Human Related Challenges in Lean Implementation: A Case of Sri Lankan Large Scale Contractors

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Abstract

Several studies reflect that, human related challenges are heavily impacting the successful lean implementation in the construction industry. Hence, overcoming the human related challenges is one of the most prominent considerations to successfully implement lean concept in construction industry. Accordingly, the aim of this paper is to investigate the human related challenges and strategies to overcome those challenges for successful implementation of lean concept in large-scale contractors in Sri Lankan construction industry. The qualitative research approach was followed, while case studies were selected as the research strategy. Data was collected through in-depth interviews with fifteen respondents from three case studies and analysed using code-based content analysis with N-vivo 12 software. The study identified issues in human attitudes, unfamiliar with the new concepts, lack of knowledge, lack of commitment, unwillingness to adopt new culture, lack of communication, lack of networking and collaboration, lack of committed leadership as few of the key challenges for unskilled, craft, administrative & professional, and managerial level employees. Among the identified key strategies, introduce new rules and regulations, provide training and motivation, conduct CPD and workshops on lean, enhance communication circle and provide lean performance-based promotions for unskilled, craft, administrative, and professional & managerial categories can be highlighted.

Keywords
Human Capacity Building, Lean Construction, Challenges and Strategies, Large Scale Contractors, Sri Lanka.

1. Introduction
Lean Construction (LC) is one of the best practices and a management principle, which has been borrowed from the Toyota automobile production system in order to seek the waste minimisation, effort maximisation, and guaranteeing value for money to clients or end users (Dallasega et al. 2018). Koskela (1992), one of the masterminds in LC research, stated that lean concept is undoubtedly beneficial in both long and short term for industry practitioners to execute construction projects more efficiently and effectively. Major benefits of using LC include reduction of construction cost, increase of the construction site safety, improvement of the quality of construction, reduction of project duration, diminishing of environmental impacts, increase of the productivity and customer satisfaction, and enhancement of the sustainable development idea of the project (Sarhan et al. 2018; Babalola et al. 2019; Aziz & Hafez, 2013).

The implementation of lean in construction industry is not free from challenges. The construction industry worldwide is struggling in lean implementation due to several challenges irrespective of the economic status of the particular country. This fact is evident by the considerable number of research studies in several developed, developing and under developed countries across the world. Sarhan and Fox (2013) have found that lack of lean awareness and understanding, lack of top management commitment, time and commercial pressure, new cultures and human attitudinal issues as key challenges for successful lean implementation in the context of United Kingdom. Shang and Pheng (2014) identified the absence of a lean culture in Chinese organisations as one of the most crucial challenges to implement lean concept in their construction industry, while revealing six underlying factors that hinder the lean implementation as, (a) people and partner issues, (b) managerial and organizational issues, (c) lack of support issues, (d) culture and philosophy issues, (e) government issues, and (f) procurement issues. The challenges to implement successful LC in developing countries have also been found similar as to the developed countries namely lack of management commitment, limited awareness on lean concept, inadequate awareness and unwillingness to adopt to the lean culture (Abdullah et al. 2009). When considering under developed countries, Bajjou and Chafi (2018) have

emphasized lack of knowledge on LC, unskilled human resources, lack of management capabilities and insufficient finances as key challenging factors for successful lean implementation in construction industry.

In Sri Lankan construction industry, Thilakarathna and Senaratne (2012) have identified challenges for implementing lean principles as lack of proper lean implementing framework and knowledge of human resources on lean concept along with the changing culture of the organisation within the built environment. Moreover, Madanayake (2015) has assessed several challenges towards successful lean implementation in Sri Lanka as lack of top management commitment, lack of lean awareness and understanding, and financial issues through an extensive literature review. Further, Ranadewa, Sandanayake and Siriwardena (2018) have identified challenges for implementing lean principles as lack of finances, insufficient training, lack of individual capacities, lack of networking and collaboration, lack of cultural inertia and lack of action learning for Small Medium Enterprises (SME's) in Sri Lanka. Hence, it is clearly evident that the most commonly identified lean implementation challenges in worldwide are related to the human aspects such as training, knowledge, skills and attitude of workers, commitment and style of management and culture.

