



Factors affecting labour productivity in building construction projects of Sri Lanka: A workforce perspective with special emphasis to ABC building site

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Abstract

A good labour productivity in construction work is required to make a good profit for a construction company. Having a productive workforce, a company can save not only construction materials and time but also nonrenewable energy. The aim of this research was to investigate factors affecting labour productivity in building construction projects of Sri Lanka in workforce's perspective. A pretested questionnaire was used to identify how these factors affect the productivity of labourers. Labourers were individually interviewed to get the answers for their view on twenty factors. Collected data was analyzed and ranked according to the importance index. Lack of material factor acquired the highest importance index which was compatible with many other researches done around the world. Weather condition, Physical disabilities (Hearing, Speech Problems), tool and equipment shortages and Inaccurate Instructions were also ranked very important by the construction workers. However, language issues had the lowest degree of importance. Supervisor absenteeism and lack of competition were also considered relatively less important by the workers.

Keywords: building construction projects, good labour productivity

Introduction

Construction is a labour oriented industry which highly relies on the skills of its workers. As resources including human resource are limited, it is important to efficiently utilize these resources for successful completion of construction projects. Further, efficient usage of physical resources depends largely on the workforce who utilizes them. Therefore, managing productivity of the manual workers in a construction project determines the overall productivity of the project.

According to Investopedia (2018) labour productivity is a measure of economic growth within a country. Labour productivity measures the amount of goods and services produced by one hour of labour. However it was said that labour productivity measures the amount of real gross domestic product produced by an hour of labour. According to Investopedia (2018), growth in labour productivity depends on three main factors. Those are investment and saving in physical capital, new technology and human capital.

Productivity can be defined in many ways (Attar, Gupta and Desai, 2012) ^[4]. According to Mostafa (2003) ^[15], construction productivity is the value of money obtained by construction client. Productivity in construction can be determined by mean labour productivity. Mean labour productivity is units of work placed or produced per man hour. Productivity is the ratio of output to all or some of the resources used to produce that output.

$$Productivity = \frac{Output}{Labour\ cost}$$

Labour productivity is an important factor in determining the productive potential of the economy (Pettinger, 2015) ^[18]. According to Pettinger (2015) ^[18] Countries which have strong labour productivity growth, tend to benefit from high rates of growth, strong export demand and low inflation. When labour productivity is increased it can enable a higher long run trend rate of growth.

Labour productivity is one of the major factors that affect construction industry since a project has to be completed within a given period. Poor labour productivity is often encountered in construction projects (Attar, Gupta, and Desai, 2012) ^[4]. Project managers, construction managers, engineers and supervisors face lot of problems due to low productivity of labourers. According to Gopal and Murali (2015) ^[9], in most countries, 30-50 percent of total project cost is comprised of labour cost. Hence, increasing labour productivity is important to maintain the labour cost within reasonable limits. Increasing labour productivity helps the management to reduce cost, manage time taken to complete a project efficiently without lowering the quality of the output.

It is generally believed that construction workers like to idle at work while the supervisors are away. According to Assaf and Al-Hejji (2006) ^[3] delay of the construction occurred due to poor productivity of labourers. However, many factors can contribute to poor labour productivity. Detailed assessment of these factors is necessary to identify the most influential factors that cause poor labour productivity. Managers often ignore the manual workers perspective in improving labour productivity. As manual workers play a key role in construction projects, it is important to see the

issues related to labour productivity from their point of view.

Significance of the study

Construction industry is flourishing in Sri Lanka. Many major construction projects are being executed Island wide (Sunday Observer, 2017) [22]. Managing labourers efficiently and ensuring high levels of labour productivity has become a priority concern of managers in construction industry. The knowledge of productivity is an essential part of the construction management (Mostafa, 2003) [15]. Many researchers in other countries have done researches on labour productivity. However, lack of research in the local setup is observed in area of labour productivity. This knowledge gap needs to be filled to improve the labour productivity in the future in Sri Lanka.

Further, it is important for the managers of construction projects to have a wide understanding of the workers perspective in labour productivity as it can be the bottleneck to improve the productivity of the project. Identifying the relative importance of the factors may help to efficiently take measures to overcome the most influential factors of labour productivity. This in turn will improve the quality of the project, reduce the cost and minimize the delays in completion of the project.

Author of the present study is a civil engineer in the construction field. The knowledge gained through this study will help him to comprehensively understand the importance of different factors affecting labour productivity and to take remedial action. Evidence based action may help to improve project success rate, increase profits and long lasting customer relationships.

ABC building construction is a project to build a 47 storied hotel and spa in the heart of Colombo. It has a large workforce of 300 manual workers. Therefore, it gives a suitable setting to assess factors affecting labour productivity in construction field. The factors causing poor labour productivity may defer from one worker to another. Hence, the importance of each factor according to the workers perspective will be assessed through this study.

Delimitations of the study

The study mainly focused on selected factors identified in the literature review which have been studied in other countries. The construction field and the factors affecting labour productivity may vary from country to country. Differences in labour laws and regulations, environmental factors and other unique factors specific to the country or the project may influence labour productivity. However, considering the time and resource constraints the author limited the study to a selected number of known factors without attempting to identify above mentioned unique factors. Further, the study was limited to one construction project due to time limitation.

Literature Review

Introduction

Literature were reviewed through the internet in order to identify current knowledge and research done regarding the productivity and labourers productivity. However, a special attention was paid for the labour productivity in construction field. Reviewing researches done in the labour productivity in construction field, it was found that many factors affect labour productivity not only in construction

field but also other field. Web sites, electronic journals through Google scholar search and other electronic journal publication web sites were referred for the literature review.

Labour productivity

According to Ghate and Minde (2016) [8], labour is the most valuable asset in construction industry. Labour productivity leads to overall productivity in construction projects. Decreasing productivity is currently a major concern in the industry (Ghate and Minde, 2016) [8]. Therefore, many researchers have attempted to find the factors affecting labour productivity worldwide.

A study conducted among civil engineers in Mumbai India identified twenty four (24) factors that influence labour productivity in construction industry. Most important factors influencing labour productivity were skilled labour, availability of material, availability of tools, project manager's leadership, construction method, safety condition on site, communication between site management and labour supervision (Ghate and Minde, 2016) [8].

