Understanding and Mitigating the Effects of Shortage of Skilled Labour in the Construction Industry of Sri Lanka

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Abstract

Skilled labourer is a key resource that has a direct impact on the success of any construction project. This study analyses the present situation of the construction industry in Sri Lanka with respect to skilled labourer by assessing the need to increase the number of skilled labourers and their skill level by identifying the causes and effects of the shortage of skilled labour. This paper summarises the results of a survey conducted in Sri Lanka and propose mitigation measures to rectify the problem.

This is a timely and needful study in the present context of Sri Lanka with the expected rapid growth of the construction industry especially after the end of the civil war. The objectives of this study are to identify the causes for the shortage of skilled labour in the Sri Lankan construction industry, the resulting effects due to the shortage and to come up with effective mitigation measures. The research was conducted via two types of questionnaire surveys, namely; the individual surveys and the institutional surveys among contractors, consultants and clients represented by Architects, Engineers, Quantity Surveyors, Technical Officers and other similar grades. A project wise analysis was carried out through the institutional questionnaire survey. To support the findings of this research, present salary scales of selected skilled labour types were compared with salary scales of similar overseas opportunities. Categories of skilled labour and professionals were based on International Standard of Classification of Occupations, Labour Market Information System (LMIS-1996) and past studies.

In this research the "Significance Index" was used to rank causes and effects and the "Importance Index" was used to find out important mitigation measures. This study revealed that the most significant causal factor for skilled labour shortage is "inadequate number of trained personnel coming out from training institutions and joining with the labour market" and resulting effect is "time over-run" of construction project. This study also revealed that "Increasing the wages to minimize migration of skilled labour seeking foreign employment" as the most important mitigation measure to overcome this problem. According to the study, the current shortage for concrete workers and masons are 70% and 67% respectively.

Keywords: Construction Industry, Skilled Labour, Causes, Effects, Mitigation Measures

1. Introduction

It is apparent that, with the end of the civil war, the Sri Lankan Construction Industry awakened and is expanding rapidly to all areas as never before. In this context, Sri Lanka is experiencing increased investment on high-rise and medium scale buildings. The construction sector development is expected to grow at a high rate in the coming years too [1].Therefore, effectively facing the challenges and upgrading the construction industry is important to cope with the present and future needs locally and internationally. Therefore it is the high time that effective and efficient construction management practices are adopted in Sri Lanka. Furthermore, it is essential to carry out research related to management practices of construction industry to facilitate its development by identifying the challenges and counter measures and thereby the development of the country.

A previous study on challenges faced by construction industry concluded that skills drain and shortages as an identified problem in the Sri Lankan construction industry [2]. Researchers in Sri Lanka and other developing countries who analysed the causes of delays in the construction projects identified 'shortage of skilled labour' as an important contributory factor [3,4,5].Construction is a labour intensive industry, which relies heavily on the skills of its labour force [6]. The unstable levels of activity in the industry causes severe fluctuations in man power requirements, which in turn results in labour surplus and shortages from time to time [6].

Meeting the client's requirements of cost, time and quality of the work depends considerably on the performance of skilled labour and their acquired training and skills. The level of skill and updated knowledge about recently introduced techniques and technology are also important matters to be considered along with the adequacy of the number of skilled labour. Ineffective manpower training and entry in to construction labour force in both numbers and requisite skills can present continuing problems not only for the contractors but also for other stakeholders of the industry [6].

A past study on training needs of construction workers revealed that the current programmes are turning out inadequate number of workers annually in comparison to the anticipated growth in the construction jobs. It is further supported by a recent publication which says "with the economic growth in Sri Lanka, the manufacturing and foreign employment shows an upward trend. As a result, there is a short supply of Technicians and Associate Professionals and vacancies prevail in middle level and highly skilled categories. Hence a need arises for the creation of highly trained workers, technicians and technologists" [7]. Thus, shortage of skilled labour is a key issue which need to be analysed.

The scope of this study was limited only to building construction projects. The specific objectives of this study were:

- To identify whether there are any shortages of skilled labour
- To identify causes for the above shortage and the effects resulted by this shortage.
- To come up with useful mitigation measures to counter act the above problem.

1.1. Significance of this study to the present context of Sri Lanka

Even though several researchers identified that the shortage of skilled labour is a key factor which affects the construction industry in many aspects, recent studies lack in this area of research. There are many reasons that can be imagined as to why there is a shortage of studies in this area. For example, lack of interest shown to this topic by researchers, poor response rate for a questionnaire survey from the construction industry and inadequate labour market statistics of the construction industry for effective analysis of the problem would be those reasons.

