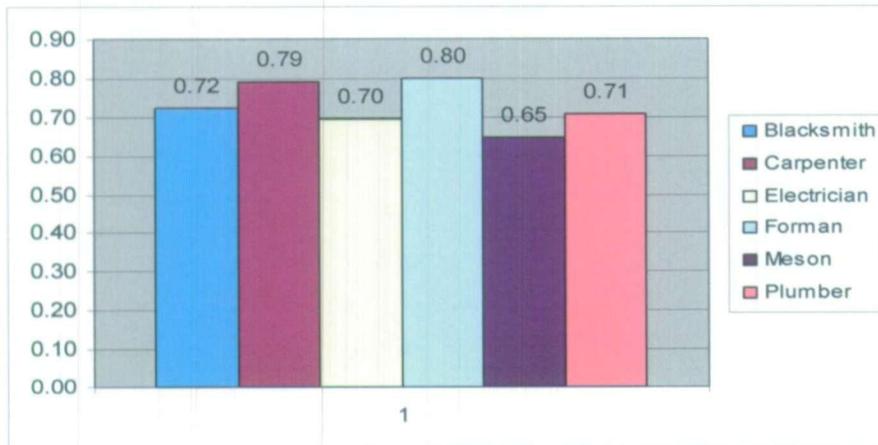


Figure 4-22 Severity Index variations with the Trade of Workers (Accommodation)

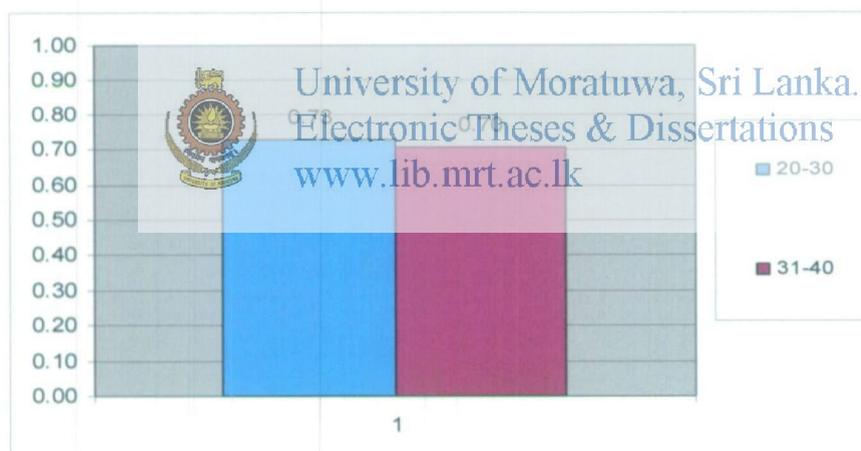


Figure 4-23 Severity Index variations with the Workers Age Group (Accommodation)

4.5.9 Communication (Easy flow of information, being well communicated)

With a severity index of 0.71, communication was analyzed as the top ten most severe factors of motivation and productivity. Lack of effective communication between site management and workers is a major barrier to the efficiency and productivity of construction projects. By the time the flow of information or instructions from the management level reaches the worker level, many shortcomings in the accuracy of

instructions received to the bottom level. Further analysis of the severity with the trade of the workers and age group are not shown significant variation as shown in following figures.

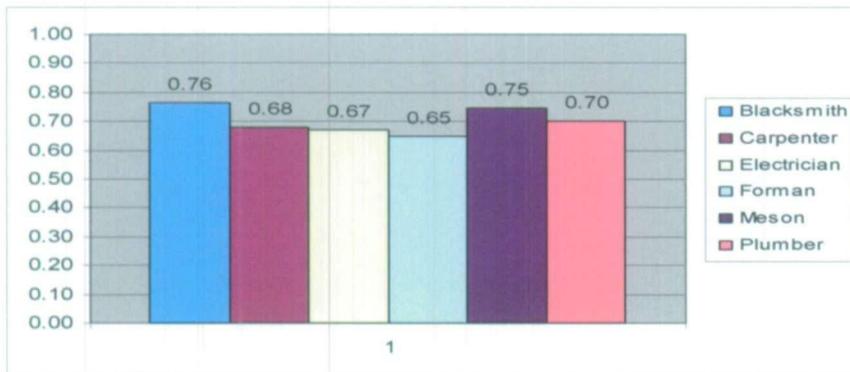


Figure 4-24 Severity Index variations with the Trade of Workers (Communication)

