

A Comparative Study On Bamboo Scaffolding And Metal Scaffolding In Construction Industry Using Statistical Methods

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Abstract: Scaffolding represents an important trade in the construction of buildings by providing platforms which allow the workers to carry out their works at height. In Mega City of Central Gujarat region of India particularly Ahmedabad and Vadodara, a variety of scaffolding systems are available. The bamboo scaffolding is regarded to be the dominant type in the local construction industry over the years chiefly because of its low costs. Local buildings have been constructed with the ever increase in height. Literatures reveal the importance of safety and cost as well as their close relationship in construction. and it is found that bamboo scaffolding is rather unsafe and unreliable especially in such high-attitude constructions, while metal scaffolding is too expensive. The success of a scaffolding system depends on many factors, e.g. its features, application and suitability in a market. This study aims at investigating the opportunity of scaffolding system and hence determining its success in Mega City of Central Gujarat region of India particularly Ahmedabad and Vadodara. Concentrations are put on these safety and cost issues. An investigation is carried out based on various literature, questionnaires, interviews as well as case studies. The results indicate that scaffolding system does represent a better alternative in high-rise construction, especially commercial buildings, in terms of safety and cost. Nevertheless, findings from questionnaires show that the use of the scaffolding system is very much contingent upon the scale of the company. Scaffolding system is a relatively important topic in the local construction industry. There were still inadequate acknowledgement and few research studies about the system. Therefore, an attempt to study scaffolding system by collecting responses from developers, contractors and suppliers and analyses it to explore the scaffolding system to give a better insight and recommendation to its local application.

Keywords: Bamboo, metal, scaffolding, safety, cost

INTRODUCTION

There comes a long history for Ahmedabad's (Gujarat) economy having been relying heavily on the Real Estate sector Ahmedabad and Vadodara (Gujarat) is developing its infrastructure very rapidly and this development continues for further some years. The construction industry has always played a major role in Ahmedabad's (Gujarat) economy and contributed almost 25 per cent of Ahmedabad's and Vadodara's GDP. Despite being frustrated by economic recession over the past few years, the construction industry is ever growing as a result of the dynamic transaction activities in the first-hand market, especially during recent booming recovery.

Due to the large amount of developments undertaking throughout the years, scaffoldings are found everywhere. Scaffolding play major role in building construction. They present an important part in construction-especially building operations at height.

Bamboo scaffolding has long been the mainstream for providing temporary support and access. According to past record, the bamboo scaffolding has 100% and 95% of the market share of the construction work in the private section in the 2001s and 2011s respectively. Meanwhile, the bamboo scaffolding also grasps 100% of the market share in the work issued by the Housing Society and in the new building work issued by the Building Authority. It is regarded as one of the oldest scaffolding (bamboo) system has been widely used in the local construction industry over decades. Its properties of high flexibility, cost effectiveness and speediness in construction have been appreciated by many literatures. And it is believed that those properties keep bamboo scaffolding stand out from open competition with various metal scaffolding

system imported overseas and become the dominant type of access scaffolding in Ahmedabad's and Vadodara's building construction .

Regardless of its merits, the local application of bamboo scaffolding has inevitably been a controversial issue in the building construction. From the Labor of the Occupation Safety and Health Branch of Labor Department, expresses his worry about the high percentage of the accident tolls related to working with scaffold. He concludes that there is a need to make a great deal more to improve the safety of bamboo scaffolds, despite of the steady improvements over the past decade. According to past records, there have been reports of bamboo scaffolding related accidents for years. Obviously, the volatile property and safety aspect of this traditional method desperately need deeper examination.

Safety is a basic human need. To achieve zero accidents is a common goal that everybody would like to see. However it is not easy to attain it and we still have much to work towards it. In fact, construction safety can be further developed and continually improved by providing adequate and practical training to the relevant workers of the contractors.

Nowadays, everything is speed and all projects have to be completed within this time frame. Moreover, for multi-storied buildings, traditional system of wooden poles and bamboos are neither suitable nor meeting any safety parameters. So for staging, centring, Access Scaffolding various metallic system are being used.