While there is a need to carry out further research to study about the shortage of skilled labour and how to face it, especially after the end of the civil war with the expected rapid growth rate of construction industry, not many studies have been carried out in this area. This study is an attempt to fill the gaps and also as a timely need.

2. Literature review and data collection methodology

2.1. Data collection methodology and type of surveys

According to the literature, questionnaire surveys have been the most widely used mechanism to obtain data from construction workers in the past with variations in implementation [8]. Even though mail questionnaire surveys showed poor response rate in many cases compared to face to face interviews, postal questionnaires were commonly used in the past for construction related studies. Few previous studies indicated that distributing questionnaires with a stamped reply envelop gives higher response rate [8].Considering all these aspects, a mixed methodology was adopted for this research which comprises of: (i) field visits and distributing questionnaire by hand with a stamped envelope to the professionals, (ii) face to face interviews, (iii) postal survey, including a stamped envelope; and (iv) e-mail survey.

Two types of surveys were used for data collection, namely: (i) institutional questionnaire survey and; (ii) individual questionnaire survey. Institutional survey was targeted to get construction related company views on managerial issues like available type of skilled labour and their salary scale. It was carried out on project basis and a project wise analysis was carried out to analyse the characteristics of shortages and to find out whether there are any shortages. The individual survey was designed to get the opinions of the professionals according to their perception and experience regarding this research problem. Both these surveys were conducted among consultants, contractors and clients represented by engineers, architects, quantity surveyors, technical officers and similar grades.

2.2. Sampling method and size of sample

In the past many researchers used random sample to get a representative sample from the population [6], while few researches used snowball sampling [5]. Snowball sampling method is a non probability sampling method which is preferred when it is difficult to get the response

from a sample selected at random and it shows higher response rate [5]. In this research both these sampling methods were used.

According to literature, an average sample size varies from 29 to 147 [3] and many researches showed an average response rate of 40% could be expected in a construction related questionnaire survey [9,10]. Therefore with an expectation of 40% response rate, a total sample size of 125 was selected for the individual questionnaire survey from various districts, targeting 50 responses. But the actual response rate obtained was 65.6% (82 responses) as opposed to the expected 40%.The institutional survey was carried out among 30building construction projects in various districts.

3. Questionnaire design and techniques

To list down the potential causal factors, effects and mitigation measures, expert ideas from several academics and industry professionals were used. Further, few face to face interviews were conducted with skilled labour to find out the above factors. With these identified factors and the knowledge gained through the literature survey, initial questionnaire was designed. A pilot study was conducted among 6 key persons (approximately 5% of the total sample) from industry to fine tune the initial questionnaire. Along with the pilot survey questionnaire, a 'feedback form' was attached to get their comments. The purpose of this form was to find ways of improving the initial questionnaire and to increase the response rate. With the feedback of the pilot survey, the final questionnaire was designed adopting several changes to the initial questionnaire.

Categories of skilled labour were selected based on International Standard of Classification of Occupation by the International Labour Organization (ILO), Labour Market Information System (LMIS) and past studies [6,10]. Included skilled labour types were: bar bender, carpenter, concrete worker, electrician, mason, painter, plasterer, plumber/pipe fitter, stutterer, scaffolder and tiler.

To motivate the respondents psychologically to respond the questionnaire and thereby to increase the response rate, several techniques were adopted. For example unnecessary questions that probe more into personal or confidential matters about both respondent and company were avoided. Anonymity of respondent was maintained throughout the questionnaire (name, age and educational background which may make respondents reluctant to answer were avoided).To convince them psychologically to answer and to make a good rapport simple and non-sensitive questions were placed at the beginning of the questionnaire. Also the confidentiality of the information was guaranteed to the respondent in writing by the researchers through a letter attached with questionnaire.

With all these techniques and continuous following up, a response rate of 65.6 %(82 responses) was achieved for individual survey, which was much greater than the average response rate of 40% documented in past studies.

4. Data analysis approach and data processing

To rank casual factors and effects, Significance Index (SI) was used.

$$SI = \sum a \left(\frac{n}{N}\right)\left(\frac{100}{2}\right) \quad \text{..... (1)}$$

Where 'n' is the frequency of response, 'N' is the total number of responses and 'a' is the weight depending on the degree of significance indicated by strongly agree (+2), agree (+1), no clear idea (0),disagree (-1), strongly disagree (-2). SI takes the values between +100 and -100 where negative values are considered as not suitable factors.