Reviewing many publications on labour productivity Yi and Chan (2013) [24] concluded that construction labour productivity is affected by management factors namely, proper planning, realistic scheduling, adequate coordination and suitable control. Labour related factors such as union agreements restrictive work practices, absenteeism, turnover, delays, availability level of skilled craftsman and use of equipment were also identified as factors influencing labour productivity. Further, according to Rojas and Aramvarekul (2003) [20] management skills and manpower issues have been identified as two greatest potential areas to affect productivity. However, external factors, which are often cited as major causes for low productivity in the construction industry, have been identified to be one of the least relevant productivity factors (Rojas and Aramvarekul, 2003) [20].

According to Durdyev and Mbachu (2011) [5] they have found from their research that the key external constraints to on-site labour productivity are comprised of statutory compliance, unforeseen events and wider external dynamics. Further, the internal constraints, which contribute to 67 percent of the onsite productivity issues are comprised of reworks, level of skill and experience of the workforce, adequacy of method of construction, buildability issues, and inadequate supervision and coordination.

According to Durdyev, Ismail and Bakar (2012) [6], most significant factors affecting labour productivity are, lack of local experienced labour, schedule pressure caused by the Government, working overtime, financial weakness of the contractor, rework, inadequate financial policies of the Government and working seven days/week without holiday. According to Alinaitwe, Mwakali and Hansson (2007) [1] labourers were given to rate in their experience how 36 factors affect productivity with respect to time, cost and quality. It was identified that there were ten (10) most significant factors affecting labour productivity. Those were incompetent supervisors, lack of skills from the workers, rework, lack of tools/equipment, poor construction methods, poor communication, inaccurate drawings, stoppages because of work being rejected by consultants, political insecurity, tools/equipment breakdown and harsh weather conditions. It was identified in this research that poor communication is one of the ten most significant factors affecting labour productivity. As many labourers in Sri

Lanka speak Sinhala and Tamil and know only one language, communication problem occurs in a construction site. Therefore, studying whether communication problems affect labour productivity in Sri Lanka, will help for project managers to eliminate this issue. This research was done in Uganda which is a developing country. Therefore, as Sri Lanka is a developing country these factors can be similar to Sri Lankan context.

According to Enshassi, A. *et al* (2007) ^[7] forty five factors have been considered for the research and main factors that negatively affected, were material shortage, lack of labour experience, lack of labour surveillance, misunderstandings between labour and superintendent, and drawings and specification alteration during execution. Compared to other research done considering factors affecting productivity, material shortage was ranked in the first position of all forty five factors negatively affecting labour productivity. According to Thomas and Napolitan (1995) ^[23] material availability problem was the most obvious disruption linked with change work.

According to a research done in United States by Arditi and Mochtar (2000) ^[2], it was found that cost control, scheduling, design practices, labourer training and quality control were the function for productivity improvement.

According to Attar, Gupta, and Desai (2012) ^[4], there are fourteen guidelines to improve labour productivity. Those are properly training to the labourers, motivation to workers towards project completion, properly and in advance material procurement and management, on time payment to the workers, systematic flow of work, properly, clearly and in time supervision, advance site layout, maintain work discipline, facilities to the labourers, clearance of legal documents before starting of work, systematic planning of funds in advance, premonsoon plan to avoid work stop, maximum use of machinery and automation system and advance equipment planning.

Careful analysis of literature on factors affecting labour productivity showed that many different manpower related, communication related, resource related and external environment related factors influence labour productivity. Whether, these factors are as important as in other countries in Sri Lankan context is yet to be established.

According to the literature review, all these labour productivity factors were categorized into four issues. Those were manpower issues, external issues, communication problem and lack of resources. Researchers in other countries have considered many labour productivity problem under those main issues.

Manpower issues

According to literature review, it was found that one of the major issue regarding labour productivity in construction industry was manpower issues. Many researches have considered this issue in their research. According to Makulsawatudom and Emsley (2001) ^[14], labour absenteeism was ranked as 12th position out of other factors. According to Odesola and Idoro (2014) ^[16], lack of skill of the worker, labour personal problem, lack of labour experience, labour absenteeism, misunderstanding among labour, labour dissatisfaction, increase of labourer age and lack of competition of labour related factors affecting labour productivity were ranked as 2, 5, 6, 9, 11, 12, 13 and 15 respectively.

According to Enshassi, A. *et al* (2007) ^[7], lack of labour

experience was ranked as 2nd. Misunderstanding between labour and superintendents was ranked as 3rd position (Enshassi, A. *et al*, 2007) ^[7]. Labour dissatisfaction was ranked as 14th position in their research. As a manpower issues, misunderstanding among labour was ranked as 17th position. However, lack of competition was ranked as 25th position and it indicate that competition among labour is not much affected for labour productivity. Increase of labourer age was ranked as 30th position in their research. Labour absenteeism was ranked as 41st position (Enshassi, A. *et al*, 2007) ^[7]. Labour personal problems was ranked as 42nd position.

According to Gundecha (2012) ^[10], lack of experience was ranked as 12th position. Absenteeism was ranked as 18th position in this research. Misunderstanding among labourers was ranked as 31st position in this research. However, age factor was ranked as 34th position. Further, lack of competition among labourers was ranked as 38th position. Personal problem was ranked as 40th position and it was ranked as lowest affected factor out of 40 factors considered for this research.

External issues

Kadir, M.R.A. *et al* (2005), ^[11] indicated poor weather condition as 28th position out of 50 factors. They ranked strict government policy on recruitment of foreign workers as 15th position. It is an external factor. In their research, they indicated stop work order because of infringement of government regulation as 33rd position. Coordination problem with client was ranked 41st position in their research.

According to Enshassi, A. *et al* (2007) ^[7], weather changes was ranked as 29th position. However, augmentation of Government regulations was ranked as 36th position.

According to Makulsawatudom and Emsley (2001), weather condition was ranked as 20th position.

According to Gundecha (2012) ^[10], weather condition was ranked as 7th position out of 40 factors affecting labour productivity. Further, implementation of the Government laws was ranked as 32nd position.