However, there is a lack of evidence on the empirical investigation on human related challenges and strategies to overcome those challenges in implementing lean concept in large scale contractors of Sri Lankan construction industry. There is therefore a need to investigate human related challenges and strategies to overcome the challenges in successful implementation of LC of large-scale contractors in Sri Lankan construction industry. Hence, the aim of this study was established to investigate the human related challenges and strategies to overcome the challenges for successful lean implementation in large-scale contractors in Sri Lankan construction industry.

2. Literature Review

2.1 The Role Play by Humans in Lean Implementation in Construction Industry

The philosophy of achieving improvements of manufacturing in most economical way while focusing on the reduction of "muda" (waste) laid the foundation for lean concept and lean thinking (Womack & Jones, 2010). Howell (1999) explained that lean manufacturing has the capability of optimizing the production system performances, while meeting the requirements of end customers. Lean concept is basically focusing on the elimination of processes that do not create any value, while using large amount of resources, and identification and reduction of process cost (Ostapchuk et al. 2020). LC is a term coined by the International Group of Lean Construction (IGLC) in 1993 to describe an approach of designing and carrying out construction activities to minimize waste in materials, time and efforts, with the aim of achieving maximum cost-effective value by considering the success and potential applications of lean manufacturing approach in construction projects (Pinch; 2005, Ballard; 2007). According to Akanbi et al. (2019), LC is about costs reduction by cutting waste, innovating by engaging people, and organizing the workplace and human resources to be more efficient, which offers new techniques of constructing sustainable projects. According to Bhasin (2012), lean concept is not only implying the set of tools and techniques, but the human resources, and their knowledge, intelligence and desire for organisational development are at the core. Further, Green, Harty, Elmualim, Larsen, and Kao (2008) highlighted the need for paying attention towards human capacities in order to achieve successful LC implementation in global context. Hence, it is evident that human resources and individual capacities is paramount for successful implementation of lean construction (Ranadewa, Sandanayake, & Siriwardena, 2021).

2.2 Human Related Challenges in Lean Implementation in Construction Industry

Many researches have been carried out in various regions in order to identify the factors that can affect the successful lean implementation and categorised the highlighted challenges under several groups. According to Bashir et al., (2015), challenges in lean implementation can be classified in to six categories namely management, educational, governmental, financial, technical and human related challenges. Among the above-mentioned categories, human related issues are one of the major categories, which can highly impact the successful implementation of LC (Howell, 1999). Human related challenges in lean implementation in construction industry identified by the researchers are summarised in Table 1.

According to the table, many researchers have highlighted the significant impact of lack of cooperation by workers, misconceptions about lean practices, lack of committed leadership, unskilled human resources, lack of top management commitment, changing employees working culture, lack of lean awareness and understanding, and lack of knowledge on lean practices, on the successful lean implementation. Further, it can be observed that some of the literature findings highlight that poor understanding of client's brief, lack of team work and self-criticism, poor house-keeping, fear of unfamiliar practices, human attitudinal issues, and unwillingness to adopt to new systems are also

making a considerable impact as a challenge towards lean implementation in global construction industry. The identification of aforementioned human related challenges has led the researcher to review the strategies provided by many industry practitioners to overcome the challenges.

Table 1: Human related challenges in lean implementation in construction industry

Human Capacities	References																	
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
Lack of cooperation by workers			X		X		X	X	X	X			X					
Poor understanding of client's brief						X			X	X		X		X			X	
Misconceptions of lean practices		X					X	X		X	X	X	X	X	X	X	X	X
Lack of committed leadership					X	X		X	X		X	X		X	X		X	
Lack of team work						X			X	X								
Lack of self-criticism						X		X	X									X
Poor house keeping							X			X								
Fear of unfamiliar practices			X						X				X	X				
Unskilled human resources	X			X			X				X	X	X				X	
Issues in human attitudes	X					X			X									
Lack of top management commitment	X				X						X	X	X	X	X		X	
Changing employees working culture	X	X			X				X		X	X	X	X		X		X
Lack of lean awareness and understanding	X	X		X	X				X		X	X	X	X	X	X	X	X
Unwillingness to adopt new systems			X	X									X	X		X		X
Lack of knowledge	X	X		X	X						X	X	X	X	X	X	X	X