To rank mitigation measures, Importance Index (II) was used.

$$II = \sum a \left(\frac{n}{N}\right)\left(\frac{100}{3}\right) \quad \text{..... (2)}$$

'N' and 'n' are same as above. 'a' is the weight for degree of importance namely; not important (0), less important (1), important (2) and more important (3). II values falls between 0 and 100.

Collected data were analysed and processed manually as well as using a spreadsheet. Responses in the questionnaire were transferred to a data entry sheet of tabular format that enabled easy processing of data.

Agreements between different parties were compared using Spearman's rank correlation coefficient method. The software package SPSS was used to carry out the calculations.

5. General characteristics of respondents

5.1. Respondents of individual survey

Among the selected total 125 samples, 82 (65.6%) have responded to the survey. Figures 1 & 2 below show their distribution.

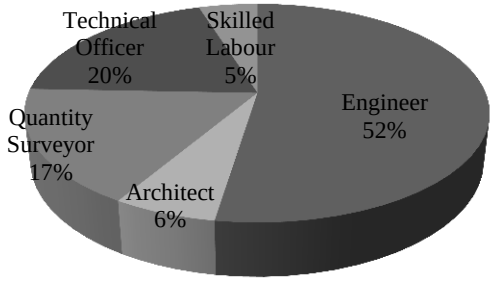

Figure 2: Participation by employment type

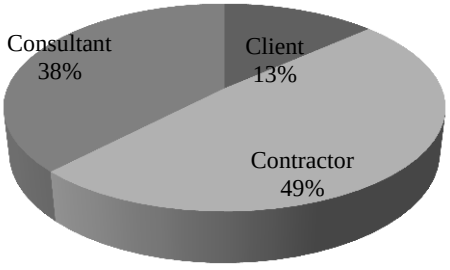

Figure 1: Participation by involvement type

Participated contractors were further divided based on ICTAD grade for building construction as C1 – 42%, C2 – 25%, C3 – 13% and others 20%.

Classification of the respondents by district includes the following: Vavuniya 20%, Colombo 17%, Kandy 13%, Badulla 7%, Jaffna 10%, Trincomalee 6%, Batticaloa 4%, Kilinochchi 5%, Mullaitivu 5%, Galle 2%, Matale 1%, Not indicated 10%.

7% of participants have work experience in the construction industry for more than 20 years, 20% of them have 10 to 20 years, and 30% of them have 5 to 10 years and 43% of them have below 5 years' experience.

5.2. Respondents of institutional survey

Data were collected from contractors of 30 projects. ICTAD grades of those contractors are shown below: C1- 46.7%, C2 –30%, C3 – 16.6% and others 6.7%. Among the 30 respondents 26.7% were Engineers, 20% Quantity Surveyors and 53.3% Technical officers.

Classification of the respondents by district includes the following: Colombo 20%, Kandy 16.7%, Vavuniya 16.7%, Jaffna 13.3%, Kilinochchi 13.3%, Mullaitivu 10%, and Galle10%. Furthermore 16.6% of participants have more than 20 years' work experience in the construction industry, 36.7% of them have 5 to 10 years, and 46.7% of them have below 5 years' experience.

6. Findings of individual survey

6.1. Ranking the causal factors for shortage of skilled labour

Using Severity Index the casual factors were ranked. Tables 1 & 2 below show how different parties perceive the problem based on their exposure and experience in the industry.

Table 1: Ranking of causal factors according to the view of involved parties

No	*Casual Factors*	*Client*		*Consultant*		*Contractor*	
		SI	*Rank*	*SI*	*Rank*	*SI*	*Rank*
1	*Inadequate number of trained personnel coming out from training Institutions and joining labour market*	*72.73*	*1*	*48.39*	*3*	*53.75*	*1*
2	*Difficult to find suitable persons*	*63.64*	*2*	*27.42*	*6*	*23.75*	*6*
3	*Seeking Foreign Employment with higher salary*	*22.73*	*5*	*46.77*	*4*	*45*	*4*
4	*Management policy of the organization - can manage with the number of skilled labour*	*-13.6*	*8*	*-1.61*	*8*	*1.25*	*8*
5	*Management policy of the organization - targeting higher profit margin*	*22.73*	*5*	*38.71*	*5*	*26.25*	*5*
6	*Available training facilities are inadequate*	*40.91*	*3*	*50.0*	*2*	*51.25*	*3*
7	*After the training, shifting their carrier*	*0.0*	*7*	*19.35*	*7*	*16.25*	*7*
8	*Contractors do not provide training for employees (because they are not permanent)*	*36.36*	*4*	*59.68*	*1*	*52.5*	*2*