Communication problem

According to Makulsawatudom and Emsley (2001) ^[14], four factors were indicated for communication problem out of his top eight factors affecting labour productivity. Those were inaccurate drawing, inspection delay, instruction time and also poor communication. Incomplete drawings was ranked as 2nd according to Makulsawatudom and Emsley (2001) ^[14]. Enshassi, A. *et al* (2007) ^[7] indicated only one communication problem out of their main factors affecting labour productivity. It is drawings and specification alteration during execution.

According to Enshassi, A. *et al* (2007) ^[7], drawings and specification alteration during execution was ranked as 5th position. According to Gundecha (2012) ^[10], variations in the drawings was ranked as 14th position. However, incomplete drawings was ranked as 16th position. Further, design changes was ranked as 20th position.

Lack of resources

Kadir, M.R.A. *et al* (2005) ^[11] investigated 50 factors affecting labour productivity. According to the research, material shortage at project site was considered the highest importance factor affecting construction labour productivity.

However, in their research they found that tool shortage was 37th position. Further they identified that lack of tool and equipment in the market was ranked as 43rd position. According to Makulsawatudom and Emsley (2001) [14], lack of material was ranked as 1st position. Therefore it was the most important factor affecting labour productivity according to their research. Lack of tools and equipment was ranked as 6th position in Makulsawatudom and Emsley (2001) [14] research. According to Enshassi, A. *et al* (2007) [7], material shortage was ranked as number one. However, tools and equipment shortages was ranked as 10th position in their research. According to Gundecha (2012) [10], lack of required construction material factor was ranked as 1st position. Further lack of required tools and equipment was ranked as 4th position. However, inadequate construction material was ranked as 28th position.

Objectives

Main Objective

To investigate factors affecting labour productivity in building construction projects of Sri Lanka and give recommendations to enhance labour productivity.

Specific Objectives

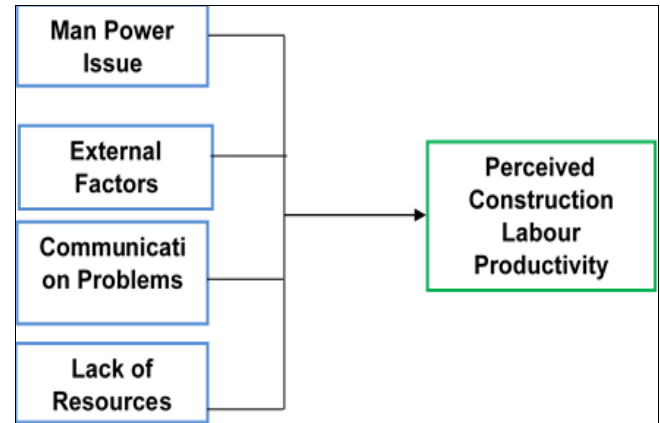
- a. To investigate the productivity problems in building construction sites of Sri Lanka, by using a questionnaire to ascertain workforce's perception of this aspect.
- b. To investigate the potential for improvement associated with factors influencing construction labour productivity.
- c. To create the foundation for further study of construction labour productivity and improvement of the same in Sri Lanka

Conceptual framework of the research

The conceptual framework was prepared by using above

research questions and the main research objective. Above four research questions were identified as the independent variable while dependent variable is identified according to the research objective. Conceptual framework for the research is shown below in the Figure 1.0.

Independent Variable
Dependent Variable



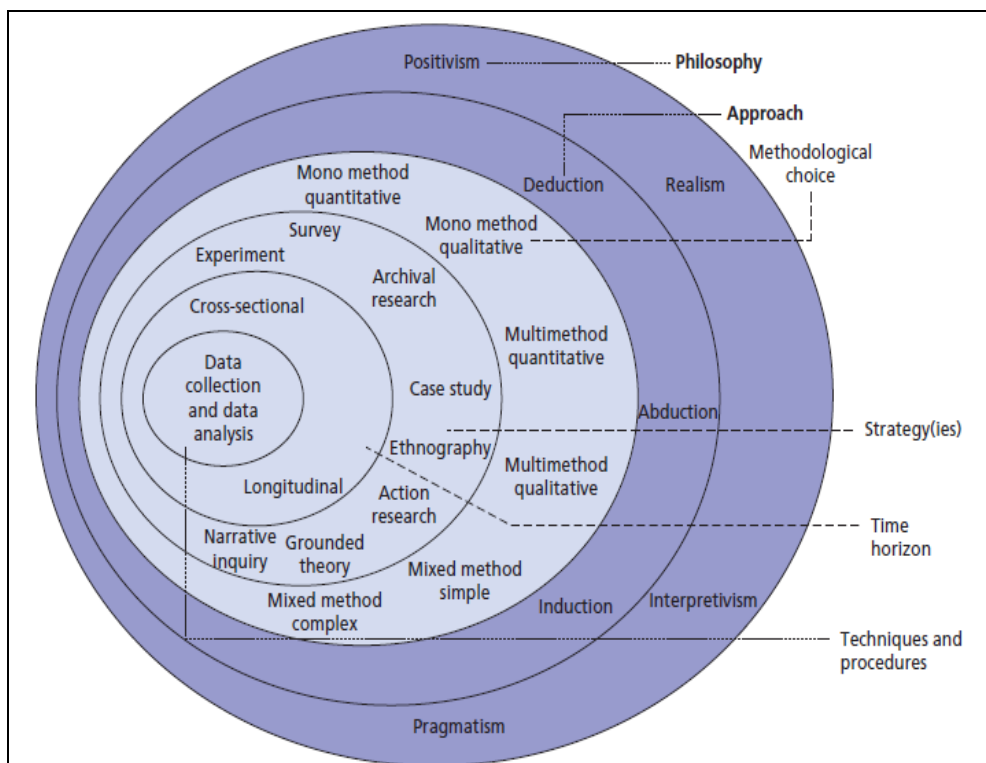
(Source: Author, 2017)

Fig 1: Conceptual framework

Research Methodology

Research methods

According to Saunders *et al* (2012), aspects of the research design are vital to understand what a researcher wish to achieve and how a researcher intend to do. As this research distinguished numeric data, this research was quantitative research. Quantitative data is generally associated with positivism. Hence this research had a positivist philosophy using a deductive approach.