For the ever blooming property market in Ahmedabad and Vadodara, there is always a high demand of the scaffolding formwork for the construction of new high-rise buildings. According to current market status, scaffolding works normally share about 1% of a construction project, which can be a considerable sum in large projects. As a result, there comes a wide variety of scaffolding systems, whether inherited from tradition or imported overseas, within the market. And each system has its respective merits and weaknesses in the cost and safety performances.

Analysis of Findings

Analysis of the findings from questionnaires and interviews forms the heart of a research. Different approaches of analysis are used

for different types of findings and also to present the findings in different perspectives.

The purpose of analysing the data is to provide information about variables and relationships between them so as to aid understanding and support decision making of a matter. The data analysis aims at condensing a mass of data into summary statistics that succinctly characterize the observations and variables, and examining the relationship between two or more variables.

Statistical Methods

Nonparametric tests are mainly used in the analysis of the ordinal data. Nonparametric tests, as defined by Darren (2003), deals primarily with populations that are not normally distributed. Since the valid sample size in the research is not large enough to ensure normality, the technique is therefore employed. It highlights the advantage of this technique of being flexible as it is distribution-free.

Below are the techniques adopted in this research:

- ✚ Ranking and scoring
- ✚ Correlation
- ✚ Tables and charts
- ✚ Scoring of the ranked data

All ordinal data are obtained in a ranking pattern. It points out that ranking is an integral part of statistics, especially in non-parametric analysis. It aims at investigating respondents' preferences and ordering of different issues. However, the ranking responses from individual respondents are difficult to combine in giving an overall picture of the issue. As a result, scoring system is used, where different scores are assigned to the respective ranks. Total, mean scores as well as a proportional ratio for different variables can then be calculated to present the overall perspectives of the respondents.

DESIGN OF QUESTIONNAIRES

Factors Influencing Questionnaire

Cost, Availability, Safety, Erection and dismantling time, Others (please specify), Bamboo scaffolding, Metal scaffolding, Bamboo-metal mixed scaffolding, Seminars and conferences, Other companies, Articles and journals, No confidence,

Inaccessible to supply, Cost factor, Time factor, Market trend, and Cost-effectiveness

Questions

- Q.1) Considerations in adopting a scaffolding system.
- Q.2) Usage of various types of scaffolding systems.
- Q.3) Reasons for adopting the most frequently used scaffolds.
- Q.4) Areas that need most improvement.
- Q.5) Supply of various scaffolding systems at current.
- Q.6) supply of various scaffolding system in the past 5 years.
- Q.7) Sources of acknowledgement.
- Q.8) Reasons for not using/supplying bamboo scaffolding.
- Q.9) Reasons for not using/supplying metal scaffolding.
- Q.10) Reasons for not using/supplying bamboo metal mixed scaffolding.
- Q.11) Considerations in adopting bamboo scaffolding.
- Q.12) Considerations in adopting metal scaffolding.
- Q.13) Considerations in adopting bamboo metal

- mixed scaffolding.
- Q.14) Merits of bamboo scaffolding.
- Q.15) Merits of metal scaffolding.
- Q.16) Merits of bamboo metal mixed scaffolding.
- Q.17) Satisfaction towards the most frequently used scaffolds
- Q.18) Acknowledgement of bamboo scaffolds
- Q.19) Acknowledgement of metal scaffolds
- Q.20) Acknowledgement of bamboo-metal mixed scaffolds
- Q.21) Experience in the use/ supply of bamboo scaffolding
- Q.22) Experience in the use/ supply of metal scaffolding
- Q.23) Experience in the use/ supply of bamboo-metal mixed scaffolding
- Q.24) Interests in using bamboo scaffolding.
- Q.25) Continue use/supply of bamboo scaffolding.
- Q.26) Interests in using metal scaffolding.
- Q.27) Continue use/supply of metal scaffolding.
- Q.28) Interests in using Bamboo-metal mixed scaffolding
- Q.29) Continue use/supply of Bamboo-metal mixed scaffolding.
- Q.30) Suggestions for improvement of scaffolding system.