Table 2: Ranking the causal factors according to type of employment

No	Casual Factors	Rank			
		Eng.	Arch	QS	TO
1	Inadequate supply (inadequate number of trained persons coming from Technical Institutes)	1	2	2	4
2	Difficult to find suitable persons	2	5	6	8
3	Seeking Foreign Employment with higher salary	5	1	5	5
4	Management policy of the organization can manage with the less number of skilled labour	8	8	7	7
5	Management policy of the organization to target higher profit margin	6	5	3	2
6	Available training facilities are inadequate	4	2	4	2
7	After the training shifting their carrier to another field	7	7	4	6
8	Contractors do not provide training for employees (because they are not permanent)	3	4	1	1

Eng. - Engineer, Arch - Architect, QS - quantity surveyor, TO – Technical Officer

6.2. Ranking the effects due to shortage of skilled labour

Tables 3 & 4 below show the diverse view held by different parties.

Table 3: Ranking the effects according to the view of involved parties

No	Effects	Client		Consultant		Contractor	
		SI	Rank	SI	Rank	SI	Rank
1	Delay in project duration/slow construction	63.64	3	66.13	3	20	7
2	Inability to understand drawings	40.31	10	70.37	1	38.75	5
3	Inability to manage unforeseen site condition	31.82	11	45.16	10	40	4
4	Improper construction method	54.55	9	43.55	11	7.5	10
5	Extra cost for removal of bad work	77.27	1	59.68	6	5	11
6	Poor quality of work	63.64	3	62.90	5	11.25	8
7	Errors during construction	59.09	7	59.68	6	11.25	8
8	Less labour productivity	59.09	7	46.77	9	50	1
9	Time overrun	68.18	2	64.52	4	48.75	2
10	Cost overrun	63.64	3	63.35	2	45	3
11	Improper material handling	63.64	3	58.06	8	37.5	6

Table 4: Ranking the effects according to type of employment

No	Effects	Rank			
		Eng.	Arch	QS	TO
1	Delay in project duration/slow construction	1	1	7	1
2	Inability to understand drawings	9	1	5	6
3	Inability to manage unforeseen site condition	11	4	8	9

4	*Improper construction method*	*10*	*3*	*8*	*11*
5	*Extra cost for removal of bad work*	*4*	*10*	*1*	*10*
6	*Poor quality of work*	*7*	*4*	*3*	*3*
7	*Errors during construction*	*7*	*4*	*10*	*1*
8	*Less labour productivity*	*4*	*10*	*10*	*3*
9	*Time overrun*	*3*	*4*	*3*	*7*
10	*Cost overrun*	*6*	*4*	*2*	*3*
11	*Improper material handling*	*2*	*4*	*6*	*8*

Eng. - Engineer, Arch - Architect, QS - quantity surveyor, TO – Technical Officer

6.3. Ranking the mitigation measures to overcome the effects

Using Importance Index, the mitigation measures were ranked in Table 1 & 2 below.

Table 5: Ranking the mitigation measures according to the view of involved parties

No	*Mitigation Measures*	*Client*		*Consultant*		*Contractor*	
		II	*Rank*	*II*	*Rank*	*II*	*Rank*
1	*Increasing the supply of skilled labour.*	*84.84*	*3*	*83.86*	*2*	*77.5*	*4*
2	*Increasing the salary/wages (to minimize migration for foreign employment).*	*81.81*	*4*	*86.01*	*1*	*79.99*	*2*
3	*Conducting annual survey to find out number of available skilled labour – Also, estimating and monitoring the demand and supply for each skill.*	*78.78*	*5*	*72.04*	*7*	*63.33*	*9*
4	*Establishing minimum salary/wages scale.*	*87.87*	*1*	*68.81*	*8*	*75.83*	*5*
5	*Employing permanent skilled labour and train them through the Company.*	*78.78*	*5*	*74.19*	*4*	*79.16*	*3*
6	*Arranging Training Program/Seminars through ICTAD, IESL, etc.*	*87.87*	*1*	*73.11*	*6*	*74.99*	*6*
7	*Establishing a board for skilled labour, train them through it. Also supply skilled labour to contractors through it, who registered for employment.*	*75.75*	*7*	*62.36*	*9*	*65.83*	*8*
8	*Assessing their level of skill and providing a grading system to motivate them mentally to acquire skills.*	*72.72*	*9*	*74.19*	*4*	*80.83*	*1*
9	*Conducting awareness program to contractors to recruit sufficient number of skilled labour and illustrating the advantages and high profit associated with.*	*75.75*	*7*	*78.49*	*3*	*74.99*	*6*