(Source: Saunders *et al*, 2012)

Fig 2: The research onion

The methodological choice of the research was quantitative mono method. The research strategy was survey. The time horizon of the research was cross sectional. Data collection method was a questionnaire. The survey presented 20 productivity factors generated on the basis of related research work on construction productivity. Further, these factors were divided into four issues to get a clear idea.

Sample rationale

The ABC building site was purposively selected as the study setting since it had a large workforce consisting of 300 workers.

Study population was defined as the manual workers working in the ABC building site during the study period. There were 300 labours in the site. Therefore, according to Krejcie and Morgan (1970), sample size was selected as 169. The participants were selected purposively.

Data collection instrument

An interviewer administered structured questionnaire was used to collect data as average literacy level of the manual workers was poor. The questionnaire was designed based on the factors identified by the literature survey. Likert scale was used where relevant running from 1 (very low) to 5 (very high). A validated questionnaire used in a past study was selected and modified to suit the local context.

Role of the researcher

Information bias was minimized by administering the questionnaire as an interviewer administered questionnaire and using predetermined word format for asking each question. There were Sinhala and Tamil speaking workers in the site. Therefore, a person who was bilingual in Sinhala and Tamil, was engaged to ask questions in the questionnaire to minimize an information bias.

Validity

Validity of a research in survey pertains to the extent at which the survey measures right elements that need to be measured (Research methodology, 2017). According to Research methodology (2017), validity is how well an instrument measures what it is intended to measure. Data was collected from the manual workers only. The questionnaire used was a validated one which ensured high levels of validity. It was further increased by using a predetermined word format to ask questions and using a translator to interpret the answers during interviews.

Reliability

All participants were interviewed individually and were instructed not to discuss regarding the answers to minimize participant error. Predetermined set of words were used to translate and explained the key words in the questionnaire to the participants to reduce participant bias. All participants were interviewed by one bilingual interviewer so as to reduce observer error. All answers were recorded based on the likert scale to minimize interpretation in different ways. This minimized observer bias.

Generalizability

As sample size was 169 which is a significant sample size, the sampling method affirmed generalizability of the results to labour productivity in any building construction site.

As these workers were mobilized to different building sites upon completion of one construction project their perspective can be generalized to any construction site.

Ethical consideration

Workers were not forced to participate in the study. Care was taken not to ask any embarrassing and sensitive questions in the structured interview questionnaire. The collected personal data and their answers were not released to the contractor or any party without their consent. The data was kept confidentially and will be destroyed after the purpose is achieved.

Data access

The ABC building site was the place where the researcher worked. Hence, to get the permission for collecting the data was easy. The questionnaire was presented to the project manager and its importance to the industry was explained. After that permission was taken from him. He gave his fullest support to the researcher.

The data was collected from the selected sample of the selected construction site. Labourers were explained the purpose of the research before they were interviewed to collect data. Labourers were individually interviewed to get answers for the questionnaire. Further, the researcher assured participants that collected data was not be given to the construction company.

Data analysis

Microsoft Excel and SPSS version 21 were used to analyze data. Answers were recorded using likert scale to measure the level of importance of the factors. An "Importance Index" was calculated for each factor to determine the relative influence of the factor to labour productivity. It was calculated using following equation (Lim *et al*, 1995).

$$\text{Importance Index} = \frac{5n_5 + 4n_4 + 3n_3 + 2n_2 + n_1}{5(n_1 + n_2 + n_3 + n_4 + n_5)} \times 100$$

Constraints

Due to time and resource constraints the study was limited to ABC building site only. As there were Tamil speaking labourers in this building construction site, it was very difficult to ask exact question directly from those labourers. Therefore, a translator had to be engaged for asking questions. According to literature review, more than fifty factors affecting labour productivity had been considered. However, this research only considered twenty factors affecting labour productivity due to limited time.

Results and Discussion

Introduction

There were twenty (20) questions in the questionnaire. Four independent variables were selected to identify factors affecting productivity in workforce's perception. Although there were many factors found in literature survey, four areas were assessed in this research. Those were manpower issues (MPI), external factors (EI), communication problems (CP) and lack of resources (LOR).

According to the factors assessed, importance index was calculated and factors were ranked from 1 to 20 in descending order of importance. It is shown in Table 1.0.

Table 1: Ranking of factors affecting labour productivity according to the degree of importance

Issue	Factors affecting labour productivity	Total Respond	Degree of Importance Index	Rank
LOR	Lack of Material	169	86.15	1
EI	Weather condition	169	83.31	2
CP	Physical disabilities (Hearing, Speech Problems)	169	77.40	3
LOR	Tool and equipment shortages	169	76.92	4
CP	Inaccurate Instruction	169	75.5	5
MPI	Lack of competition	169	75.15	6
MPI	Labour dissatisfaction	169	71.72	7
MPI	Increasing labourer age	169	71.48	8
MPI	Lack of labour experiences	169	70.65	9
LOR	Lack of labour	169	69.94	10
CP	Inaccurate drawings and specifications alteration during execution	169	67.34	11
MPI	Labour personal problems	169	65.80	12
MPI	Misunderstanding between labour and superintendents	169	64.26	13
EI	Augmentation of Government regulations related to the construction sector	169	59.53	14
MPI	Labour absenteeism	169	58.82	15
EI	Stoppages because of disputes with consultant and contractor	169	57.87	16
MPI	Misunderstanding among labour	169	57.40	17
LOR	Supervisors absenteeism	169	41.89	18
MPI	Lack of competition	169	36.45	19
CP	Language issues	169	30.18	20

(Source: Author generated according to survey data, 2017)

According to the data, lack of material was the most important factor (II = 86.15) determining labour productivity. Weather condition (II=83.31), Physical disabilities (Hearing, Speech Problems) (II =77.4), tool and equipment shortages (II=76.92) and Inaccurate Instructions (II=75.5) were also ranked very important by the construction workers. However, language issues had the lowest degree of importance which had an importance index of 30.18. Supervisor absenteeism (II=41.89) and lack of competition (II=36.45) were also considered relatively less

important by the workers.

