Critical Success Factors for circular economy building refurbishment construction and demolition waste management

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Introduction

As the largest emerging economy, China has been rapidly developing urban construction over past four decades (Zhang et al., 2021). Significant urbanization activities is generating significant construction and demolition (C&D) waste. The C&D waste has become a critical problem in China (Hao et al., 2020). Chinese government is promoting building refurbishment (BR) to prevent large scale demolition and rebuilt to reduce the C&D waste generation (MOHURD, 2021). Although many efforts have been made in C&D waste management, the critical success factors (CSFs) of C&D waste management studied in the previous research are under a linear "take-use-dispose" or open-ended 3R practice (Yuan, 2017). Circular economy have been theoretically studied in the field of C&D waste management, but little attempt has been made for identify critical success factors (CSFs) by practitioners (Huang et al., 2018). In addition, C&D waste management in BR projects should be focused as it has become an increasing portion now and in the foreseeing future in the building sector of China (Bao et al., 2021).b In order to fill this research gap, this study aims to identify CSFs driving towards a circular economy BR C&D waste management in China.
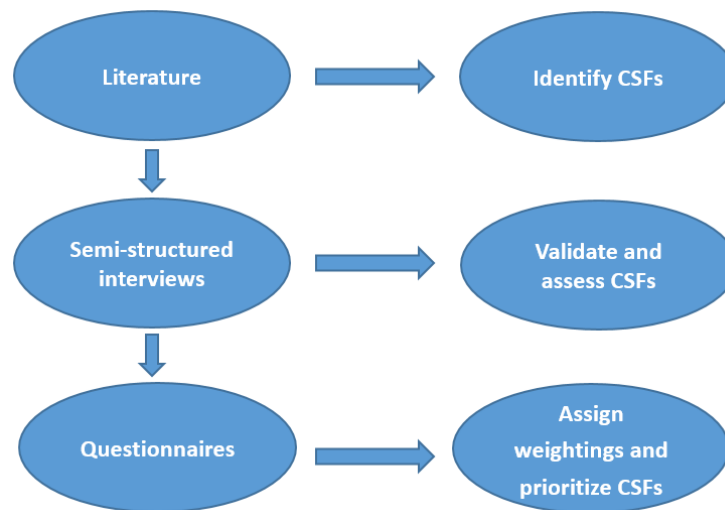
Method

Figure 1. Methodology framework of the study

The methodology framework of this study is shown in Figure 1. Firstly, CSFs towards circular economy C&D waste management are identified through literature reviews. And then, semi-structured interviews with four main stakeholders relating to the BR C&D waste management is conducted in order to validate and improve the CSFs obtained from the literature review. The semi-structured interview is adopted in this study to increase the reliability and comprehensiveness of the CSFs connecting to the reality of the BR C&D waste management of China. Each semi-structured interview is conducted from an hour to two hours. In this study, 12 local stakeholders are conducted semi-structured interviews including 4 designers from BR design institute, 4 project managers from BR contractor, 2 manager from C&D waste treatment company, and 1 officials from C&D waste management governmental office. These interviewees are carefully selected to representing four types of stakeholder involving in BR C&D waste management. The confirmed CSFs then compose to a questionnaire. The targeted respondents of the questionnaire survey are including refurbishment building owners, building contractors, building designers,

C&D waste treatment companies, and C&D waste management experts. The E-questionnaire system is used in this study to collect the questionnaire. SPSS is then adopted to analyze the results of the questionnaire. The mean and standard deviation of each factor are derived from the total sample to assign weightings and prioritize the CSFs.

Results and conclusions

There are 22 CSFs confirmed through literature review and the semi-structured interviews. These CSFs are conducted questionnaires survey by a 5 points Likert scale. The importance index value are calculated by using the equation (Wang et al., 2010):

$$CSF_i = \frac{\Sigma_{j=1}^{5} N_{ij}R_j}{\Sigma_{j=1}^{5} N_{ij}} \ (\text{i} = 1,2,\dots 22; \text{j} = 1,2,\dots 5)$$

Where,

CSF_i, importance level of a CSF

R, rating of a CSF

N_{ij}, The number of respondents who chose the jth rating R_j for the CSF_i

The SPSS is adopted to calculate the mean and standard deviation of each CSF. The questionnaire results shows that the government willingness of circular economy C&D waste management listed the first priority. Followed by the illegal dumping penalty, incentives of using secondary materials, and C&D waste information and exchange platforms. The main implementation stakeholder of the above CFSs is government. This reveals that government is a most vital stakeholder in the successes of a circular economy BR C&D waste management. In another hand, "C&D waste treatment company's willingness on circular C&D waste" and "improving secondary material quality and values" are also have importance index value. These two CSFs mainly relate to the C&D waste treatment company, which reveals that the C&D waste treatment company is critical towards a circular BR C&D waste management.

References

Zhang, M., Liu, X., Ding, Y. (2021). Assessing the influence of urban transportation infrastructure construction on haze pollution in China: A case study of Beijing-Tianjin-Hebei region. Environmental Impact Assessment Review, 87, 106547.

Hao, J., Di Maria, F., Chen, Z., Yu, S., Ma, W., Di Sarno, L. (2020). Comparative study of on-site sorting for C&D in China and Europe. Detritus, (13), 114-121.

Ministry of Housing and Urban-Rural Development of the People's Republic of China (MOHURD) (2021) Notification of prevent large scale demolition and construction in the urban renewal. MOHURD. Beijing. http://www.mohurd.gov.cn/gongkai/fdzdgknr/zfhcxjsbwj/202108/20210831_761887.html

Yuan, H. (2017). Barriers and countermeasures for managing construction and demolition waste: A case of Shenzhen in China. Journal of Cleaner Production, 157, 84-93.

Huang, B., Wang, X., Kua, H., Geng, Y., Bleischwitz, R., Ren, J. (2018). Construction and demolition waste management in China through the 3R principle. Resources, Conservation and Recycling, 129, 36-44.

Bao, Z., Lu, W., Hao, J. (2021). Tackling the "last mile" problem in renovation waste management: A case study in China. Science of the Total Environment, 790, 148261.

Wang, J., Yuan, H., Kang, X., & Lu, W. (2010). Critical success factors for on-site sorting of construction waste: a China study. Resources, conservation and recycling, 54(11), 931-936.