

Issues in small sector housing construction in Sri Lanka: case of services installation

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Abstract

Building a house is a life time venture and a dream of many individuals. However, constructing a house is a complicated process which involves interpreting various ideas and collection of number of people's effort. In such away, building services carry a significant role and efficient services installation leads to a long life of any building types. Moreover, cost of services installation represents considerable amount from the total project cost. It is notable, improper installation of services lead to an increased cost of maintenance and repair cost while dissatisfying the user. This is the common issue seen in the small sector housing construction. Therefore, the aim of this paper is to address "common issues in small sector housing construction in case of services installation". Apart from that the study analyses the informal and formal sector involvement in the housing construction. The structured questionnaire survey was carried out with house owners. The survey results analyzed using SPSS software. Electrical and plumbing are more demanding services and mechanical systems were received less demand in the small sector houses. The survey results show electrical problems are being the worst followed by plumbing and mechanical problems. Trip switch failure, power leakage and damages to equipment due to excessive power are some common dilemmas faced by the house owners regarding the electrical system. Water leakage and water seepage through walls are common issues with in the plumbing system. The study was enable to identify informal sector and formal sector involvement in installation of services in small sector housing construction as 87.64% and 12.36% respectively. Further, the suggestions and recommendations were made in order to overcome the identified issues in case of services insatalltion in small sector housing construction in Sri Lanka addresses in the paper.

Keywords: Issues, housing construction, services installation

1.0 Introduction

Construction is a large and complex industry comprising many types and sizes of organizations and a diverse range of professional and other representative bodies (Cook and Williams, 2014). In Sri Lanka, construction industry contributes more than 8 % to the GDP (Central Bank, 2012). In which housing construction gives a greater support to GDP as well. The demand of houses in the Colombo metropolitan region increased with continuing population growth and economic development. Building a house is a life time venture for most people. The demand for housing for sale or lease at market prices is extremely limited (Armstrong, 2002). According to Milanovich (2006), majority of new houses are constructed from saving money, or getting bank loans, or some other means. Nowadays, the trend of willing to build a own house is become a fashion and a dream of many individuals. As stated by Milanovich (2006) , in Sri Lanka housing problem is very acute, particularly among the poor and other marginalized categories. If the construction sector is concerned, client, consultant and contractor are the direct stakeholders involved in the construction process to get the project output in a successful manner. However, compared to the general practice, contactor's involvement with the client is very strong in a small sector housing construction (Mlinga and Lema , 1999). Meanwhile the clients give more opportunities for the informal sector rather than formal sector to do the contracts. Thereby, the consultants' role is hidden in small sector construction projects (Mitullah and Wachira, 2003). According to Chana (1981 cited Wells, 2007), the informal construction groups provide almost all the construction in the rural areas of developing countries and 50% of housing in the urban areas. Informal labour contribution to the construction industry in Sri Lanka is about 75% from the total labour usage for whole construction industry and that is a huge proportion. Among those, most of the informal workers are depending on housing construction (Jayawardena and Gunawardena, 1998). Further stated that low level of education, training and skills and poor level of workmanships are some issues with the labourforce in Sri Lankan construction Industry. When considering the small sector housing construction, there are many problems arise especially in the services installation. Building services carry a large risk aspect on many projects – they are known to have the largest profit margin within the construction process, and form on average 30-40% of the total project value, but may conversely be the biggest loss leader (Mawdesley, 2008). Thus, proper installation of services becomes vital for a sustainable building.

The design of building services traditionally suffer due to a lack of information about the system. Installation is also often unplanned, thus adding further complications (Irrey and Surgener, 2004). The knowledge about understanding building services system applicable to residential spaces, reading the drawings, and applications of elements are the essential requirements of the builders of services installation (Wild, 1997). This is being more crucial with the involvement of informal sectors in housing construction. With the demand of constructing houses, still most of the clients are relying on informal sector believing it is more economical than the consulting workers from the formal sector. However, as depicted in the literature, during the construction and operation period clients are facing more difficulties especially regarding the services installation. Therefore, the aim of this research is to identify the common problems related to services installation in small sector housing construction in Sri Lanka. In order to achieve that aim, the following objectives were formulated.

- To investigate the problems in small sector housing construction projects in terms of services installation
- To recommend good practices, and strategies that could be adopted to strengthen and develop informal contractors in services installation

This research was limited to the residential buildings up to three stories and age of the house was greater than five years.