Man power issues affecting building construction labour productivity in Sri Lanka

Man power issues were assessed using eight questions in the questionnaire. Those were lack of labour experiences, labourer absenteeism, labourers’ personal problems, labourer dissatisfaction, misunderstanding among labourers, Lack of competition, misunderstanding between labourer and superintendents and increasing labourer age.

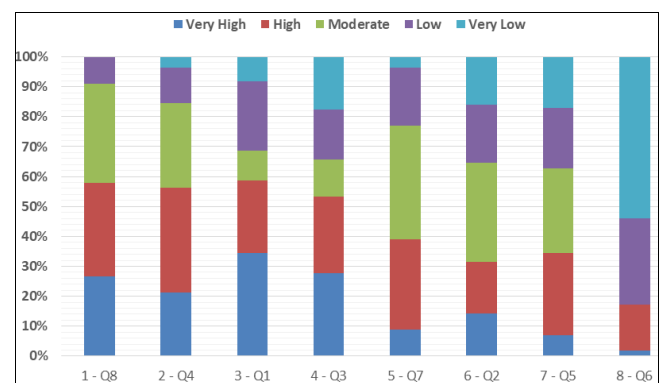
Table 2: Factors affecting Manpower Issues (MPI)

No	Factor	Degree of Importance Index	Overall Rank	Rank in MPI
Q8	Increasing labourer age	75.15	6	1
Q4	Labour dissatisfaction	71.72	7	2
Q1	Lack of labour experiences	70.65	9	3
Q3	Labour personal problems	65.80	12	4
Q7	Misunderstanding between labour and superintendents	64.26	13	5
Q2	Labour absenteeism	58.82	15	6
Q5	Misunderstanding among labourer	57.40	17	7
Q6	Lack of competition	36.45	19	8

(Source: Author generated according to survey data, 2017)

Considering factors related to manpower issues, the highest degree of importance was observed in increasing labourer age and its value was 75.15. Nevertheless, it was ranked sixth (6th) position in overall ranking. Lowest importance index was recorded as 36.45 for lack of competition. However by considering overall ranking, lack of competition was ranked as nineteenth (19) position. Apart from ‘lack of competition all the other factors had a importance index more than 50 indicating the relative importance of these manpower factors.

Following figure 3.0 shows labourers’ response for manpower factors affecting labour productivity.



(Source: Author generated according to survey data, 2017)

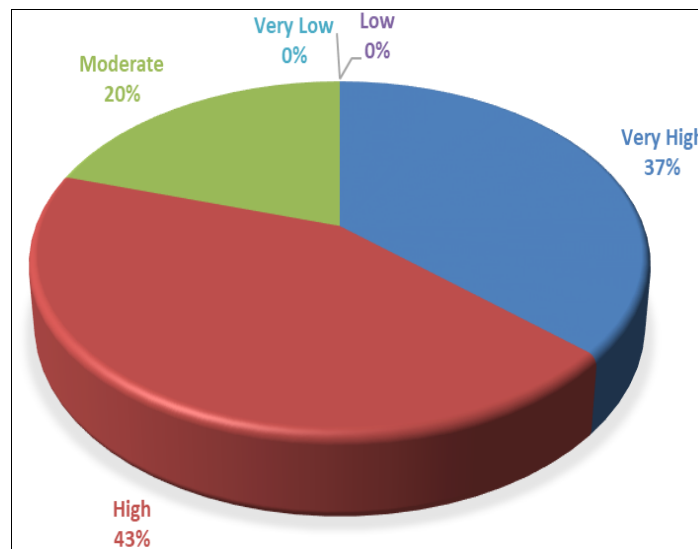
Fig 3: Labourers’ responses for manpower issues

Considering the frequency of responses lack of experiences was considered very important by majority (n=58, 34.3%). Only 26 workers (1.8%) said that lack of competition was a very important factor of labour productivity. The columns of the above bar chart are placed according to the descending order of important index. When both ‘very high’ and ‘high’ responses are considered cumulatively, a similar trend is observed in importance of the factors. Therefore, both frequency of responses and the importance

Index shows a similar picture.

External factors affecting building construction labour productivity in Sri Lanka

Three questions were asked for external issues. Those were augmentation of Government regulations related to the construction sector, weather condition, and stoppages because of disputes with consultant and contractor. The distribution of responses of labourers for weather condition was shown in following figure 4.0.



(Source: Author generated from survey data)

Fig 4: Weather condition factor

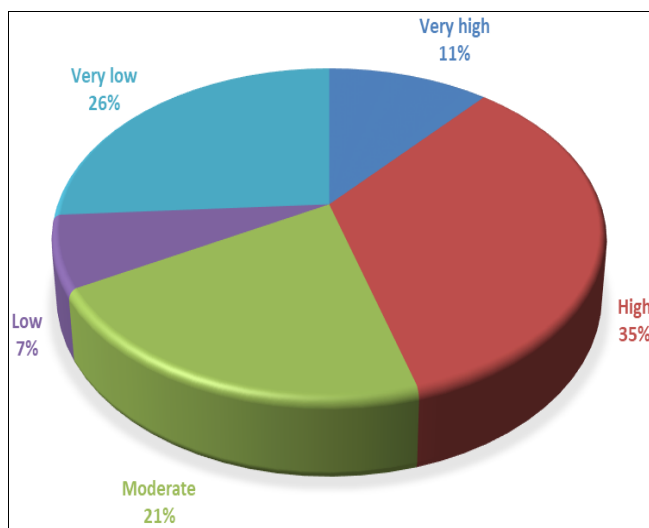
Weather condition was the second highest value of degree of importance and it was 83.31%. Although weather condition of the external factor got a high rank as second (2nd), other two factors got a low rank as fourteenth (14th) and sixteenth (16th) positions.

According to labourers answers, 43% of labourers answered it as high affect for the labour productivity and 37% of labourers responded it as very high affect for the labour productivity.

The distribution of responses for ‘augmentation of government regulations’ are shown in following figure 5.0.