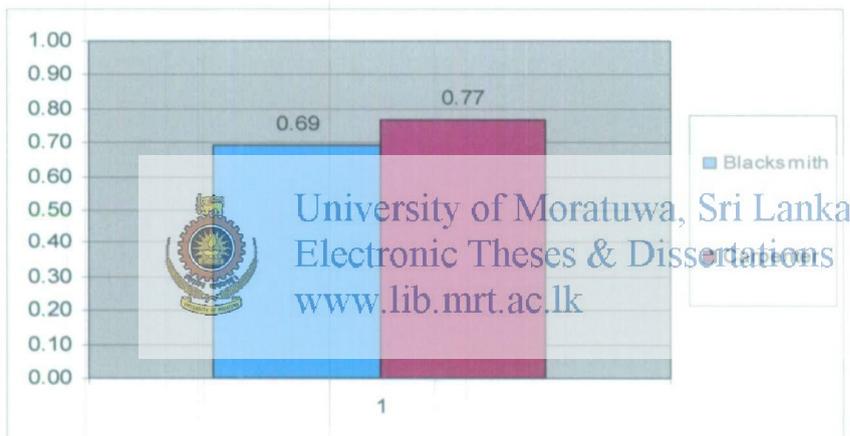


Figure 4-25 Severity Index variations with the Workers Age Group (Communication)

4.5.10 Love and belongingness

Love and belongingness is essential in any working environment. It was ranked sixth frequent and seventh severe factor with $F.I=0.737$ and $S.I=0.536$ respectively. Workers always feel motivated when superiors, colleagues and subordinates show concern and care to one another. The organization of regular meetings to interact and identify problems of workers makes them feel that they belong to the setup. According to Aynur and Serdar (2006), workers always rely on the company to provide opportunities for social activities after work. The most popular activities are

sports and entertainment but sports are the most affordable to all construction companies. This affirms Aynur and Serder's findings that physical activities are the most preferable among workers. This will, therefore, motivate workers and further enhance their performance which will in effect increase productivity.

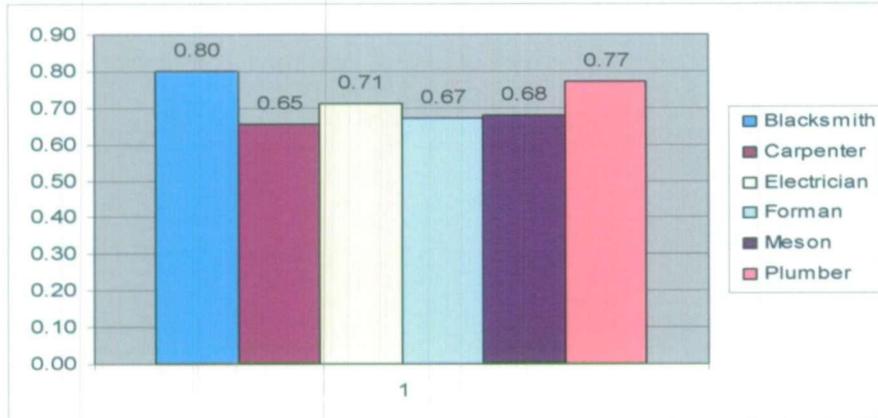


Figure 4-26 Severity Index variations with the Trade of Workers (Love and belongingness)