DATA ANALYSIS

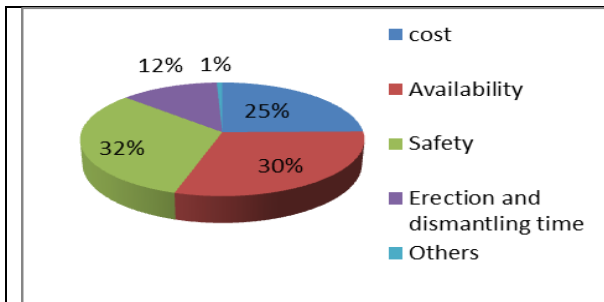


Figure1. Considerations in adopting a scaffolding system.

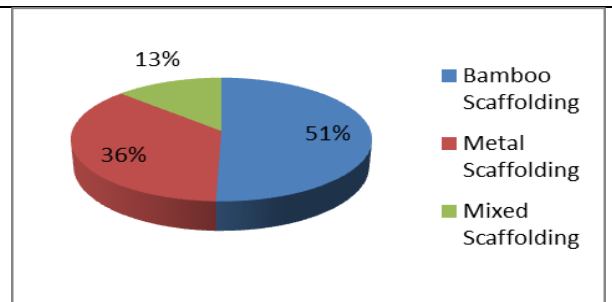


Figure2. Usage of various types of scaffolding systems.

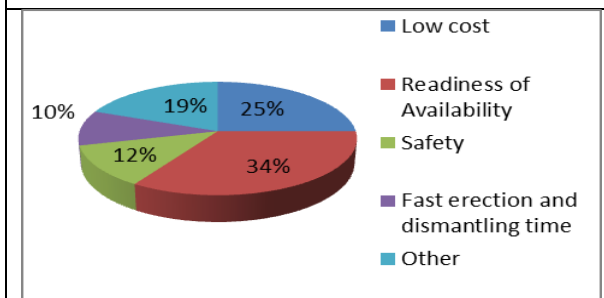


Figure3. Reasons for adopting the most frequently used scaffolds.

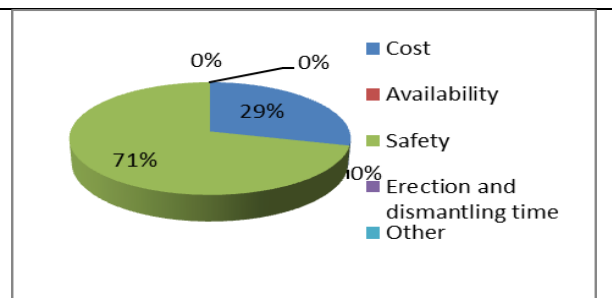


Figure4. Areas that need most improvement.

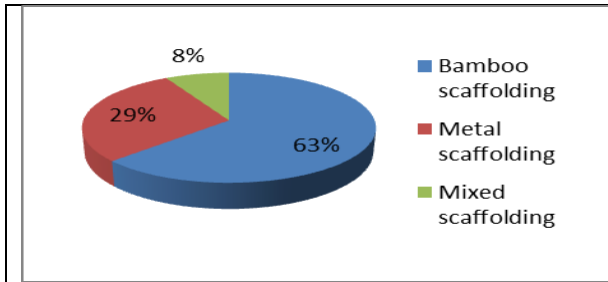


Figure5. Supply of various scaffolding systems at current.

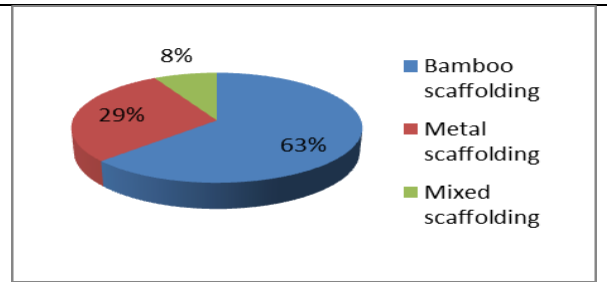


Figure6. Supply of various scaffolding system in the past 5 years.