References: [A] Sarhan & Fox, 2013; [B] Bashir et al., 2015; [C] Johansen & Walter L, 2007; [D] Abdullah et al. 2009; [E] Ayarkkwa et al. 2012; [F] Alarcon et al. 2002; [G] Mossman, 2009; [H] Suresh et al. 2012; [I] Common et al. 2000; [J] Cua et al. 2001; [K] Dulaimi & Tanamas, 2001; [L] Olamilokun, 2015); [M] Bajjou & Chafi, 2018; [N] Sarhan et al. 2018; [O] Shang & Pheng, 2014; [P] Omran & Abdulrahim, 2015; [Q] Alinaitwe, 2009; [R] Devaki & Jayanthi, 2014

2.3 Strategies to Overcome Human Related Challenges in Lean Implementation in Construction Industry

The challenges that have been identified with reference to the successful lean implementation in construction industry are necessary to be addressed in order to achieve a smooth implementation of lean concept and realize expected benefits. Accordingly, the strategies that have been put forward by several researchers worldwide have been summarised in Table 2.

Table 2: Strategies to overcome human related challenges

Strategies to Overcome Human Related Challenges	References
Organisations need to engage staff in learning process	[A], [B]
Ensure the confidence within employees regarding the new approach	[A], [C]
Ensure to reduce the fear regarding the misconceptions of LC	[A], [B]
Top management need to be fully involved in the implementation procedures	[A], [C], [D]
Ensure that entire staff is putting the continued effort in lean implementation	[A]
Ensure the higher involvement of whole staff in implementation and suggestion making	[A], [D]
Adopt training programmes for workers to make aware about lean practices	[C], [E], [F]
Establish new government policies to encourage lean practices	[A]
Avoid sudden cultural changes and instead, moving for gradual implementation procedures	[A], [G]
References: [A] Bashir et al. (2015); [B] Karim & Arif-Uz-Zaman (2013); [C] Sarhan et al. (2018); [D] Bakas et al. (2011); [E] Shang & Peng (2014); [F] Ahmed et al. (2019); [G] Belhadi et al. (2016)	

The above table summarised various solutions put forwarded by many researchers with reference to the human related challenges worldwide, which are hindering the smooth implementation of lean concept in the global construction industry. The aforementioned solutions have been highlighted with respect to the different contexts. Accordingly, it can be summarised that enhancing knowledge, awareness, confidence, involvement, and commitment of employees towards the lean implementation practices through training and learning programs, top management involvement, and governmental policies will contribute in overcoming the human related challenges in lean implementation in construction industry. On the other hand, Bashir et al. (2015) and Belhadi et al. (2016) suggested that avoiding the sudden cultural changes within an organisation due to the lean implementation practices is healthier for smooth continuation of implementation. Further, the authors emphasized the importance of gradually teach the fundamentals of concept and implement through different stages over a considerable period of time, so that the employees will be able to seize the chance to understand and apply lean tools efficiently and effectively.

Considering the Sri Lankan construction industry, Ranadewa et al. (2019) have highlighted the necessity of enhancing the lean knowledge and technical know-how of lean construction implementation, introducing sufficient training programs on lean practices, and maintaining proper culture within an organisation as strategies to overcome the challenges of lean construction implementation in SME's. Further, Madanayake (2015) has stressed several strategies to overcome the lean implementation challenges such as integration of policies to adhere to cultural changes, decentralizing the top management, ensuring training and development within the organisations. According to the above literature findings, there is a dearth of research on strategies to overcome human related lean implementation challenges in large scale contractors of Sri Lanka. Hence, the aim of this study was established to investigate the human related challenges and strategies to overcome the challenges for successful lean implementation in large-scale contractors in Sri Lankan construction industry.

3. Research Methodology

The nature of the research problem, which is to investigate human related challenges and strategies to overcome the challenges in successful implementation of LC of large-scale contractors in Sri Lankan construction industry necessitates an in-depth investigation. Moreover, the in-depth opinions of respondents regarding the human related challenges and strategies to overcome the challenges were also required to be collected. Hence, a qualitative approach was selected as the suitable research stance for this study.