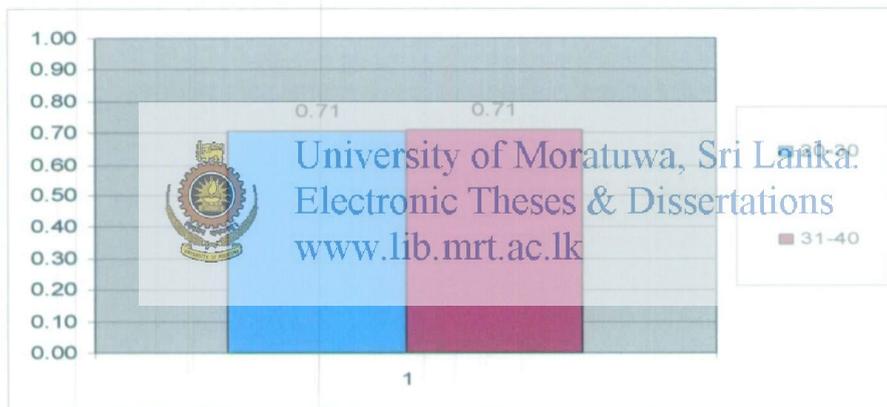


Figure 4-27 Severity Index variations with the Workers Age Group (Love and belongingness)

4.6 Motivational strategy

The potential benefit of motivation is basically to enhance individual behaviors towards works by which it impact on the overall performance. The success of any organizational set up is dependent on the workers engaged on various task of the organization. This study has revealed the ten most severe factors that usually affect behavioral change of workforce at workplaces in the construction industry. The established factors are

Table 4-4 Top Ten Motivational Factors affecting on labour productivity

Medical care (Having a particular hospital to attend in case of illness or subsidizing the cost of hospital bills)
Supervision
On-time payment
Overtime (Provision of extra money after normal working time)
Canteen for employee (Good food for free or at a reduced price)
Social activity opportunities (Sports & Entertainment)
Job security (Permanent job, Job all the time, payment)
Accommodation (Provision of physical accommodation, package as subsidy to rent apartment)
Communication (Easy flow of information, being well communicated)
Love and belongingness

These ten factors conform with Herzberg's Two Factor and Alderfer's Need Modified theories. Table 4.11 and 4.12 show the classification of the factors under the respective theories.

4.7 Herzberg's Dual Factor Theory

Herzberg dual factor theory provided managerial applications as to what makes workers feel good and bad about their job. One of the factors in the theory has to do with the basic factors surrounding the job that triggers dissatisfaction when not

adequate. This has been termed hygiene factors. These are extrinsic and include medical care, working condition; canteen facilities; social activity, accommodation facilities, relationships among workers, love and belongingness. The other factor which according to Herzberg make an individual feel the potential for satisfaction if he or she is able to marshal momentous work motivation which he also termed motivators. This is intrinsic and unique to every individual and includes quality supervision; on time payments, over time payments, job security, communications (Mullins, 2005). It is essential for management to maximize the effect of factors that have positive influence and also control or minimize those which negatively impact on motivation and productivity.

4.8 Alderfer Need Modified Theory

Alderfer (1969) modification theory condensed Maslow's need hierarchy theory into three levels of need namely; existence, relatedness and growth needs (ERG). Four factors among the ten most severe factors will impact on motivation and productivity under existence needs and these are:



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- On time payment
- Supervision
- Communication
- Overtime

Furthermore, teamwork and love and belongingness, medical care, canteen facilities, social activities, accommodation can also be categorized under relatedness needs whiles, job security be under growth needs. It can be deduced that responses of the study revealed that more than one factor needs to be present to cause behavioral change and also affect productivity. This conforms to Alderfer's suggestion that individual need is more of continuum than hierarchical. Client, representatives of clients and management at this instant have to contribute their quota to ensure the provision of existence needs. The positive effect of these factors should be enhanced

and control measures should be taken on the negative effect on both motivation and productivity.

In addition relatedness needs to be encouraged with the formation of teams at working places. A strong teamwork will create a healthy environment and facilitate sharing of ideas, problem solving and skills learning. This will enhance the opportunity for workers to undertake challenging task. These motivate workers and improve performance as well. More so, jobs should be given to workers on contract with conditions. Some of the conditions should be quality of work, precision and timely delivery. In the situation where the quality of work and precision is not achieved, the cost of rework should be borne by workers. Also workers who delay in delivery of tasks should sacrifice a percentage of the sum to be collected. Appreciation should also be shown to workers who will be able to deliver to quality, precision and timely by identifying and rewarding or recognizing them. Finally workers should be given responsibility or opportunity to undertake challenging tasks and achievements should be recognized. These enable workers to be innovative and motivated to seek more innovations to undertake tasks. Workforce will generally be motivated when existence, relatedness and growth needs are present in their respective setup and further contribute to performance enhancement and productivity s a whole.