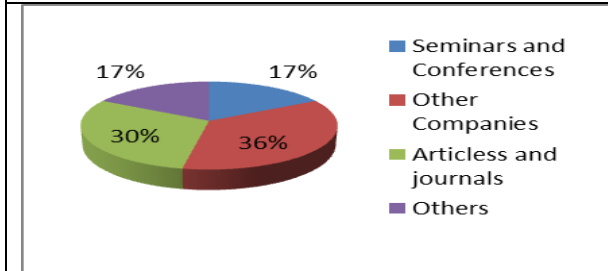


Figure7. Sources of acknowledgement.

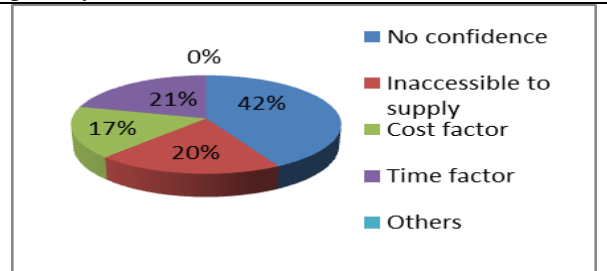


Figure8. Reasons of not using/supplying bamboo scaffolding

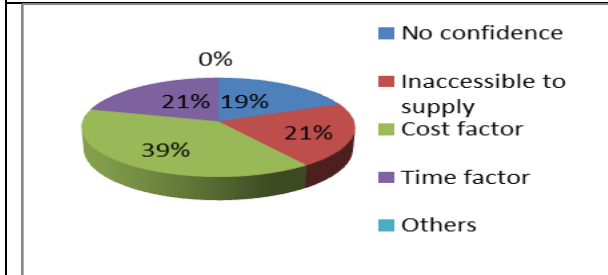


Figure9. Reasons of not using/supplying metal scaffolding.

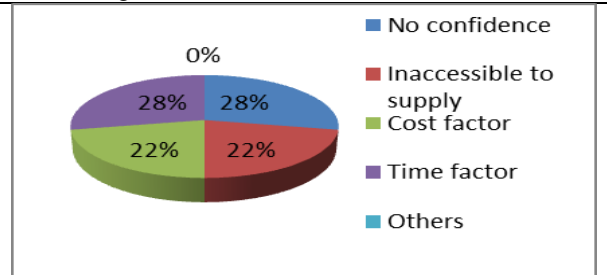


Figure10. Reasons of not using/supplying bamboo metal mixed scaffolding.

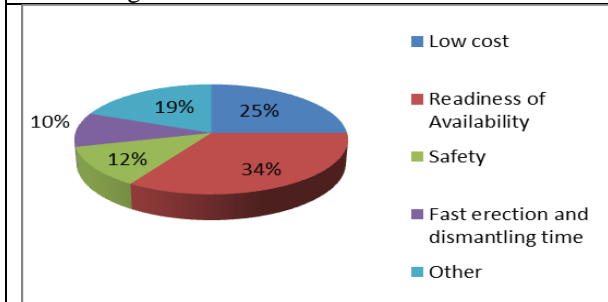


Figure11. Considerations in adopting bamboo scaffolding.

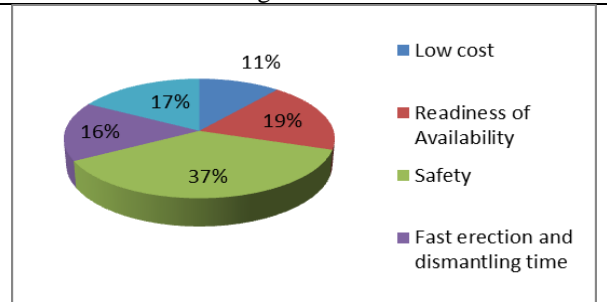


Figure12. Considerations in adopting metal scaffolding.