Within the qualitative research approach, case study research strategy was adopted to proceed with the study considering several reasons. Case study strategy could facilitate to accomplish the aim of this study since this strategy enables the in-depth investigation (Yin, 2011). Further, the study investigated a real-life phenomenon, which was human related challenges in LC implementation, using the experiences of executive level employees of a construction projects. Considering the aforementioned reasons, the case study strategy was adopted to the study. The boundary of the case studies was identified as the lean implemented construction projects by large contractors (Grade C2 or above according to the Construction Industry Development Authority [CIDA] grading system) in Sri Lankan construction industry. Hence, three cases were selected for the study, from large contractors in Sri Lankan construction industry, those who have implemented LC practices. Human related challenges for successful LC implementation have been considered as the unit of analysis.

According to Yin (2011), several data collection techniques can be comprised in case study strategy such as interviews, document reviews and observations. Data was collected using an open-ended interview guideline by allowing respondents to answer independently in this study. The collected data was analysed with code-based content analysis using NVivo software. Five executive level respondents from each project were interviewed. The profile of the cases and the respondents are elaborated in Table 3.

Table 3: Profile of the cases respondents

Case	Detail of the Case	Respondent	Designation	Experience
Project A	• Construction of a university building • Value: Rs.2 billion • Duration: 1.5 years • Implemented lean concept at construction site level	A1	Project Manager	20 years
		A2	Deputy Project Manager	15 years
		A3	Planning Engineer	5 years
		A4	Site Engineer	3 years

	• Respondents are well aware of lean concept	A5	Quantity Surveyor	12 years
Project B	• Construction of an apartment building • Value: Rs. 6 billion • Duration: 3.5 years • Implemented lean concept at construction site level • Respondents are well aware of lean concept	B1	Project Manager	25 years
		B2	Construction Manager	18 years
		B3	Resident Engineer	20 years
		B4	Site Engineer	6 years
		B5	Quantity Surveyor	16 years
Project C	• Construction of a high-rise apartment & hotel building • Value: 12.5 billion • Duration: 5 years • Implemented lean concept at construction site level • Respondents are very well aware of lean concept	C1	Project Manager	23 years
		C2	Deputy Project Manager	20 years
		C3	Planning Engineer	10 years
		C4	Site Engineer	5 years
		C5	Quantity Surveyor	8 years

4. Research Findings

4.1 Human Related Challenges in Lean Implementation in Construction Industry

The respondents were questioned regarding the human related challenges affecting the successful implementation of lean concept under unskilled, craft, administrative, and professional & managerial level employees and findings are discussed below.

Human related challenges of unskilled level employees

Several respondents of all projects highlighted *"issues in human attitudes"* as one of the major challenges of unskilled level workers. The lethargic nature of unskilled level workers in not agreeing to the ideas and suggestions made by the professional and managerial level employees identified as one of the major reasons behind this challenge. Further, *"unfamiliarity in new concepts"* is another challenge face by unskilled workers. According to A2, unskilled workers are having neutral behaviour in thinking and practicing within the working environments and hence, are not familiar with new concepts practicing in the construction sites. Moreover, *"lack of knowledge"* has been highlighted by several respondents as another major challenge of unskilled workers and as well a reason for unfamiliarity in new concepts. Since the unskilled workers are not having adequate level of knowledge on new concepts such as lean construction, it would be a challenge for the lean implementers. Further, the *"lack of commitment"* of unskilled workers towards the organizational and process development of the construction work have been highlighted by B1. As the unskilled workers are not interested in the innovative ways of project development and desire of organizational development, their commitment will also be comparatively lesser than the commitment of top management. *"Unwillingness to adopt to new culture"* has been identified by A3, B2, and C5 as another major barrier, which unskilled workers are having. According to C5, due to the unfamiliarity of unskilled workers towards new concepts such as LC, it leads to the unwillingness to adopt to the new culture within the working environment. Further, B2 highlighted that majority of unskilled workers would be fearful in adhering to the new processes and changes of culture within the working environment. Further, *"lack of communication"* between unskilled workers and site level and top management is another challenge related to unskilled level employees. Due to the lack of proper communication between these two levels, the successful implementation LC can be disturbed as per C3. According to A5, lack in proper communication can be causing for the lesser collaboration and networking between unskilled workers and top-level management in implementing LC. Moreover, *"poor house-keeping"* has been highlighted by B4 as another barrier of successful LC implementation as it will lead the unskilled workers to unnecessarily moving within and off site. Moreover, the poor house-keeping will cause for several non-value adding activities such as over processing, unnecessary motion, and defects, which will hinder the successful LC implementation.