2.0 Literature Review

According to the Arabic dictionary Al-Munjid (Al-Balabki, 1987), a house means a place to settle down, relax, become calm, calm down, reside in a place. In the modern day's context, housing development is seen as a key issue to be addressed in the socio-economic and political agenda across the world, particularly in the developing countries where urban housing poses a challenge in the process of development (Jayasena et al., 2006). The design and construction of building services traditionally suffer due to a lack of information about the system. It is not deemed necessary to provide the building services engineer with an upfront design. Installation is also often unplanned, thus adding further complications (International Housing, 1999; Surgener, 2004). The housing construction sector is unique in its nature and projects are different from each other. According to Terry and Surgener (2004), over the course of several years and hundreds of new home inspections, never inspected a home with less than worth of \$600 in defects.

In 'traditionally' procured construction projects, building services and structural design are not integrated (Hinks, 2005). As stated by Mawdesley (2005), in the most cases construction is well under way before any thought is given to the building services design although the design and construction of mechanical, electrical and plumbing services are generally overlapping processes. Thus, often many practical issues associated with building services, including too many visits by too many trades. This leads to greater health and safety risks, and questions over maintenance and access issues. Building services are not considered at the front-end of the project, thus resulting in work hastily being completed in difficult conditions, and it could be seen services distribution and installation are often unplanned processes in the reality. Wijayamali et al. (2014) identified that quality aspects is common issue with the services provided. In addition, another critical issue is fragmented of the construction team. This leads to dissatisfaction in performance of the building function. According to Brankovic (2003), the biggest obstacle to improving on this process is a lack of knowledge and skill transfer from project to project. Individuals often learn 'on-the-job'. Once the task is completed they move on to another job. However, more effective learning process always leads to the perceived 'ideal' route which is currently underpracticed by the workers in the informal sector.

Mawdesley (2005) pointed out that there are many factors in building services construction which are uncertain. For example, design, manufacture and installation time, overall project duration, resource demands, potential errors involved in traditional and prefabricated installation of services distribution, training requirements, and cost. These uncertainties present risk to members of the project team. Since risk is present, it must be controlled. As Connolly and Leiper (2005) stated, construction and installation of services system is major part and do at last. Another important fact highlighted is, the space within which the services installed is restricted, and often cramped with more than one trade completing its part of the works. Due to lack of full design and layout information, it is unclear about what occurs within the service voids, and impact on the quality of the final outcome.

Building surveying reports are recording more than one hundred common issues in terms of services problems, structural problems, designing problems, repair and maintenance problems, in buildings (Glover, 2006). The purpose is giving some warning in relation to a future repairing liability or affecting the value of the property and what kind of actions or precautions need to be taken by the building owners. These lists are not intended to be exhaustive but should be of interest (Glover, 2006). The common problems regarding services are listed as follows.

- Leakage from poorly designed shower enclosures
- Defective drains
- Lead plumbing
- Sub-standard electrical installations
- Failure of damp-proof courses
- Leakage of water into wall cavities from concrete ‘Finlock’ gutters
- Lack of party/fire walls in old terraced roof spaces
- Leaking parapet and valley gutters
- Lack of party/fire walls in old terraced roof spaces
- Leaking gutters and down pipes
- Shortage of power sockets
- Poor septic tank and cess pit drainage arrangements
- Damp penetration and staining to walls from leaking overflow pipes
- Corrosions in steel water tanks

3.0 Research Methodology

Comprehensive literature survey was done to identify the problems related to services installation in small sector housing construction and its generation during the construction process. First unstructured interviews were carried out with suitable persons who have greater knowledge in the area of housing construction to identify the related issues of the subject area and to improve the directions of the research as a preliminary survey. Then, structured questionnaire survey was carried out to identify mostly encountered problems related to services installation and to formulate solutions for mitigating the problems in services installation related to housing constructions. The questionnaires were distributed among the house owners with the sample of 45 houses in Moratuwa region.