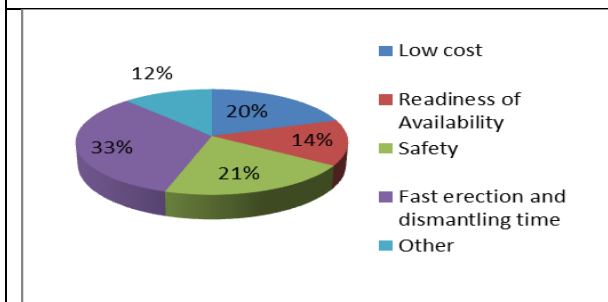


Figure13. Considerations in adopting bamboo metal mixed scaffolding.

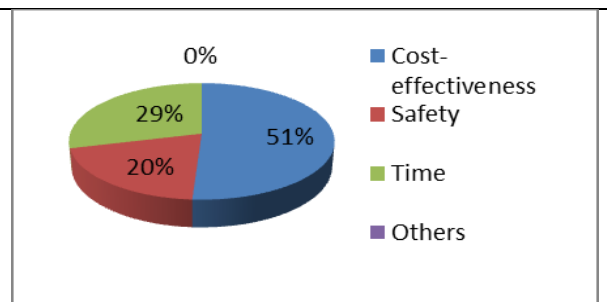


Figure14. Merits of bamboo scaffolding

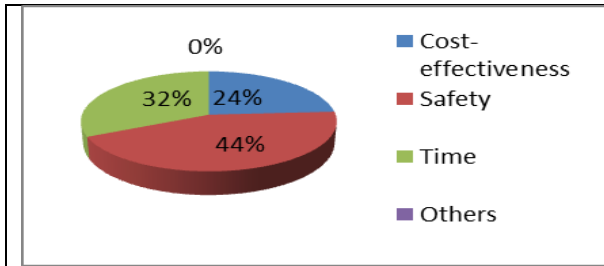


Figure15. Merits of metal scaffolding.

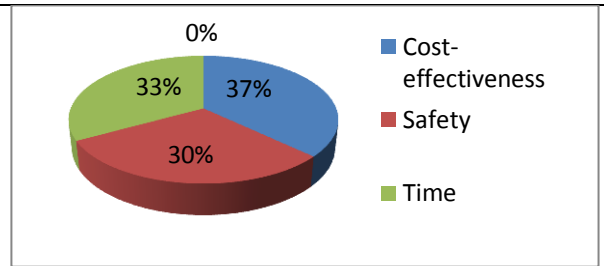


Figure16. Merits of bamboo metal mixed scaffolding.