Table 6: Ranking the mitigation measures according to type of employment

No	*Mitigation Measures*	*Rank*			
		Eng.	*Arch*	*QS*	*TO*
1	*Increasing the supply of skilled labour by increasing the intake to training institutions*	*4*	*3*	*1*	*2*
2	*Increasing the salary/wages (to minimize migration for foreign employment).*	*2*	*3*	*3*	*1*
3	*Conducting annual survey to find out number of available skilled labour – Also, estimating and monitoring the demand and supply for each skill.*	*9*	*8*	*4*	*5*
4	*Establishing minimum salary/wages scale.*	*6*	*1*	*4*	*8*
5	*Employing permanent skilled labour and train them through the Company.*	*5*	*5*	*6*	*2*
6	*Arranging Training Program/Seminars through ICTAD, IESL, etc.*	*1*	*5*	*8*	*7*
7	*Establishing a board for skilled labour and train them through it. Also supply skilled labour to contractors through it, who registered for employment.*	*8*	*5*	*9*	*9*
8	*Assessing their level of skill and providing a grading system to motivate them mentally to acquire skills.*	*2*	*2*	*7*	*6*
9	*Conducting awareness program to contractors to recruit sufficient number of skilled labour and illustrating the advantages and high profit associated with.*	*7*	*8*	*2*	*4*

Eng. - Engineer, Arch - Architect, QS - quantity surveyor, TO – Technical Officer

6.4. Summary of above findings as an overall view

Tables 1 to 6 above showed different parties hold different views about the research problem and different ranking pattern depending on type of involvement and employment. The overall view of the respondents (irrespective of the view of neither involved parties nor type of employment) is tabulated below against first five ranks:

Table 7: Summary of casual factors according to overall view

Rank	*Casual Factors*
01	*Inadequate number of trained personnel coming out from Training Institutions and joining labour market*
02	*Contractors do not provide training to employees (because they are not permanent)*
03	*Available training facilities are inadequate*
04	*Seeking Foreign Employment with higher salary*
05	*Difficult to find suitable persons*

Table 8: Summary of effects according to overall view

Rank	*Effects*
01	*Time overrun*
02	*Cost overrun*
03	*Inability to understand drawings*
04	*Less labour productivity*
05	*Improper material handling*

Table 9: Summary of mitigation measures according to overall view

Rank	*Mitigation measures*
01	*Increasing the salary/wages (to minimize migration for foreign employment)*
02	*Increasing the supply of skilled labour by increasing the intake to the training institutions*
03	*Employing permanent skilled labour and train them through the Company*
04	*Assessing their level of skill and providing a grading system to motivate them mentally to acquire skills*
05	*Conducting awareness program to contractors to recruit sufficient number of skilled labour and illustrating the advantages and high profit associated with*

6.5. Agreements between two parties

The above analyses show that different parties have diverse view about the problem where they agree upon some points and deviate in few. Many identified factors are common among considered parties. The agreements between two parties were found using Spearman's rank correlation like in some other studies [4,5].Spearman's rank correlation is a non-parametric test, which does not require normality or homogeneity of the variance. It compares medians rather than mean. The coefficient falls between -1 and +1, where +1 implies perfect positive relationship (agreement), while -1 implies perfect negative relationship (disagreement).

Table 10: Spearman's Rank Correlation

No	*Combination of two parties*	*Causes*	*Effects*	*Mitigation Measures*
01	*Clients and consultant*	*0.611*	*0.325*	*-0.004*
02	*Consultant and contractor*	*0.929*	*0.586*	*0.613*
03	*Clients and contractor*	*0.731*	*-0.145*	*-0.068*
04	*Engineers and Architects*	*0.590*	*-0.160*	*0.494*
05	*Engineers and quantity surveyors*	*0.635*	*0.237*	*-0.076*
06	*Engineers and technical officers*	*0.590*	*0.312*	*0.252*
07	*Architects and quantity surveyors*	*0.582*	*-0.108*	*0.013*
08	*Architects and technical officers*	*0.461*	*0.131*	*-0.090*
09	*Quantity surveyors and Technical officers*	*0.843*	*-0.215*	*0.689*

Table 9 above shows the highest degree of agreement is 92.9% between consultant and contractor for causes where as the lowest is – 21.5% (negative sign implies disagreement) between Quantity surveyors and Technical officers for effects.