Human related challenges of craft level employees

The human related challenges identified for the unskilled level workers namely *"issues in human attitudes"*, *"unfamiliarity in new concepts", "lack of knowledge", "lack of commitment", "unwillingness to adopt to new culture", "lack of communication", and "poor house-keeping"* were also highlighted under the craft level workers

by majority of the respondents in all three projects. Additionally, C2 has highlighted the *"lack of team work"* as one of the major challenges significantly affecting the lean implementation by craft level compared to the unskilled worker level. According to C2, craft level workers must essentially be required to work as a team by co-operating with the other co-workers within the working environment rather the unskilled workers. Moreover, *"Lack of self-confidence"* is highlighted by A1 as another human related challenge at craft level affecting the successful lean implementation.

Human related challenges of administrative level employees

Similar to unskilled and craft levels, the respondents from all three projects have highlighted the *"issues in human attitudes"* of the administrative level staff as another challenge. More comprehensively, A3 stressed that administrative level employees must avoid the attitudinal issues towards the lower-level workers, and colleagues within working environment in order to successfully achieve the LC implementation. Further, *"lack of knowledge"* in LC principles, tools and techniques including mathematical and analytical knowledge have been identified as a major human related barrier of administrative level employees as they are involving in the staff recruitment, training and administrating processes. Hence, to recruit the competitive enough employees to the project to successfully implement LC, the adequate level of knowledge on LC is essential for the administrative level employees of the project. Further, *"lack of awareness and understanding"* of LC in the administrative level employees will be a severe challenge in the successful implementation. More comprehensively, A2 has highlighted that proper understanding of the concept and the implementation benefits would be more beneficial in effective implementation of LC. Hence, lack of understanding and awareness would cause hindering the successful LC implementation. Moreover, "*Lack of commitment"* of the administrative level employees is another human related challenge of administrative level employee since their commitment is essential to enhance the effective performance of the lower-level workers and the colleagues. *"Lack of interest in new concept"* has been stressed by C5 as a human related challenge of administrative level employees. In order to promote the lean culture within a particular organisation, the administrative level employees need to initiate the implementing process with the guidance of top management. Therefore, C5 highlighted that lacking the interest of administrative level employees towards the new concepts such as LC would be a major challenge for successful LC implementation. Furthermore, B5 has highlighted the *"lack of networking and collaboration"* in administrative level employees as a challenge for LC implementation within working environment since administrative level employees are playing a major role in practicing co-workers to adhere to the lean environment while ensuring the proper interpersonal relationship and networking within the team members.

Human related challenges of professional and managerial level employees

When considering the human related challenges at professional and managerial level employees, several respondents have highlighted the same challenges as suggested for the administrative level employees. C5 has more comprehensively highlighted the *"issues in human attitudes"* of professional and managerial level employees. Accordingly, C5 stated that ego problems are highly affecting for the attitudinal issues of professional and managerial level employees, which will also affect the disorganized culture in the projects. Hence, it will create more challenging environment for successful lean implementation. Further, B4 highlighted that due to the attitudinal issues of professional and managerial level employees, they will not be agreeing and respecting to the other's ideas, which will lead to hinder the successful implementation of LC. In addition to the human related challenges identified in the administrative level, C2 highlighted a significant challenge related to the professional and managerial level namely *"lack of committed leadership".* More comprehensively, C2 stressed that committed leadership would be lacking in the professional and managerial level employees, since they are focusing more on their own comfort level and individual short-term benefits rather the productivity or the long-term benefits that can be obtained through the lean implementation. Hence, *"lack of committed leadership"* can be identified as another significant human related challenge at professional and managerial level.

4.2 Strategies to Overcome Human Related Challenges in Lean Implementation in Construction Industry

The strategies to overcome human related challenges in organizational level to successfully implement LC concept have been identified as described in the below sections with respect to the challenges identified for the unskilled, craft, administrative and professional & managerial level employees.

