

Enhancing circular economy through digital technology adoption in renovation waste management based on the theory of planned behaviour

S.W. Yu^{1,2}, J.L. Hao^{1,2}, X. Tang^{1,2}, L. Di Sarno²

¹ Department of Civil Engineering, Xi'an Jiaotong-Liverpool University, Suzhou, 215123, PR China

² Department of Civil Engineering and Industrial Design, University of Liverpool, Liverpool, L69 3BX, UK

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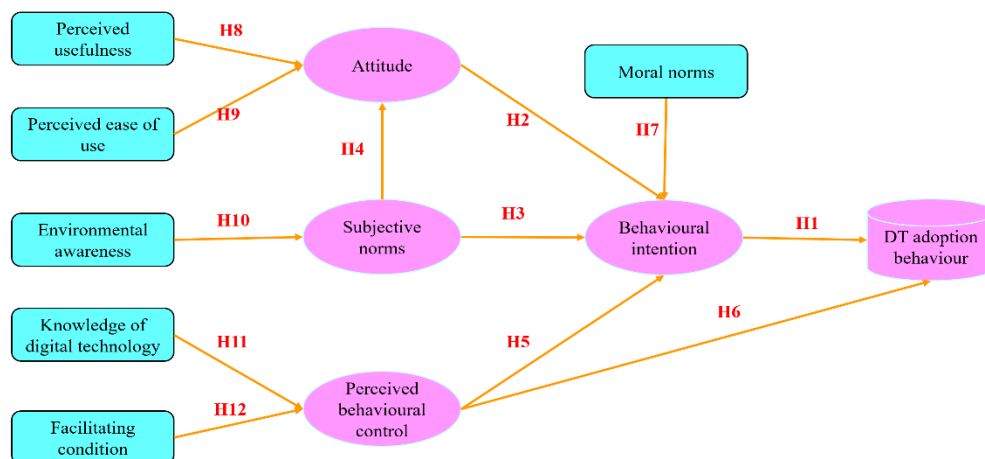
Corresponding author email: jianli.hao@xjtlu.edu.cn

Presenting author email: shiwang.yu19@student.xjtlu.edu.cn

China's rapid urbanisation and urban regeneration has contributed to the rapid growth of urban residential renovation projects. This has created a lot of opportunities for renovation companies, but it has also generated a large amount of renovation waste. An increasing number of wastes has been generated within renovation activities (Hao et al., 2020; Sun et al., 2020). Up to 18 million tons of renovation waste (RW) were produced in Jiangsu Province in 2017, accounting for 17.7% of the total construction, renovation and demolition waste (Pan et al., 2019). With the Chinese government at all levels actively promoting the reduction and resource recovery of construction waste, including renovation waste, renovation companies are faced with many challenges in managing renovation waste.

Digital technology has been proven to be effective in improving the performance and efficiency of the construction and waste management industries. The era of the construction industry 4.0 has seen the emergence of many digital technologies (DT) that provide significant impetus for improving the performance and efficiency of construction and renovation projects, helping to achieve value chain integration across the industry and facilitating digital development (Yevu et al., 2021). There is growing evidence that a large number of DT are already being used in the construction and renovation industry, including Building Information Modelling (BIM), Augmented Reality (AR), Virtual Reality (VR), Radio Frequency Identification (RFID) devices, Big Data, Geographic Information Systems (GIS), Global Positioning Systems (GPS), Quick Response Codes (QR), Blockchain and laser scanning devices. The adoption of digital technology will help renovation companies to manage renovation waste efficiently.

However, few studies have focused on the key factors that influence the adoption of digital technology in the renovation waste management process by renovation companies. This study examines the personal, organisational, social and environmental factors that influence the adoption of digital technology in renovation waste management by renovation managers, using the theory of planned behaviour.



After a review of the literature, twelve hypotheses have been proposed and tested. All the hypotheses are summarized in Fig. 1.

Figure 1. Theoretical framework

In support of the proposed hypotheses, a questionnaire including the respondents' demographic information and their perception about the variables of the hypotheses was designed and distributed to the employees in renovation companies in Jiangsu Province, China.

SmartPLS 3.3.2 was employed for the data analysis. The partial least squares technique was used for the data assessment and prediction of the results based on the hypothesis testing for a range of determinants. Composite reliability analysis of determinants showed that all items gave a value of 0.8, representing an acceptable level of reliability of each determinant. The discriminant validity for the measurement model also confirms the reliability of the variables.

Hypotheses were tested via structural equation modelling and the results shows that all the hypotheses were supported except H5 and H11 which can be seen in Table 1.

Table 1. T-values and path analysis of structural model

Hypotheses	Hypotheses paths	Standardized coefficient	T-value	P-Value	Results
H1	BI → Behavior	0.154	3.321**	0.001	Supported
H2	Attitude → Intention	0.147	3.259**	0.001	Supported
H3	SN → BI	0.117	2.600**	0.009	Supported
H4	SN → Attitude	0.144	4.927***	0.000	Supported
H5	PBC → BI	0.091	0.976	0.329	Rejected
H6	PBC → Behavior	0.120	3.419**	0.001	Supported
H7	MN → BI	0.115	2.211*	0.027	Supported
H8	PU → Attitude	0.156	2.691**	0.007	Supported
H9	PE → Attitude	0.114	2.241*	0.025	Supported
H10	EA → SN	0.081	7.128***	0.000	Supported
H11	K → PBC	0.112	1.485	0.138	Rejected
H12	FC → PBC	0.099	7.497***	0.000	Supported

The study shows that personal determinants influencing the adoption of digital technology for renovation waste management by renovation managers include behavioural intentions, perceived ease of use of technology and perceived behavioural control; determinants influencing behavioural intentions include attitudes, subjective norms and moral norms; determinants influencing attitudes include perceived usefulness and knowledge; determinants influencing subjective norms include environmental awareness and government support; determinants influencing perceptual behavioural. Determinants influencing perceived behavioural control include facilitating condition. These findings will help renovation management policy makers to develop more rational policies to promote the digitalisation of renovation waste management.

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