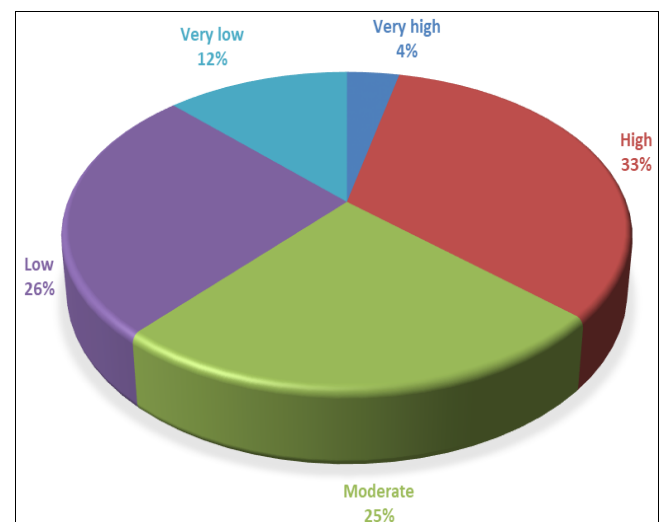
Augmentation of Government regulations related to the construction sector gave 59.53% for the degree of importance and was ranked as fourteenth (14th) position.

35% of labourers responded it as high while 11% of them answered as very high. However, 26% of labours responded its influence was very low. Therefore, it got low position in the ranking.



(Source: Author generated from survey data)

Fig 5: Augmentation of Government regulations related to the construction sector



(Source: Author generated from survey data)

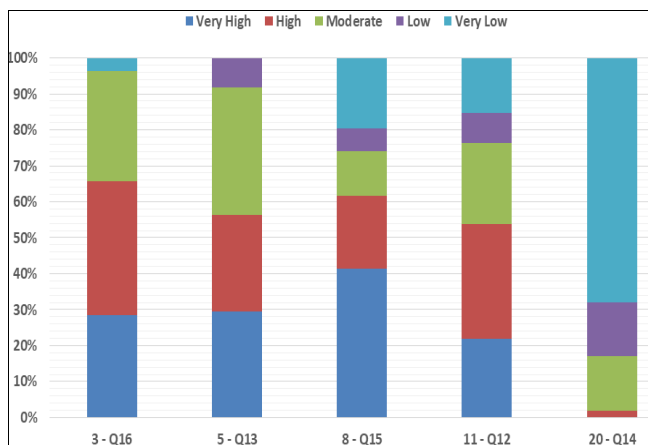
Fig 6: Stoppage due to dispute related to the construction sector

Stoppages because of disputes with consultant and contractor got 57.87% of degree of importance index and it got sixteenth position in ranking. Figure 6.0 shows the distribution of answers.

According to survey data 33% of labourers responded it as high effect for productivity. 25% of labourers answered it as low while 25% of them responded it as moderate. However, 12% of them answered it as very low and 4% of them responded it as very high. Therefore, according to importance index calculation it was ranked as sixteenth (16th) position.

Communication problems affecting building construction labour productivity in Sri Lanka

Five factors were assessed for communication problems. According to survey data, physical disabilities (Hearing, Speech problems) had the highest degree of importance index value in communication problems. The second highest value of the communication problem was Inaccurate Instruction while supervisor’s criticism was ranked as third.



(Source: Author generated from survey data)

Fig 7: Labourers’ responses for communication problem

According to the survey data, physical disabilities (Hearing, Speech Problems) gave the highest of communication problem and third of overall ranking. 37% of labourers answered it as high while 31% of labourers responded it as moderate effect for labour productivity. 28% of labourers answered it as very high and 4% of them responded it as very low. No one answered it as low.

Inaccurate instruction was ranked as fifth (5th) of overall ranking and it gave second highest position of communication problem. However, 35% of labourers answered it as moderate while 30% of them responded that its effect was very high. 27% of labourers answered it as high. 8% of labourers responded it as low while no one answered that its effect was very low.

Supervisor’s criticism was the third (3rd) of the communication problem and eighth (8th) of overall ranking. 41% of labourers responded it as very high while 20% of them answered it as high. 12% of them answered it as moderate. However, 20% of labourers answered it as very low effect while 7% of them answered its effect as low.

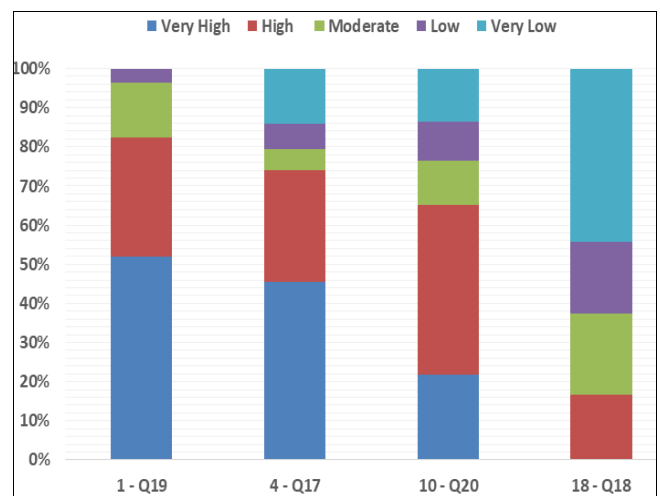
Inaccurate drawings and specifications alteration during execution was ranked as eleventh (11th) position in overall ranking while fourth (4th) in communication problem. 32% of labourers answered that its effect was high while 22.5% of labourers responded it as moderate. 22% of labourers responded it as very high effect for this question. 8.28% of labourers answered it as low while 15% of labourers responded it as very low.

Language issue had the lowest degree of importance index

which was 30.18. Therefore it was ranked as twentieth (20th) in overall while fifth (5th) in communication problem. 68% of labourers thought that its effect was very low while 15.38% of them answered it as moderate. 14.79% of labourers answered that its effect was low. However, no one answered its effect was very high.