Strategies to overcome human related challenges of unskilled level

To overcome the challenges of unskilled level workers, A1 proposed to *"introduce new rules and regulations".* More comprehensively, A1 stated that introducing new worker friendly rules and regulations would enhance the positive attitudes within the unskilled level workers while eliminating their unwillingness to adopt to new culture within the organization. Under this strategy, B5 highlighted the importance of introducing a fine system for unskilled level

workers who are breaking the rules and regulations implemented within the working environment towards LC implementation. Further, B1 stressed that rather introducing new policies, top management must introduce new rules and regulations to keep continuous control over the unskilled workers. Further, in order to overcome the challenge of unfamiliarity in new concepts, majority of the respondents of all three projects have highlighted the importance of *"providing on the job training"* for the unskilled level workers. This would support the unskilled workers to get familiar with the LC concept, while enhancing their level of knowledge on LC tools and techniques even to some extent within the range of their knowledge level. Moreover, to ensure the familiarity in new concepts and to educate the unskilled workers on LC, B5 emphasized the importance of "*displaying visual signs"* such as notices and sign boards within the site. In order to ensure the higher level of commitment of the unskilled workers, C5 highlighted the importance of *"conducting the motivational programs".* More comprehensively, this would ensure the considerable commitment of unskilled workers. Moreover, A1, B2 and C3 stressed the importance of *"providing the required welfare facilities"* to the unskilled level workers including medicine, accommodation and foods. According to B2, this strategy would be supporting to reduce unnecessary movements of the workers both on and off site, while increasing the motivation of the unskilled workers to start to think as a part of the project. In order to overcome the challenge of lack of communication within the unskilled workers, A4 highlighted the strategy of *"conducting on-site meetings"* in the daily basis. More comprehensively, A4 stressed that it essential to keep inform and brief the unskilled workers regarding practicing the LC and maintaining quality of the work through the daily meetings. In order to overcome the challenge of poor house-keeping, B3 and C4 stressed the strategy of *"maintaining proper house-keeping"* to ensure the calm and quit working environment for the unskilled workers.

Strategies to overcome human related challenges of craft level

Similar strategies suggested for the unskilled workers have been proposed by several respondents for the craft level as well, since the human related challenges are also similar in nature for both unskilled and craft level workers. In addition to the aforementioned strategies under unskilled level workers, C2 highlighted the strategy of *"open door policy"* for the craft level workers to overcome the challenge of lacking the team work ability. According to C2, the top management of that particular case is always available for the craft level workers to come and discuss prevailing issues within the working environment and among their colleagues. In order to overcome the challenge of lack of self-confidence of the craft level workers, A1 highlighted the importance of *"giving recognition"* to the craft level workers for their performance in lean implementation. In addition to that, C3 stressed the strategy of *"appreciating the opinions"* of craft level workers regarding the process improvement and enhancing the quality of the construction work within the lean environment.

Strategies to overcome human related challenges of administrative level

According to the majority of the respondents from all the projects, *"conducting training programs"* for the administrative level workers has been proposed as a strategy to overcome the challenge of lack of knowledge, awareness and understanding on LC implementation. A1 highlighted that the implementation of LC can be enhanced by providing the proper training on tools, techniques and principles of LC. In addition to the training programs, B3 stressed that *"conducting workshops on lean"* on LC and it's long and short terms benefits would be another important strategy overcome the challenge of lacking knowledge on LC. To avoid the human related challenge of lack of commitment of administrative level employees, majority of the respondents highlighted that *"introduce an allowance system"* as an important strategy. According to C5, allocating an allowance for the administrative level employees who are involving in LC implementation would be a better strategy to either promote LC within the organization or enhance the commitment of the administrative level employees. Further, *"provide promotions"* was highlighted as another important strategy by B4 to overcome the human related challenge of lack of commitment by administrative level employees. In order to overcome the human related challenge of lack of interest in new concepts at the administrative level employees, A3 proposed the strategy of *"show long term benefits"* to the administrative level employees. More comprehensively, A3 stated that showing the individual profits and losses of implementing LC within the construction project through the cost benefit analysis would ensure the interest of administrative level employees and also to overcome the challenge of lack of interest in LC implementation. Further, to eliminate the aforementioned challenge, A4 suggested to *"conduct continual professional development (CPD) programs".* Accordingly, CPD's would guide the administrative level employees to develop the interpersonal skills and desire to practice new concepts such as LC within the working environment. Further, to enhance the individual interest of administrative level employees towards LC implementation, C4 suggested to *"promote self-learning"* related to LC implementation within the organization. According to C4, it will allow the administrative staff to learn more about new concepts such as LC. Considering the challenge of lack in networking and collaboration of workers, C2 proposed the strategy of *"enhancing communication circles"* through conducting weekly and monthly meetings for

administrative staff and also by conducting toastmaster programs. This strategy would also ensure the development of team building within the organization for successful lean implementation.