Table 4-5 Classification of established factors under Herzberg's Dual factor Theory

HYGIENE FACTORS	MOTIVATORS
Medical Care	Supervision
Canteen facilities	On-time payment
Social activity opportunities (Sports & Entertainment)	Overtime (Provision of extra money after normal working time)
Accommodation (Provision of physical accommodation, package as subsidy to	Job security (Permanent job, Job all the time, payment)

rent apartment)	
Love and belongingness	Communication (Easy flow of information, being well communicated)

Table 4-6 Classification of established factors under Alderfer's Need modified Theory

EXISTENCE	RELATEDNESS	GROWTH
On time payment	love and belongingness, , ,	Job security
Supervision	medical care	
Communication	canteen facilities	
Overtime	social activities	
	Accommodation	

4.9 Chapter Summary

This chapter illustrates the survey findings which include the number of questionnaires administered for the survey and their response. Demographic Variables such as trade age group educational level skill level years of experience, type of job were deeply analyzed to justify the quality of the sample which is selected for the research. The identified 56 numbers of factors which are directly affect on the labour productivity were analyzed separately tabulated the tabulated the Top Ten factors considering the frequency index, important index and severity index. Further workers trade and age group demographic variables were taken in to the analysis with the top ten factors calculated considering their severity index. The analysis of these factors clearly stated that important of these factors in order to enhance the productivity in the construction industry. Further classification of these factors in to the Herzberg's Dual factor theory and Alderfer's Need modified theory reveals that the potential benefit of motivation and affect of the overall performance of the work force.

CHAPTER 5 RESEARCH CONCLUSION AND RECOMMENDATION

5.1 Introduction

Productivity is considered the main value-adding function within the construction industry. Success in construction project, therefore, means the completion of projects within budget, on or ahead of time and meeting certain standards and quality safely. This study focused on strategies of motivation to improve productivity in the construction industry. Whatever the resources utilized by the industry, the focus is on human resource as they are the users of other resources to achieve a given goal. It has, therefore, been the prime concern of any profit-oriented organization to improve productivity by effective and efficient conversion of resources into marketable products and determining business profitability (Enshassi, 2007).

This chapter highlights on summary of findings and conclusion of the study. The chapter further gives recommendation on to how workers can be motivated to improve performance which in effect contributes to productivity enhancement in the construction industry.

5.2 Summary of findings

The objectives of the study were to identify factors that motivate workers and the effect of these factors on productivity at construction sites. Questionnaire survey was used to undertake this study. A total of 278 questionnaires were administered among the workers who are working at different locations. The sample was consisting of 61 carpenters, 65 mesons, 49 blacksmith, 23 Forman, 39 electricians, 24 plumbers.

A list of 56 factors that affect motivation and productivity was gathered from literature and preliminary survey. Perceptions were then sought on the degree of effect on motivation when they exist and the correspondent significance on productivity. It was observed that a fair to good agreement beyond chance existed between responses given by respondents on motivation. This gave the indication that

motivation vary from individuals. Furthermore, it can confirm that individual differences contributed to the fair agreement to good agreement. It was revealed from the survey that, the ten most severe factors that affect motivation are:

Table 5-1 Top Ten Motivational Factors affecting on labour productivity

Medical care (Having a particular hospital to attend in case of illness or subsidizing the cost of hospital bills)
Supervision
On-time payment
Overtime (Provision of extra money after normal working time)
Canteen for employee (Good food for free or at a reduced price)
Social activity opportunities (Sports & Entertainment)
Job security (Permanent job, Job all the time, payment)
Accommodation (Provision of physical accommodation, package as subsidy to rent apartment)
Communication (Easy flow of information, being well communicated)
Love and belongingness



In relation to responses on significance to productivity, a high degree of agreement was revealed. This further gave the indication that motivation always influences productivity. It was further observed that the performance of a well motivated will be affected positively which in effect will impact positively on productivity of projects.