Lack of resources affecting building construction labour productivity in Sri Lanka

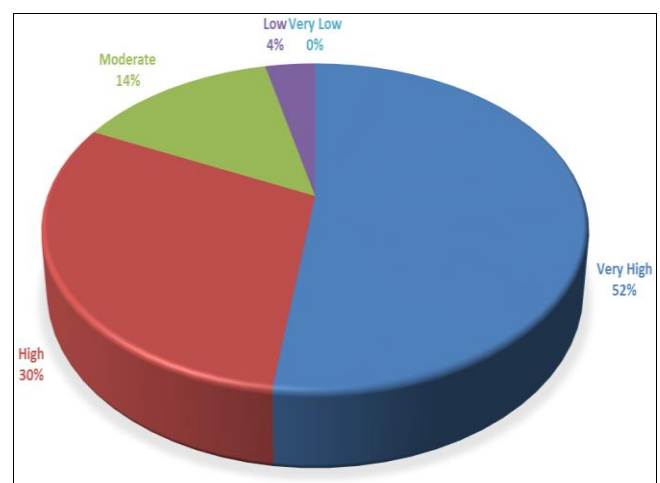
Figure 8.0 shows the responses for lack of resources factors. According to the analysis, lack of material was ranked as the first out of all factors and its importance index was 86.15. Second highest importance index of this was lack of tools and equipment factor and its value of degree of importance index was 76.92. However, according to importance index it was ranked as fourth in overall. Lack of labour was ranked as tenth (10th) in overall while supervisors absenteeism got eighteenth (18th) position in overall ranking.



(Source: Author generated from survey data)

Fig 8: Labourers’ responses for lack of resources

According to survey data, labourers’ responses for the lack of material was shown figure 9.0.



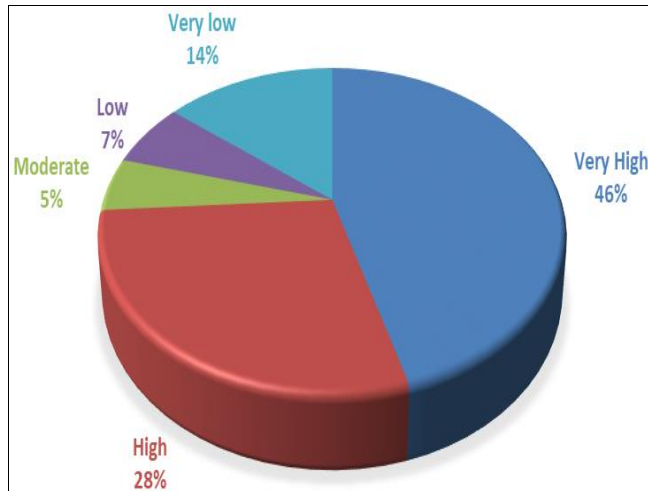
(Source: Author generated from survey data)

Fig 9: Labourers’ Responses for Lack of Material

52% of labourers answered that lack of material affected very high for the labour productivity. 30% of labourers answered it as high while 14% of labourers responded it as moderate. 4% of labourers answered it as low. However, no

one answered it for very low. Therefore, lack of material was the highest ranked factor which affects labour productivity in construction field.

Responses for the tools and equipment shortages are shown in figure 10.0.

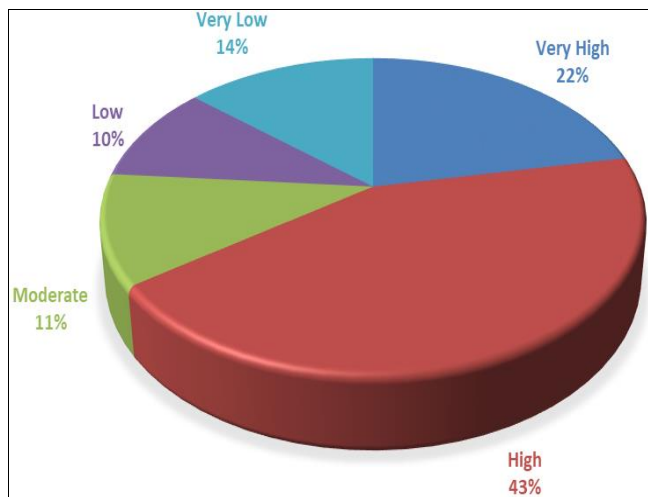


(Source: Author generated from survey data)

Fig 10: Labourers’ Responses for Tools and Equipment Shortages

46% of labourers answered that tools and equipment shortages factor affect very high for the labour productivity. 28% of labourers answered it as high while 14% of labourers responded it as very low. 7% of them answered that it affected low for the labour productivity. However, 5% of them answered it as moderate. Therefore, tools and equipment shortages factor got 76.92 degree of importance index and ranked as fourth in overall.

Figure 11.0 shows the responses for lack of labour factor affecting labour productivity in construction field.

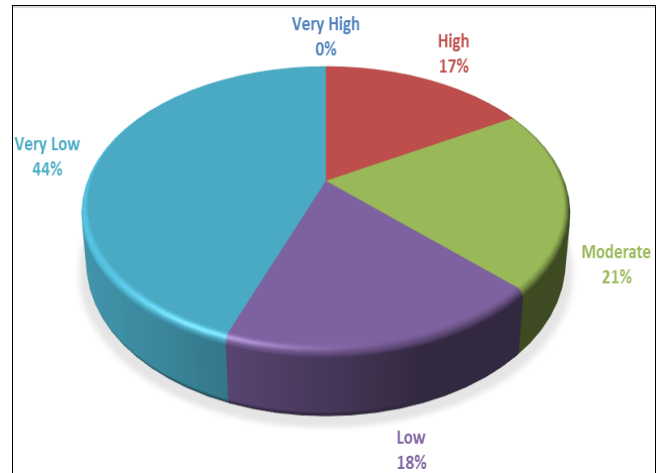


(Source: Author generated from survey data)

Fig 11: Labourers’ Responses for Lack of Labour

According to survey data, 43% of labourers answered it as high and 22% of labourers responded it as very high. However, 14% of labourers responded that it affected very low while 11% of them answered it as moderate. 10% of labourers answered it as low. Therefore, its degree of importance index was 69.94.

Figure 12.0 shows the responses for the supervisor absenteeism affecting labour productivity.