7. Findings of institutional survey

Data on how many projects that are experiencing shortages among the 30projects considered is shown below in Table 10. It further compares present salary scales of the Sri Lankan construction industry with some foreign countries for skilled labour categories.

Table 11: Extent of shortages and comparison of salary scale (monthly salary in LKR)

No	*Type of Skilled labour*	*Percentage Shortage (Out of 30 projects)*	*Sri Lankan Salary (Rs)*		*Doha Qatar*	*Saudi Arabia*	*Kuwait*
			Average	*Maximum*			
1	*Mason*	*66.7*	*29650.00*	*39000.00*	*42400.00*	*54100.00*	*35950.00*
2	*Carpenter*	*43.3*	*27750.00*	*36000.00*	*72650.00*	*35300.00*	-
3	*Plumber/pipe fitter*	*60.0*	*27600.00*	*36000.00*	*45400.00*	*54100.00*	*51900.00*
4	*Electrician*	*40.0*	*31100.00*	*36000.00*	*42400.00*	*44050.00*	*51900.00*
5	*Bar Benders*	*43.3*	*31200.00*	*45000.00*	*36300.00*	*35300.00*	-
6	*Painters*	*23.3*	*31050.00*	*36000.00*	*36300.00*	*29400.00*	*57900.00*
7	*Tilers*	*33.3*	*37000.00*	*45000.00*	*30300.00*	*35300.00*	-
8	*Scaffolders*	*20.0*	*28000.00*	*36000.00*	*27250.00*	*25000.00*	-
9	*Plasterers*	*63.3*	*32700.00*	*39000.00*	*33300.00*	*29400.00*	-
10	*Concrete workers*	*70.0*	*32850.00*	*45000.00*	*42400.00*	*54100.00*	-
11	*Shutters*	*30.0*	*34150.00*	*45000.00*	*39350.00*	*32300.00*	-

Sri Lankan Salary data was collected through Institutional survey and salary scale of other countries are based on official website of the Sri Lanka Bureau of Foreign Employment (SLBFE) and rounded off to the nearest Rs.50.

8. Conclusion

This paper studied the causes, effects and mitigation measures related to the problem of "shortage of skilled labour in the construction industry", through individual and institutional field questionnaire survey conducted in the Sri Lankan construction industry.

Collected data were analyzed and ranked using Importance Index and Severity Index according to the views of Engineers, Architects, Technical Officers and Quantity Surveyors as well as depending on the type of involvement; client, contractor and consultant. Overall research ranking indicated that "Inadequate number of trained personnel coming out from Training Institutions", "Time overrun" and "Increasing the salary/wages (to minimize migration for foreign employment)" as the cause, effects and mitigation measure for the shortage of skilled labour.

The analysis based on different types of employment and involved party showed they have diverse views about this problem. Spearman rank correlation was used to find the agreement between two parties. It indicates that different types of respondents agree upon many factors positively in many cases while they disagree on few factors.

9. Discussion and Recommendations

In this context it should be noted that in Sri Lanka the percentage of skilled labourers who have undergone formal training is less compared to some other countries. Approximately 17% of the workers of the craftsmen level categories in the Sri Lankan construction industry have undergone formal training in the year 2000[6]. In USA the level of formal training is at a level as high as 60% to 55% between 1986 and 1996 [11,12].

Therefore, it is recommended to increase the intake to the training institutions, develop the existing training institutions and establish new centres at suitable locations where there is a severe shortage. To increase the number of new entrants to the skilled labour market, the existing unskilled labourers can be motivated to undergo training programmes for skilled labour.

To motivate new entrants and to sustain the existing skilled labourers, an acceptable attractive minimum salary scale should be established. While having the above minimum scale, by introducing productivity based payment system, can motivate them to acquire new skills and to undergo formal training programmes.

Further if the employers are motivated or required to recruit minimum number of permanent or long-term contract based workers that may encourage the employers to provide necessary trainings to the workers.

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