5.3 Conclusion

From the findings of this study, it can conclude that majority of the construction workers who are working in the building construction industry in Sri Lanka, are highly de-motivated due to the difficulties faced by them to full fill their basic needs in that poor working environment. It is evident that the industry has totally forgotten the value of these people while providing good working environment for them. The motivation varies from one individual to the other. This can be attributed to the age, trade or profession, qualification, years of experience and years with which the individual has been with the establishment. It can infer from varying research findings on productivity conducted in other part of the world that, a corresponding variation in motivation will also prevail. In the study of factors affecting the productivity on the Thailand construction industry, comparisons were made with five other countries. Among the ten most critical factors established in this study, the entire factors can classified into the base needs for the workers irrespective of their age group, trade. Therefore, concluded that when attention is directed towards the revealed ten most severe factors, it will enhance motivating workers at their respective establishment. This will in effect impact positively on performance, hence it corresponding productivity improvement.

The established factors are Medical care (Having a particular hospital to attend in case of illness or subsidizing the cost of hospital bills), Supervision, On-time payment, Overtime (Provision of extra money after normal working time), Canteen for employee (Good food for free or at a reduced price), Social activity opportunities (Sports & Entertainment), Job security (Permanent job, Job all the time, payment), Accommodation (Provision of physical accommodation, package as subsidy to rent

apartment). Further it was revealed that the established factors conform to Herzberg and Alderfer's theories. (Refer Appendix-C & D)

5.4 Recommendation

The goal of this study was to find strategies to motivate workers to achieve a higher level of productivity, cost savings, and profit enhancement at construction projects. Productivity improvement is readily initiated with identification of productivity factors. Although many previous studies suggested factors that affect productivity, some investigated the individual effect of one productivity factor, while others reviewed factors which were productivity drivers for a particular trade or for a specific world region. However, this study introduced a more comprehensive view by combining all previous productivity factors that influence motivation. The efficiency of these strategies may be utilized by management to motivate workforce and control productivity of construction projects and thereby redeem the value of the construction project in measurable terms. These proposed strategies of motivation and productivity improvement may be applied to construction projects of various type and size.

Based on the findings of this study and a review of previous research, the following recommendations are suggested for future projects in the construction industry in Sri Lanka.

Strategy.

- a. Management and immediate supervisors should ensure that good teamwork is established through collaborations, both on and off site by assigning task to groups of workforces with qualified and competent supervisors.
- b. Timely payment of interim certificates so as to improve cash flow to facilitate smooth running of projects giving on time payments to the workers
- c. There should be a clear line of communication between management and workers. Also regular interactions should be organized to recognized workers so as to motivate others to work harder to be recognized one day.
- d. Provide better accommodation facilities including sanitary facilities
- e. Provide safe drinking water

- f. Provide canteen facilities for the workers
- g. Provide medical facilities such as insurance scheme , counseling etc...
- h. Organizing of social activities
- i. Ensure the workers job securities
- j. The government of Sri Lanka has to implement policy system to ensure the workers safety, health, standard of the living at the site level in order to protect this vulnerable group of the society.
- k. Highlight the value of this people to the society while changing the mental setup, attitudes towards these people have in the society at present
- l. Most important factor as far as myself concern is treat them as human beings



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Appendix-A Questionnaire (To Be Completed by Worker)

The research is being undertaken by Mr. PDHD Gunawrdana, a final year MSc student in Construction Project Management. It is aimed at finding the factors that have lead to the decline in productivity facing the construction industry for the past decade and recommend strategies of motivation that will facilitate the improvement of productivity.