4.0 Research Findings

4.1 Problems in services installation

It was revealed that around 42% of the houses were constructed with less provisions in services integration at the initial stage. Later on as time dictates and as need arises it was planned to expand the number of rooms, bathroom, and other amenities which in turn requisite the need of new types of services integration according to the requirement. It was identified that the problems regarding Electrical services is being the most significant issue, statistically it is around 90%. Plumbing problems were identified as the second leading problem, statistically proved as 65% and the Mechanical problems were identified as the least types of problem and it contributes around only 20% among all aspects while its integration had been reported at a very low level in small sector housing construction. According to the questionnaire survey, it was identified that electrical problems are being the worst followed by plumbing and mechanical problems. Figure 4.1 graphically shows the percentages for problems in each service according to the house owner’s perspective.



Figure 4.1: Problems in Services Installation

Mechanical systems are very hard to find in the small sector houses. However, air conditioning was the most commonly used systems while communication and security systems were also available in few houses.

During the literature and preliminary survey it was identified 10 common issues with electrical systems, 17 issues with plumbing systems and 4 issues with mechanical systems. Table 4.1, 4.2 and 4.3 summarise the findings, as per the owners’ experience. Electrical problems were analyzed according to the collected data.

Table 4.1: Ranking of problems with electrical systems

Item	Electrical Problems	Rank	Agreed %	Disagreed %
E.1)	Current leakage (during the rainy season)	2	74.33%	25.67%
E.2)	Current shorts	6	63.45%	36.55%
E.3)	Power cuts occurrence	7	60.44%	39.56%
E.4)	Trip switch (on/off) problem	1	78.34%	21.66%
E.5)	Main distribution board failure	9	25.00%	75.00%
E.6)	Switches don't work properly	5	65.98%	34.02%
E.7)	Fuse failure	8	56.80%	43.20%
E.8)	Damages occurred to electrical equipments (excessive current)	3	73.56%	26.44%
E.9)	Earth wiring problems	10	24.88%	75.12%
E.10)	Insufficiency of fittings location (out lets)	4	72.56%	27.44%

It was found that more than 78% respondents agreed that trip switch failures was the common issue faced with electrical system. More than 70 % respondents viewed that current leakages during the raining season, damages to the electrical equipments due to excessive current load, and insufficient outlets were other major issues faced by them. It is clear that one of the reasons for E8 (damages occurred to electrical equipments) may be E10 (insufficiency of fittings location-outlets) . As stated by many respondents, most of the houses were constructed without considering the future aspects. People constructed houses according to their present requirement on those days. That is why all most all the housing owners were paying their favor to expand the existing electrical system. Poor workability of switches in the fifth position and which was occurred in most of the houses as well. Generally the buttons (gang) were not properly functioning. Moreover, problem regarding current short or short circuiting was identified in sixth place. This event was caused several problems in electrical equipment and exaggerated the peoples' life. Main distribution board failures and earth wiring issues are rarely occurred. Significant failures in electricity generally lead to a huge loss in houses which includes damages to the equipment, entire structure of the whole house, or even loss of lives. Therefore, it is critical to have a more secured electrical system. Another point revealed that owners were using two different current lines. Main reason was to get separate current bills for each floor and most of the houses are rented by the third party.

Table 4.2 : Ranking of problems with plumbing systems

Item	Plumbing Problems	Rank	Agreed %	Disagreed %
P.1)	Water leakage	1	89.54%	10.46%
P.2)	Low water flow rate	12	54.66%	45.34%
P.3)	Water seepage through walls	2	82.13%	17.87%
P.4)	Water seepage through slab	5	76.43%	23.57%
P.5)	Blocks in pipes	15	25.00%	75.00%
P.6)	Cracks in pipes	9	65.98%	34.02%
P.7)	Failures in gutter arrangements	6	73.44%	26.56%
P.8)	Problems in stop valve	8	66.00%	34.00%
P.9)	Problems in check valve	16	24.88%	75.12%
P.10)	Failures in water closet	4	76.56%	23.44%
P.11)	Overflow in toilet pit (rainy season)	3	80.00%	20.00%
P.12)	Excessive air struck in water motor	11	64.33%	35.67%
P.13)	Foot valve failure	13	42.75%	57.25%
P.14)	Problems in taps ,showers workability	14	36.84%	63.16%
P.15)	Failures in showers	17	24.65%	75.35%
P.16)	Failures in Taps	7	71.33%	28.67%
P.17)	Insufficiency of gully points	10	65.00%	35.00%