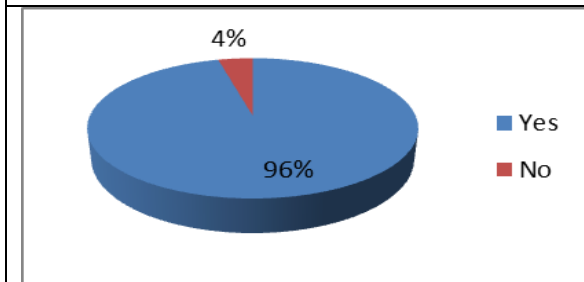


Figure17. Satisfaction towards the most frequently used scaffolds

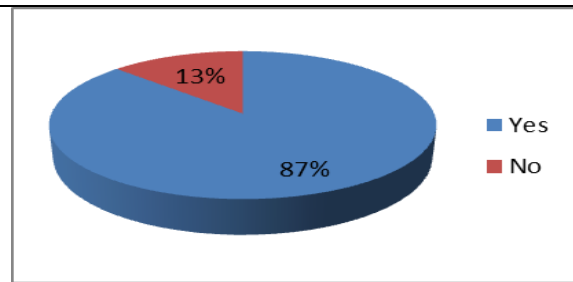


Figure18. Acknowledgement of bamboo scaffolds

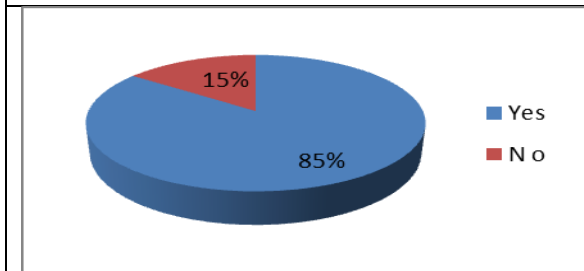


Figure19. Acknowledgement of metal scaffolds

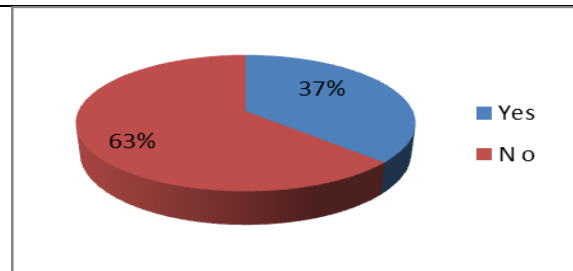


Figure20. Acknowledgement of bamboo-metal mixed scaffolds

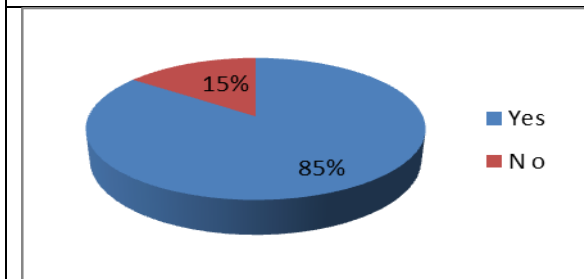


Figure21. Experience in the use/ supply of bamboo scaffolding

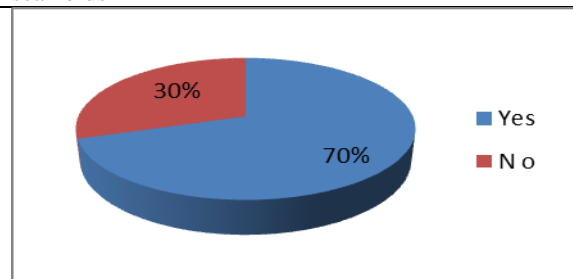


Figure22. Experience in the use/ supply of metal scaffolding.

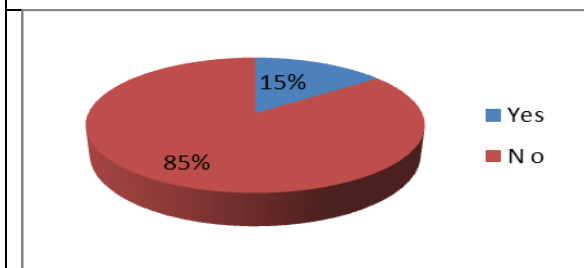


Figure23 Experience in the use/ supply of bamboo-metal mixed scaffolding.