1. Address:..... Tele-Number-.....
2. Age:
3. Education level:
 - Not up to year eight
 - Up to year eight
 - O/L Examination
 - A/L Examination
4. Position  University of Moratuwa, Sri Lanka.
€ Foreman Electronic Theses & Dissertations
€ Mason www.lib.mrt.ac.lk
€ Steel bender
€ Carpenter
€ Plumber
5. Terms of employment
 - € Permanent
 - € Contract
 - € Casual
6. Skill Develop From
 - Family
 - Vocational Training Center
 - Youth Center
 - On site working

7. Below are factors that normally affect motivation and productivity at work in the construction industry. From your experience please rate the degree of effect of occurrence on your motivation as well as the degree of significance on your performance.

Tick once (✓) as appropriate the following:

- i) In order of effect in occurrence.
- ii) In order of degree of significance on productivity

•Effect :

1 = low;

2 = medium;

3 = high

•Significance:

1 = strongly not significant;

2 = not significant;

3 = average;

4 = Significant;

5 = Strongly significant



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S/N	Factors that affect on labour productivity	Effect			Significant					
		1	2	3	1	2	3	4	5	
	Organizational factors									
1	Material management (materials getting finish while working)									
2	Systematic flow of work									
3	Unrealistic deadline for project set by client (deadline that is not easy to attain)									
4	Supervision									
5	Inadequate site planning(site layout which leads to difficulty in movement)									
6	Occupational education or Employee training (Introduction into new ideas, further studies, workshops etc)									
7	Crew size and efficiency									
8	Firm reputation									
9	Camping conditions									
10	Late issuance of construction drawings									
11	Late payment of interim certificate									
12	Rework due to construction error (Making corrections on wrong work done)									
13	Inadequate site staff. (less labour for a task leading to excessive work load)									
14	Waiting for other crew (waiting for gang of different trade to finish before another can continue)									
15	Safety plans (Availability of first aid provision of safety kits etc)									
16	Orientation for new employee (Introduction to old staff, introduction into the policies of the company.)									
17	Constant disruption of work (Frequent changes in design and specifications)									
	Economic factors									
1	Salary (Pay, wage, etc)									
2	On-time payment									
3	Amount of pay or rate									
4	Working in social insurance									
5	Incentive payments and financial rewards									
6	Bonus at the end of project or year (showing appreciation at the end of the project and year)									
7	Overtime (Provision of extra money after normal working time)									

වැඩ බලමිනි එළවැහිකාරිය මිනුම් කිරීම සඳහා පත්වන මාලාව

1. බිහිවූය:..... දුරකථන අංකය:.....
 2. වයස :
 3. අධ්‍යයන සුදුසුකම් :

අව වස පන්තිය දක්වා වත් අධ්‍යයන හොඳබිම	
අව වසට සමත්	
අපොස ස/පෙ	
අපොස උ/පෙ	

4. වෘත්තීය හා තොරතුරු

කමිකරු බාස් (Foreman)	
පෙදෙරේරු	
පාස්සුම් කරු	
වඩු කාර්මික	
සත්තු භූමා කරු	
විදුලි කාර්මික	

5. රැකියාවේ ස්භාවය

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කොන්ක්‍රීට්	
අතීතය	

6. කමිකරු පලපුරුද්ද සහ නිපුණතාවය ලබාගත් අභ්‍යන්තර

පවුල් පසුබිමින්	
වෘත්තීය පාඨමාලා මගින්	
කරුණ සේවා මධ්‍යස්ථාන මගින්	
වැඩ විවිද පුහුණුව මගින්	

7. වැඩ බලමිනි එළවැහිකාරිය සඳහා පහත සඳහන් කරුණු බලපානු ලැබේ. ඔබගේ පලපුරුද්ද උපයෝගීකරගෙන පහත සඳහන් කරුණු ඔබ දකින ආකාරය පරිදි පහත උපදෙස් දී ඇති අයුරින් (✓) මෙන් සලකුණු දී ඇති කරුණු ඉදිරියෙන් සලකුණු කරන්න.