Table 4.2 illustrates the plumbing problems with the relevant priority order by comparing the agreed percentage of the individual house owners. Among those problems, water leakage was identified as the most significant problem. It represented 89.54%. Water seepage through walls is in the second place and it was taken a figure statistically 82.13%. All most all the houses had these problems. These events caused several defects in wall finishes such as blistering, cracking, spalling etc. For this aspect they were spending a certain amount of money in carrying out repair works. Overflow in toilet pit was identified as the third problem. This event was mainly happening during the rainy season and could be observed in some houses which were constructed ten years ago. This issue was very rarely happening in newly built houses. The fourth problem was identified as Failures in Water closets. Failures means in case of cracks in water closet, damages in bidet sprayers, float ball, and tank lever were being the other common issues. A failure in gutter arrangement was in the sixth place. By this problem the valance boards, valleys were affected to a certain extent.

From this survey it was denoted that few of the house members were using hot water. Some of the people do not have a proper knowledge in handling the plumbing equipment perfectly; some of them do not know how to do even smaller repair works by themselves. In such instances house owners were seeking the help of a plumber. 67% of the people agreed that they were facing many plumbing issues during the rainy season rather than dry season.

Table 4.3: Ranking of problems with mechanical systems

Item	Mechanical Problems	Rank	Agreed %	Disagree %
M.1)	Air condition failure	1	33.23%	66.77%
M.2)	Security system failure	3	3.45%	96.55%
M.3)	Fire fighting equipment failure	4	2.30%	97.70%
M.4)	Errors in data communication system	2	30.23%	69.77%

Table 4.3 summarizes the problems with mechanical systems. It was identified at the beginning of the survey, rarely used mechanical systems by the selected sample. Mechanical problems were classified as the least level when comparing with whole services as this survey was targeted on small sector housing scale. It is apparent that the usability of mechanical services was in the lowest level in small scale houses. The survey results shows that problems regarding Air conditioning units failure was identified as the leading issue such as water leakage and corrosion in the outdoor unit. It was identified, in ceratin situations the house owners forget to close the door and windows when A/C was operating. It leads to increase the open space level. This would accrue more current to cool the particular area. Further , the respondents said that they do not maintenance work regularulary for A/C , if somthing wrong with the unit consult person to check the system.

The second most important problem was errors in data communication system. Security system failure was categorized as the third important failure. This problem was also able to occur due to the poor knowledge among the users. And the fourth problem was identified as failure of fire fighting equipments. In a few houses fire extinguishers were found which were expired as they were not used frequently and lack of inspection.

4.2. Parties involvement in services installation in small sector housing

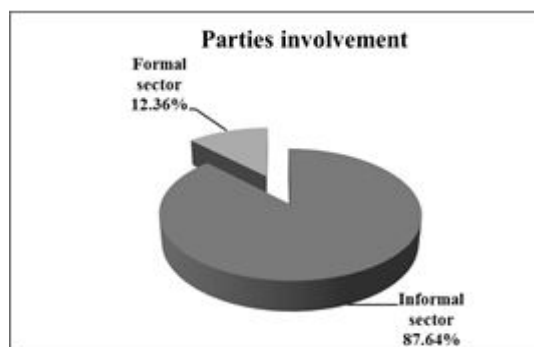


Figure 4.2 : Formal and informal sector involvement

It is clear that the problems regarding the services is very acute through the above findings and as it was reflected necessary to identify the causes of the problems. Further, during the survey the respondents were asked to interpret the parties who involved for the services work. In this survey 45 houses were identified as the sample. Out of these, 39 houses placed under the informal sector involvement and 6 houses placed under the formal sector involvement. Figure 4.2 illustrates the involvement of formal and informal sector. As per the respondents, informal sector involvement is 87.64% during the services installation. This is considerably high figure.

Many scholars mentioned that some basic characteristics of the informal sector. Wells (2007) pointed out that informal sector workers are employed in casual basis without any regular contracts and social protection. According to Koushki et al., (2005), time delay, cost overruns, low quality, financial constraints, and lack of construction knowledge are some issues in the informal sector contracts. Further, during the survey, the respondents were asked to give reasons on consulting informal workers for the services work. The respondents mentioned that main reasons for consult informal sector as believing that less cost spend compared to the formal sector although heard formal sector workers perform better than the informal sector workers. Moreover, it was revealed that many house owners are less awareness and experience with services installation. Therefore, it is very difficult to choose proper workers, materials, and hard to inspect the works during the installation time.