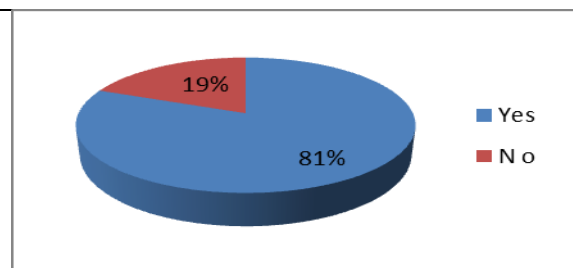
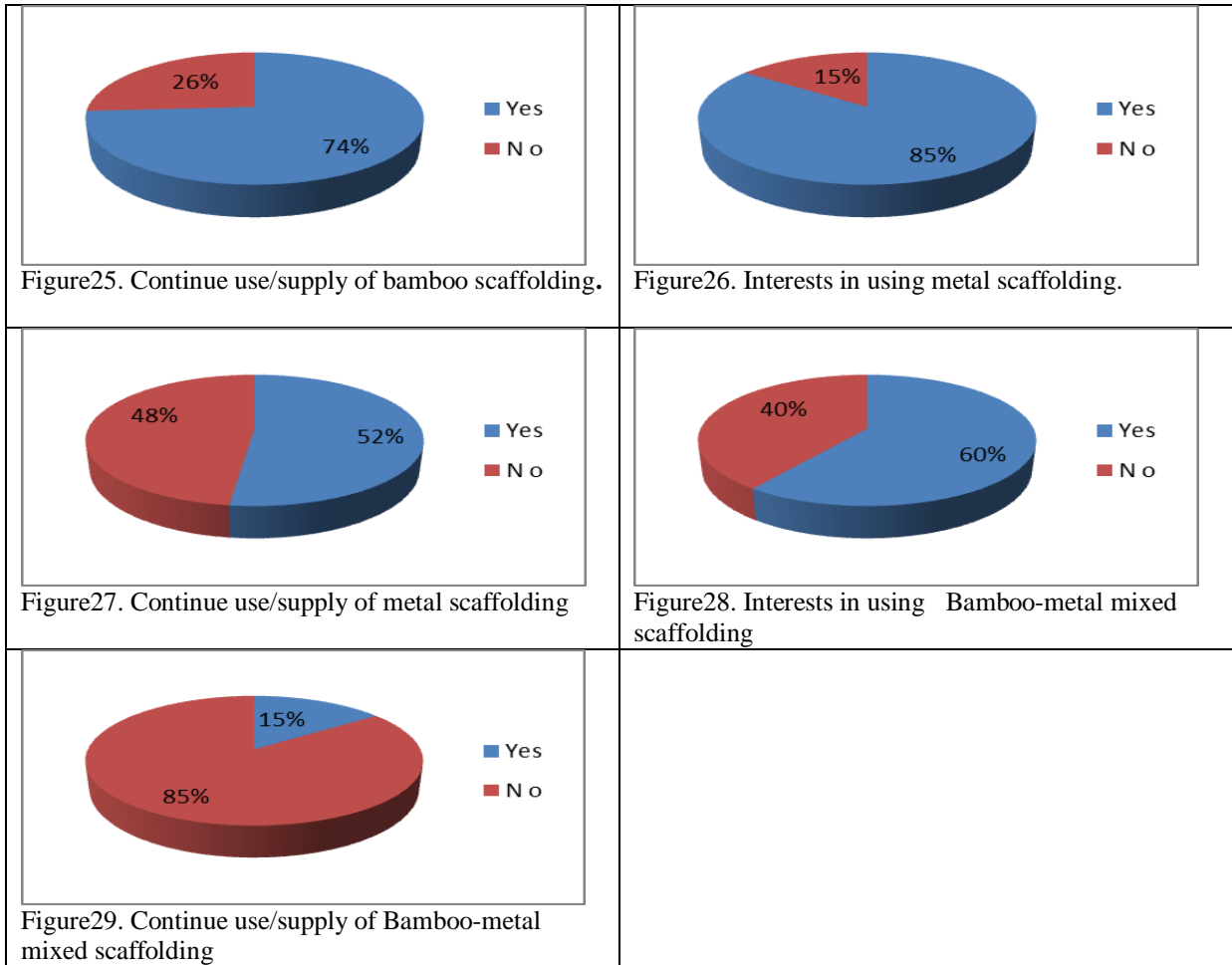


Figure24. Interests in using bamboo scaffolding



CONCLUSION

1. The findings showed that people in the construction industry generally concerned safety more than anything. The overall ranking of the factors was: "safety" (32%) > "availability" (30%) > " cost" (25%)>" erection and dismantling time (12%)".
2. From the analyses, it was obvious that bamboo scaffolding (51%) maintained the most frequent type adopted by the developers and contractors, followed by metal (36%) and bamboo-metal mixed (13%) types in descending order. The findings showed that the traditional trade still dominated the scaffolding market nowadays.
3. In the perspective of overall considerations within the respondents' pool; "Readiness of Availability" (34%) represented the major reason to adopt bamboo scaffolding, followed by "low cost"(25 %) and "safety"(12%).
4. Areas that need improvement most, Most of the respondents 71% thought bamboo scaffolding needed to improve its "safety" while the remaining

- 29% pointed out that the system shall improve its "cost".
5. In both supply and demand sides, bamboo scaffolding was found to be in the largest average amount according to the respondents.
6. Supply of various scaffolding system in the past 5 years, among the 54 respondents most of them 69% supplies bamboo scaffolding system. 23% of the respondents supply metal scaffolding system, 8% of the respondents supply bamboo metal scaffolding system.
7. Among the 54 respondents most of them (36%) got the knowledge of scaffolding through other companies' source. 30% of the respondents heard of the system from articles and journals sources, 17% of the respondents heard of the system from Seminars and conferences sources, and 30% of the respondents heard of the system from Others sources like it from traditional view.
8. Reasons of not using/supplying bamboo scaffolding main reason is respondents' have no confidence in it they fill less safety in using it. 42% of the respondents selected no confidence factor.