(Source: Author generated from survey data)

Fig 12: Labourers’ Responses For Supervisor Absenteeism

44% of labourers responded as very low for supervisor absenteeism affecting labour productivity. 21% of labourers answered for it as moderate while 18% of labourers answered it as low. However, 17% out of all labourers responded it as high. None of them answered very high for supervisor absenteeism affecting labour productivity. Therefore it got 41.89 for degree of importance index and was ranked as eighteenth (18th) position in overall ranking. Considering analyzed data, the highest degree of importance index was lack of material while the lowest degree of importance index language issues.

Conclusions

Revisiting the aim and objectives

The main objective of the research was to investigate factors affecting labour productivity in building construction projects of Sri Lanka and give recommendations to enhance labour productivity. Identifying factors affecting labour productivity is very important since many construction projects are being conducted as a developing country. Although many factors were found through the literature survey, few factors were selected to investigate four main issues. From this research it was investigated the productivity problem in construction industry on workforce’s perception.

According to analyzed data, there is a potential for improvement of labour productivity. Since lack of material is a highly affected factors for the labour productivity, labour productivity can be improve by supplying construction materials on time. However some factors cannot be changed such as weather condition. Weather condition got the second highest importance index and it is beyond people’s control. Therefore, it is suggested that advanced technology should be used to do construction work without affecting weather condition.

From this research it was found how selected factors affecting labour productivity. Further research can be done to find out many factors affecting productivity. This research done considering only one building construction project. Therefore further research can be done by considering few building construction projects.

Summary of the outcomes and discussion

According to the data analysis, lack of material got the highest importance index and language issues got the lowest

value for importance index. 58 labourers responded that lack of labour experiences was very high. It is the highest rank of manpower issue. However, 3 labourers answered it as very high. However the graph of the importance index and frequency of response are almost same.

62 number of labourer answered very high for weather condition while 6 number of labourers answered stoppage because of dispute with consultant and contractor as very high.

70 number of labourer answered supervisor's criticism for the communication problem while no one was answered as very high for language issue. And, 88nos of labourers answered as very high for the lack of resources. However no one was answered for lack of resources. Stoppages because of disputes with consultant and contractor was the highest one of external factor. For external factor, 62 labourers answered weather condition as very high.

Contribution to knowledge

According to the data analysis, it was found that lack of material had the highest rank of importance index. It is a highly affecting factor for the labour productivity. Other research done in other countries had found that lack of material was highly affected for the labour productivity. Therefore, past researches and this research in Sri Lankan context gave the same factor affecting labour productivity. It was lack of material. Sri Lankan context has same highest factor as other countries.

Suggestions for further research

The highest importance index was given to lack of material factor. It was 86.15. Sometimes, there may be other factors which can get more than 86.15 for the importance index. Therefore, further researches can be done considering many factors affecting labour productivity. Since this research done only for building construction project further research can be done for other construction sector such as road construction project, water supply projects etc.

This research done only for one building construction project. Further research can be done considering few building construction projects.

Further research can be done to identify new unique factors affecting labour productivity and how those factors affect for the labour productivity in construction projects.

Recommendations

Introduction

According to results of the study, final recommendations are given to enhance labour productivity under four (4) issues.

Recommendation on manpower issues

Construction is a labour intensive field. Therefore, labourers are a major determinant of labour productivity, successful completion of projects leading to higher profits.

In order to improve the labour productivity, it is important to improve the status of the labourers. Therefore, the author recommends the management of construction projects to identify the correct person with correct skill set for the correct task. Further, adequate training prior to recruitment and after recruitment is recommended to improve the skills and knowledge of the labourers.

Often, career development opportunities are not given adequate attention by the management for labourer category. However, establishment of a fair performance

appraisal system and offering career development opportunities for the labourers to gain specific knowledge in masonry, carpentry etc. can increase the productivity, retention of staff and worker satisfaction.

In Sri Lankan context labourers belong to poor socio economic group. Therefore, establishment of welfare facilities to help their personal problems, economic problems and health problems may improve their living conditions increasing labour productivity. Health insurance, concessional loan facilities, scholarships for children are possible options that can be implemented by large construction firms.

Recognition and rewarding good performance increases worker satisfaction leading to higher productivity. Therefore, such activities are recommended to the management of the construction field.

Recommendation on external factors affecting

Government regulations were identified to affect labour productivity. In order to minimize the effect of government regulations affecting productivity author recommends the management to study the existing laws and regulations of the country prior to starting construction projects. Further, establishment of a unit to evaluate the legal background of projects in large construction firms may minimize the delays and abandoning of ongoing constructions.

Disputes with clients, people affected from the constructions also reduce the productivity of constructions. Therefore, it is recommended to do comprehensive feasibility analysis prior to major construction projects. Regular discussions and reviews regarding projects, application of project planning and project management principles and maintaining proper documentation also will minimize delays due to disputes.

Even though weather conditions are beyond the control of people, the management can realistically predict and use advanced technology to reduce the delays due to unfavorable weather.

Recommendation on communication problems

Accurate instructions are important to complete constructions to meet the specifications and expectations. Poor documentation and poor communication of instructions is often encountered leading to delays and rework. Therefore, it is recommend to document and communicate the designs properly down the hierarchy to the worker level. Adequate discussion involving all levels of staff from designing to supervising at the field level to clarify doubts and practical constraints will minimize delays causing low productivity.

Improving the communication skills and interpersonal skills of engineers, technical officers and supervisors through training is recommended to improve the communication errors. Allocating supervisors speaking the same language as the labourers will reduce language barriers at the construction sites.

Strengthening the safety measures to ensure safety of the workers, sound proof appliances, goggles etc. will minimize the risk of physical disabilities interfering work.

Recommendation on improvement of resources

The author recommends the management of construction projects to properly estimate material and ensure regular supply of material. Supply of equipment and tools needed according to the nature of the construction should be

planned prior to minimize delays.

Having good rapport with the clients and having reasonable payment schedules through discussion will minimize the disturbance to cash inflows which can lead to shortage of resources.

It is observed that construction projects are often understaffed especially in private sector causing overwork and occupational burnout of the staff. Therefore, authors' final recommendation is to establish a rational system of staffing in construction projects based on the workload allocated to a person.

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