- i. කරුණ සිදුවන වාර ගතක හෝ එහි ඇති බලපෑම
 ii) කරුණේ ඇති වැදගත් කම

බලපෑම

- 1 = අවම
 2 = මධ්‍යම
 3 = උසස්

වැදගත් කම

- 1 = නිශ්චිත අයුරකින් වැදගත් නැත
 2 = වැදගත් නැත
 3 = සාමාන්‍ය
 4 = වැදගත්
 5 = ඉහත වැදගත්

9	සංස්කෘතික සහ පවුල් පසුබිම්වල ඇති වෙනස්කම්								
10	හිටපු ගැහිම් වලට සහභාගිවීමේ හැකියාව								
11	ගිවෙස් ගිව ඇති දුර								
12	සනාථිතය ප්‍රදේශ වල සිට වැඩබිමට ඇති දුර								
13	ආදාය හා භාරගැනව								
14	සේවකයන්ගේ අවංක බව								
15	රැකියාවේ ස්භාවය (ගාමනාදික/නිත්‍ය)								
16	අඩු පලපුරුද්ද ඇති පිරිස් සමඟ වැඩ කිරීමේ හැකියාව								
17	සේවකයන්ගේ වයස								
18	සේවකයන්ගේ භෞෂණික සහ වැඩබිම ආනන්ද යාම								
19	සේවකයන්ගේ ලබා දෙන උසස්වීම්								
20	සේවකයන්ගේ අභ්‍යන්තර වන ආනන්දයේ ක්‍රියා කිරීම								
21	සේවකයන් සමඟ ඉහා හොඳ සන්නිවේදන ක්‍රමයක් තිබීම								
22	අතිරේකයන්ට ඉහා දීමේ හැකියාව								
23	අරමුණු හඳුනාගැනීමේ හැකියාව								
24	වැඩබිමේ ඇති අවහිරතාවයන්								
25	කම්කරුවන් සඳහා ඉහා හොඳ සුභසාදන ආපනශාලා පහසුකම්								
27	ඉහා හොඳ භෞතික ආරක්ෂණ පහසුකම්								
28	කම්කරුවන් සඳහා වැඩබිමේ ඉහා හොඳ සේවාසිත පහසුකම්								
29	සාලගුණික තත්වය								
30	ප්‍රවාහන පහසුකම්								
31	වැඩ අවසාන වීමෙන් පසු විවේක සුවසේ තහනම්ව ඇති හැකියාව								
32	කම්කරු පලපුරුද්ද සහ නිපුණතාවය								