Strategies to overcome human related challenges of professional and managerial level

According to the respondents, the same strategies as proposed in the previous section for administrative level have been highlighted for the professional and managerial level as well. In addition to the aforementioned strategies, to overcome the challenge of lack of committed leadership of professional and managerial level employees, B3 proposed to *"conducting the motivational programs"*. According to B3, this would enhance the leadership skills of the professional and managerial staff. Moreover, C1 stated that conducting motivational programs would enhance commitment of professional and managerial staff towards the proper leadership to successfully implement LC within the working environment. Although this study is focusing only the organisational level strategies, C2 suggested that forming a lean construction professional institute in Sri Lanka will play a significant role in producing professionally qualifies lean implementers or lean trainers. In this sense, C2 emphasized that organisations can motivate the respective professional and managerial level employees to enhance the participation in the aforementioned programs.

5. Discussion

As per the research findings in the previous sections, the human related challenges in lean implementation in construction industry with reference to unskilled, craft, administrative and professional & managerial levels have been presented along with the strategies to overcome each of the challenges. Accordingly, this study has mapped the human related challenges in LC implementation with the strategies to overcome those challenges into a model as presented in Figure 1.

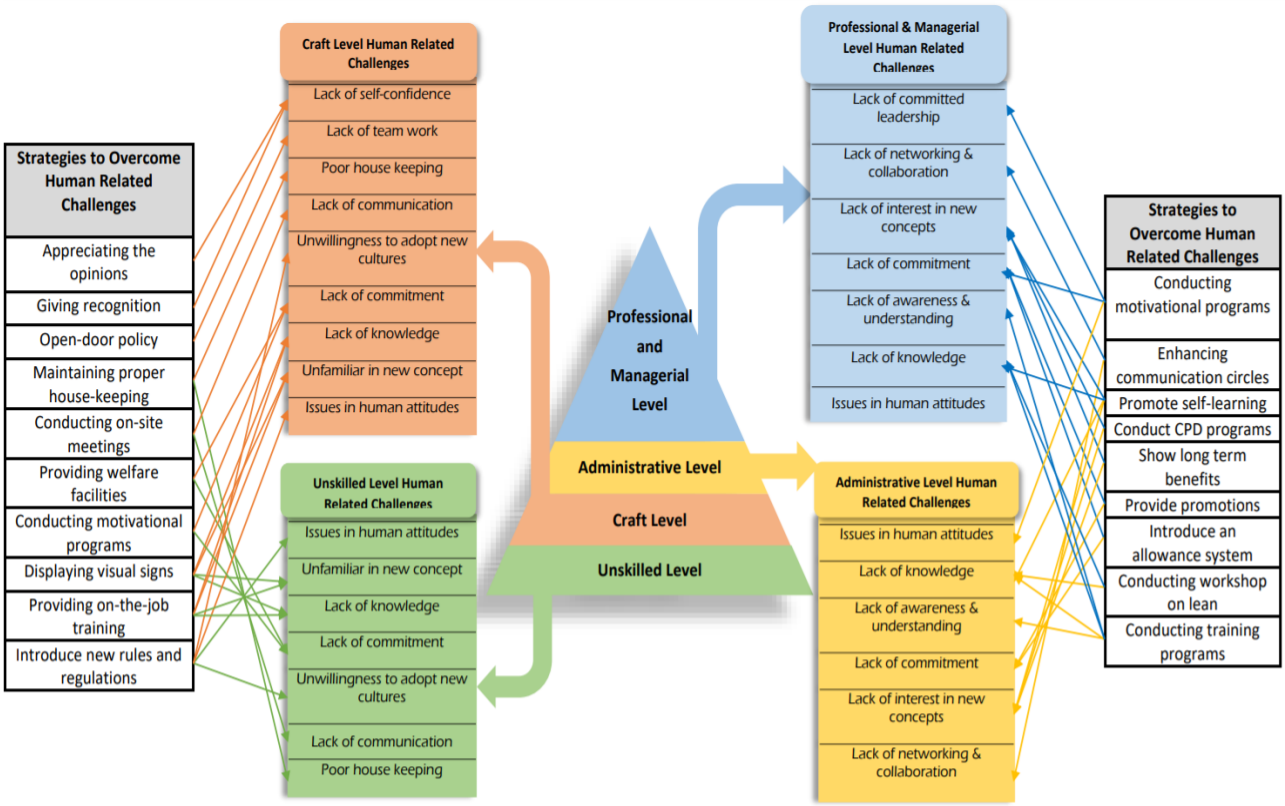

Figure 1: Model of strategies to overcome human related challenges

According to Figure 1, several human related challenges of unskilled, craft, administrative, and professional & managerial level employees in implementing LC has been identified. The identified challenges can be evidenced through the literature findings summarized in Section 2.2. In summary, the human related challenges of unskilled and craft level workers are similar in nature while two additional challenges were proposed by the experts under craft level

human related challenges. The same results were obtained for the administrative and professional & managerial levels. Accordingly, the similar human related challenges have been identified and significant challenges for professional and managerial level employees have been indicated in the model namely “lack of committed leadership”. Moreover, the strategies to overcome each human related challenge for the unskilled, craft level workers administrative and professional & managerial level employees are clearly indicated within the model.

6. Conclusions

LC implementation of large-scale contractors in Sri Lanka is still in the infant stage due to several reasons. More importantly, LC is not seeming to be rigidly implementing within the large-scale contractors of Sri Lanka due to the challenges impacting the successful implementation. Among those, human related challenges are carrying a significant impact towards the successful LC implementation of large-scale contractors in Sri Lankan construction industry. This study assessed number of human related challenges to the successful implementation of LC from and extensive literature review and identified several human related challenges in the global context and as well the strategies to overcome those challenges. Later, due to the identified need of investigating human related challenges and strategies to overcome the challenges in successful implementation of LC of large-scale contractors in Sri Lankan construction industry, a case study approach was conducted.