It is clear that most of the services installations were done by the informal sectors in small sector housing construction. A total of 10 possible limitation factors were identified from literature and preliminary survey with the informal sector workers. During the survey, the respondents were able to give their opinion and the results were summarised in Table 4.4.

Table 4.4: Limitations of informal sector

Item	Limitations	Rank	Agreed %	Disagreed %
L.1)	Time delay	3	75.78%	24.22%
L.2)	Cost overruns	6	68.83%	31.17%
L.3)	Do not have proper work plans	2	82.34%	17.66%
L.4)	Lack of adequate technology	4	72.78%	27.22%
L.5)	Less involvement of experienced professionals	1	85.34%	14.66%
L.6)	Cannot estimate required time properly	8	63.76%	36.24%
L.7)	Cannot estimate required amount of money properly	5	70.76%	29.24%
L.8)	Low quality products	9	59.87%	40.13%
L.9)	Poor quality workmanship (unskilled labourers)	7	64.76%	35.24%
L.10)	level of trust & responsibilities are not at the expected level	10	43.54%	56.46%

Among those limitations “less involvement of experienced professionals” was analyzed as the most significant limitation. Generally, it was hard to find the qualified professionals’ involvement in the services installation process of informal sector. Most of the workers were identified as unskilled labourers and some professionals were not to the required standards. And the second most important limitation was that they do not have proper work plans. It was identified when considering the services installation, informal sector is taking more time than the estimated time duration. Thus, time delay was in the third rank in the evaluation. This was due to the poor workmanship and improper work plan. Another limitation which was found in the 4th place was inadequate knowledge in technology. New technologies are being introduced by several established contractors who are employed with high financial and technical capabilities which will help to perform the task better and faster. However, this was almost difficult task for the informal sector to get used to newly introduced technologies.

Moreover, the additional fifth limitation was that they were unable to estimate required amount of money properly and the problem regarding cost overrun was in the sixth place. These limitations were taken place due to the less experienced and qualified people’s involvement and poor quality of workmanship.

5.0 Conclusions and Recommendations for good practices

This study identified the most significant issues in the small sector housing construction in case of services installation. The occurrences of services problems were identified in this survey provided that the issues regarding the electrical systems were high. Major impacted problems were namely trip switch failure, current leakage and damages occurred to equipment due to excessive current. Significant failures in electricity generally lead to a huge loss in houses which includes damages to the equipment, entire structure of the whole house, even loss of lives. The next most problems were arising from plumbing system. The major types of issues were identified as water leakage and water seepage through walls. These kind of plumbing dilemmas are occurring in houses frequently and this would acquire a high repair and maintenance cost. The least most problems were identified in Mechanical system which are of minor nature and the main problems encountered were occurred in Air-conditioning unit and not practicing regular maintenance work.

It was proved by this survey that 87.64% of informal sectors and 12.36% of formal sectors were involved in installation of services in small sector housing schemes. Less involvement of experienced professionals, poor working plans, time delay, lack of adequate technology, projects often experience a lot of hold-ups/suspensions and restarts, were identified as some limitations in the informal sector by the house owners. The results is higher repair and replacement cost to the owner. Even though the performance of the formal construction sector is beneficial than the informal construction sector, it cannot be ignored or throw out the informal construction sector completely. Majority of the house owners in Sri Lanka are not financially capable enough to get their work done by the formal construction sector because of high cost.

Therefore, an informal sector of construction industry is essential in a country like Sri Lanka. Recommendations have been made to improve knowledge and awareness of informall sector workers as well as house owners. According to the respondents, majority of house owners have no or little knowledge on services part. Thus, it is very difficult for them to choose the proper workers, materials and hard to inspect the works during the installation time. The best step is to promote hand bills, organize some awareness programmes among individual people. As well, it is important to conduct training programmes, workshops and awareness programmes to improve the skills of informal sector on new technology and new management theories. The institutions such as Institute of contractaors training and development (ICTAD) and other policy making bodies have an important role in initializing, promoting and implementing such approaches. Thus, the expected issues with services instalations in small sector housing construction could be overcome if the suggestions and recommendations given of this research is consider and put into practice.

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