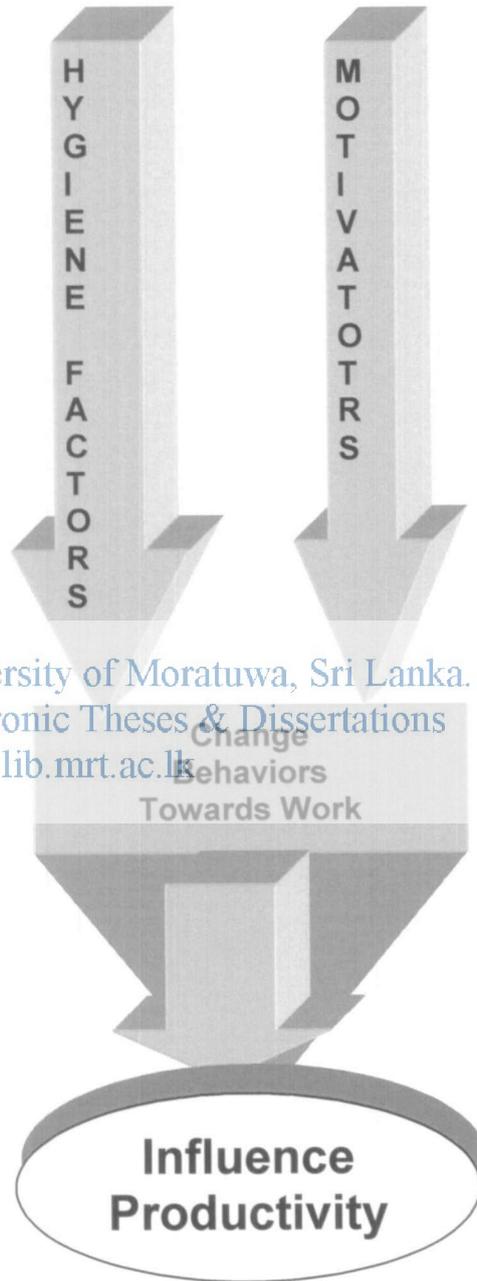


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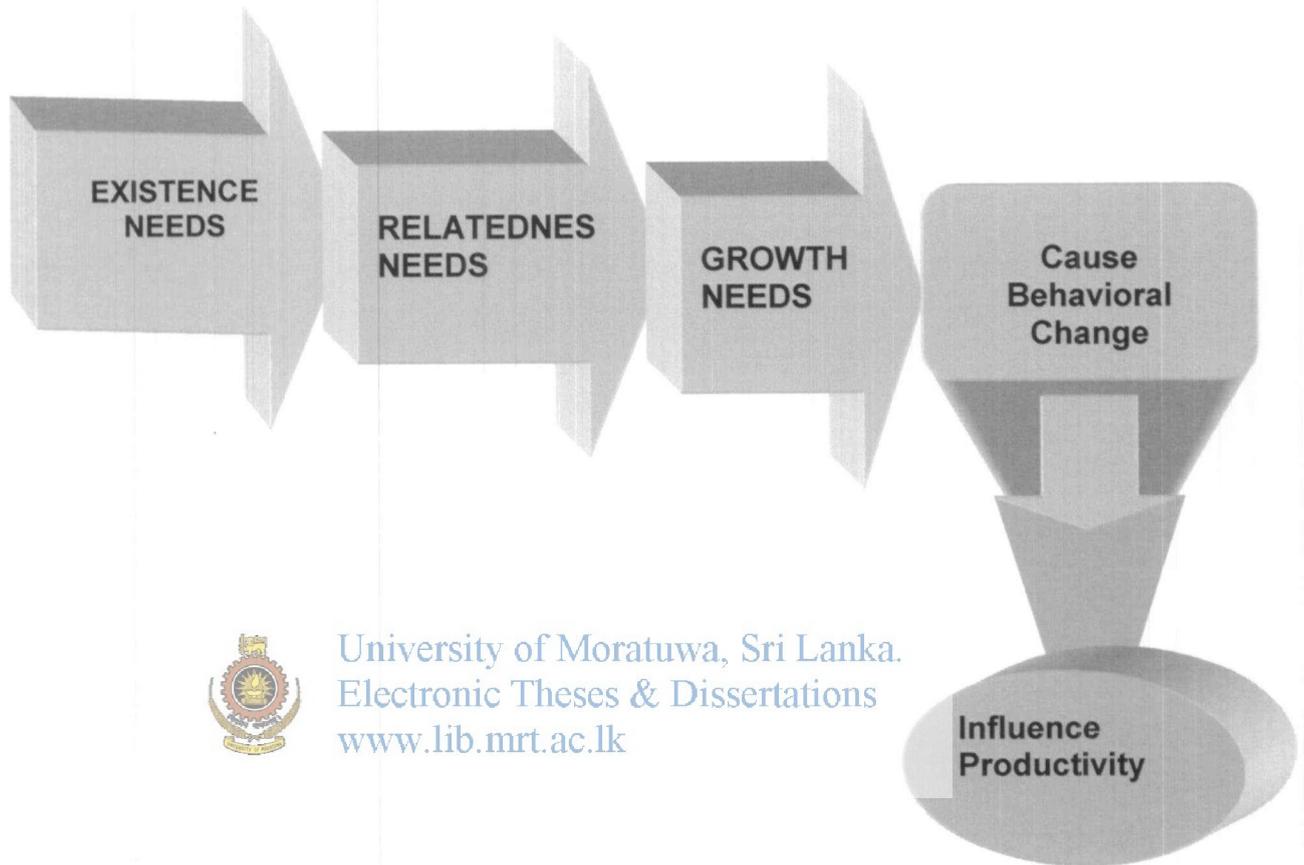
Appendix-C Herzberg's Dual Factor Theory Model



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Appendix-D: Alderfer Need Modified Theory Model



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