Accordingly, human related challenges have been identified with respect to the unskilled, craft, administrative, and professional & managerial level employees. Issues in human attitudes, unfamiliarity in new concepts, lack of knowledge, lack of commitment, unwillingness to adopt new culture, lack of communication, and poor house-keeping have been identified as human related challenges of unskilled levels workers. In addition to the aforementioned challenges, lack of team work and lack of self-confidence are the human related challenges identified in the craft level workers. When considering the administrative and professional & managerial level employees, issues in human attitudes, lack of knowledge, lack of awareness and understanding, lack of commitment, lack of interest in new concepts, and lack of networking & collaboration have been identified as human related challenges. Further, lack of committed leadership has been identified as a human related challenge significantly to the professional & managerial level employees. Finally, the strategies to overcome the human related challenges were identified to successfully implement LC in unskilled, craft, administrative, and professional & managerial level employees. Introduce new rules and regulations, providing on the job training, conducting motivational programs, providing welfare facilities, conducting on-site meetings, and maintaining proper house-keeping are some of the key strategies that have been proposed for unskilled and craft level workers. Additionally, the open-door policy, giving recognition and appreciating the opinions are the particularly highlighted strategies only for craft level workers. Conducting training programs, workshops on LC, introducing allowance system, provide promotions, show long term benefits, conducting CPD, promote self-learning and enhancing communication circles are the specified strategies for administrative and professional and managerial level employees. In addition to that, the importance of conducting motivational programs have been highlighted for professional and managerial level employees. However, the strategies that have been proposed in this study are limited to the organisational level of large-scale contractors in Sri Lanka.

The study has finally developed a model by mapping the strategies against the human related challenges. The developed model in this study will guide the large-scale contractors to identify the human related challenges impacting successful LC implementation and strategies to overcome those challenges. The findings of this study will be beneficial and applicable to the large-scale contractors in Sri Lankan construction industry as well as the contractors in the developing countries, those who have shared the same kind of practices, standards and socio-economic, demographic or cultural traits. This study mainly contributes to understand the human related challenges that are facing by large-scale contractors in the lean implementation and propose possible strategies that can be implemented within the organisation to avoid the aforementioned challenges. Further, the study will pave the way for further research to propose the strategies that can be used by the individuals, industry and the government to overcome the human related challenges in successful implementation of lean concept in construction industry.

7. Acknowledgement

The authors would like to acknowledge the funding support received from the Senate Research Committee of University of Moratuwa under the Grant SRC/LT/2020/04.

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