9. Reasons of not using/supplying metal scaffolding main reason are it is more costly than other scaffolding system.

10. Reasons of not using/supplying bamboo- metal mixed scaffolding main reason are it is costly and no more safety in using it.

11. The findings showed that 34% of the respondents selected Readiness of availability, "Readiness of availability" was regarded to be the major reason for the respondents to choose bamboo scaffolding system as the most frequently used systems while "low cost" followed in the second position 25% of the respondents selected Low cost.. Notably, "safety" did not take up the most important position in the consideration. Most respondents agreed safety was one of the most important factors to consider, but they adopted a practice which diverted from that belief.

12. The findings showed that 37% of the respondents selected Safety, "Safety" was regarded to be the major reason for the respondents to choose metal scaffolding system as the most frequently used systems.

13. Considerations in adopting Bamboo-Metal Mixed scaffolding. The findings showed that 33% of the respondents selected Fast erection and dismantling time.

14. Merits of bamboo scaffolding, from the results of the analysis, "Cost-effectiveness" as the overwhelming merits of bamboo scaffolding compared to others.

15. From the results of the analysis, "safety" as the overwhelming merits of metal scaffolding compared to others.

16. From the results of the analysis, "Cost-effectiveness" as the overwhelming merits of bamboo-metal mixed scaffolding compared to others.

17. Satisfaction towards the most frequently used scaffolds, among the 54 respondents, 52 (96%) were satisfied with the performance of the dominating scaffolding system used in their construction project. Meanwhile, 2 (4%) found the performance of the systems are not satisfactory.

18. Acknowledgement of Bamboo scaffolds, among the 54 respondents, 52 (96%) answered that they had heard of the bamboo system while only 2 (4%) had not. The result shows that Bamboo scaffolding is adequately known within the construction industry.

19. Among the 54 respondents, 46 (85%) answered that they had heard of the Metal system while only 8

(15%) had not. The result shows that Metal scaffolding is adequately known within the construction industry.

20. The result shows that Bamboo- Metal scaffolding is not known or not popular within the construction industry.

21. Experience in the use/ supply of bamboo scaffolding, among the 54 respondents, 46 (85%) answered that they had experience of the bamboo system while only 8 (15%) had not. The result shows that respondents are experienced in the bamboo scaffolding system within the construction industry.

22. The result shows that respondents are also experienced in the metal scaffolding system within the construction industry.

23. The result shows that respondents are not experienced in bamboo-metal mixed scaffolding system within the construction industry.

24. Interests in using bamboo scaffolding, among the 54 respondents, 44 (81%) answered that they had interest of the bamboo system while only 10 (19%) had not. The result shows that respondents are interested in the bamboo scaffolding system within the construction industry.

25. The result shows that respondents are continuing use/supply of bamboo system within the construction industry.

26. The result shows that respondents are also interested in the metal scaffolding system within the construction industry.

27. The result shows that respondents are continuing or not continuing use/supply of the metal system within the construction industry.

28. The result shows that respondents are not interested in bamboo- metal mixed scaffolding system within the construction industry.

29. The result shows that respondents are not continuing use/supply of bamboo-metal mixed system within the construction industry.

30. Suggestions for improvement of scaffolding system, most respondents thought that there was still a lack of relevant knowledge of the new system in the industry. They urged further education as well as a construction standard for metal scaffolding. Meanwhile, some other respondents reflected that metal scaffolding needed to have some improvement on its cost implication. They pointed out that the system was only suitable for high-rise buildings in term of cost-effectiveness, e.g. more than 20 stories. Some even responded that more

emphasize shall be put on inspection of materials and maintenance of quality of bamboo scaffolding rather than investigating the new system.

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