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AN ASSESSMENT OF STAKEHOLDERS' INFLUENCES ON CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT

THE CASE OF THAILAND

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ABSTRACT:

Successful management of construction and demolition (C&D) waste depends largely on stakeholders' initiatives. This paper aims to address, investigate, and report the results of research on C&D waste management with a focus on influences of construction stakeholders' effort, both in private and public sectors, on the success of C&D waste management. Qualitative and quantitative analysis were employed in this research. Influences of stakeholders were examined and presented. It was found that that success of C&D waste management is significantly influenced by stakeholders' level of awareness, participation, and commitment. Interrelations and directions of influencing factors show possible priority of future improvement. As a practical implication, the prioritized paths of factors that influence the C&D waste management efforts can be adapted and improved for future practical planning and implementation. The study therefore provides a significant insight and primary considerations for exerting the stakeholders' effort on C&D waste management.

Conference Topic: Integration Issues (economy, society and environment)

Keywords: Construction, demolition, developing countries, stakeholder influence, waste management

1. INTRODUCTION:

Rapid economic growth in developing countries in recent decades leads to extensive ranges of infrastructure development and urbanization. While constructing and renovating facilities to promote and maintain economic competitiveness are regarded as priorities in such countries, the problems of wastes generated from construction or renovation activities have largely been overshadowed. Every year, the amount of construction and demolition (C&D) waste generated from development activities continues to rise and become more difficult to deal with. Such wastes significantly pollute the environment (Shen et al., 2004). C&D waste problems are not yet widely recognized in developing countries, indicating inadequacy of institutional changes linked with societal and economic problems. Teo and Loosemore (2001) previously indicated that the people's willingness significantly influences changes of their behavior and attitudes towards C&D waste management, particularly when determining to achieve goals of sustainable development.

The main objective was to examine current C&D waste management practices in Thailand by conducting field studies throughout the country. It was aimed that the research output will be useful for the country's institutional framework (regulatory, normative, and cultural-cognitive) for C&D waste management in the future. Stakeholders' crucial inputs such as norms, attitudes and perceptions of Thai construction stakeholders were studied. The causal influences of three sustainability aspects on the project stakeholders' waste management efforts were investigated by analyzing primary data using the Structural Equation Modeling (SEM) technique. Meanwhile, the existing secondary data was analyzed qualitatively. Analysis of the path coefficient help identifying potentials, obstacles, and opportunities for future improvement and implementation of sustainable C&D waste management strategies and planning with main consideration on the influences exerted by all relevant stakeholders.

2. PROBLEM STATEMENT, RESEARCH OBJECTIVES, AND METHODOLOGY:

There has been very little research in Thailand concerning the management of C&D waste. A large volume of C&D waste is dumped to landfills without the system of recovering the waste's economic values or assessing the environmental impact. C&D waste management initiatives and efforts in Thailand were found to be inadequately exerted by relevant parties. This research therefore has the main objective to study the root of the problems by investigating the factors that have influence on construction stakeholders' effort and decision on initiating and implementing C&D waste management measures. It was expected that research findings would provide a significant step and basis for future research and improvement of Thailand's C&D waste management practices.

After literature reviews, a theoretical framework was established with a set of variables. An initial conceptual model was developed and variables were refined by using the Confirmatory Factor Analysis (CFA) in order to establish a starting model and design the questionnaire. Field studies (observation, interviews, and questionnaire surveys) were carried out in four regions (North, Northeast, Central, and South) of Thailand. Respondents and informants include construction stakeholders such as project owner, contractors, project personnel, local government officials, local residences, and waste service providers. Collected primary data were analyzed quantitatively by using statistical methods and the Structural Equation Modeling (SEM) technique. The starting model was then refined until the final best-fit model is achieved. This final model provides numerical results i.e. the significant path coefficient that explain the stakeholders influences based upon the factors under investigation. Then, results were discussed and a conclusion was made together with recommendations.

3. SUSTAINABLE DEVELOPMENT, GREEN CONSTRUCTION, AND THE NEW INSTITUTIONAL THEORY:

The sustainable development ideology aims to achieve a balanced economic, social and environmental goals (WHO, 2005), meaning to protect the environment, reduce pollution, conserve natural resources, and safeguard the quality of life of all people. Construction industry can contribute to the society by initiating and implementing green construction practices, which minimize consumption of natural materials, reduce waste generation, release less toxic gas, and save cost by utilizing the by-products from wastes that are generated during construction. The concept of green and sustainable construction (GSC) can therefore create a healthy built environment while balancing the economic, social, and environmental benefits.

As the concept of sustainable development is increasingly recognized, the construction industry are urged to seriously concern on issues of environmental sustainability, which is the ability to maintain the qualities valued in the physical environment (CES, 2006). Besides, systematic management of construction waste and pollution is increasingly demanded from urban construction projects (Chen *et al.*, 2000) as the general public became more concerned of environmental impacts related to construction activities (Cole, 2000 and Tam *et al.*, 2006). Meanwhile, the people's quality of life is reflected by the level of social sustainability, which also shows whether the community is responsive and supportive to the waste management options currently available (Chung and Lo, 2003). Altogether, the economic sustainability is essential factor to be considered. Without simultaneous improvement of the quality of life and the environment, the development cannot be regarded as sustainable (NHS PASA, 2008). As such, an innovative mechanism is required in order to balance the interests of gaining both economic and socio-environmental benefits for all stakeholders.

As environmental problems are related with societal and economic problems, the new institutional theory can be employed to analyze the problems (Manowong and Brockmann, 2010). The institutional frameworks are socially constructed systems of norms, values, beliefs, and definitions (Suchman, 1995). In institutionalization, regulatory processes involve the capacity to establish rules, inspect other's conformity pattern, and manipulate sanctions (reward or punishment) in an attempt to influence the future behavior. Meanwhile, the normative systems define goals/objectives and designate appropriate ways to pursue them. Finally, the cultural-cognitive systems recognize that internal interpretive processes are shaped by external cultural frameworks (Scott, 2001). In the past decades, problems of reaching the goals of sustainable development and green construction have been an inadequate awareness and ignorance of parties involved in such development activities. Hence, in order to attain a more balanced sustainability, importance and significance of sustainability issues needs to be re-institutionalized among all groups of stakeholders.

4. STAKEHOLDER INFLUENCES ON C&D WASTE MANAGEMENT:

Management of any project in the modern world needs to be attuned to the cultural, organizational and social environments surrounding the project. It is crucial to well understand such project environments and relevant stakeholders, as well as their influences, in order to successfully manage the planned projects or schemes. Jergeas et al. (2000) pointed out that the effective management of project stakeholders is an important key to project success. As such, stakeholders' acceptance and satisfaction on management policy are vital. In terms of C&D waste management, it is necessary to identify and assess stakeholders' interests and expectations on the prospective waste management scheme.

Stakeholders can be internal or external groups. Internal stakeholders are those formally connected with the project while external stakeholders are those affected by the project (Gibson, 2000). In construction, internal stakeholders include project owner, clients, project leader, designers, suppliers, and contractors. Meanwhile, external stakeholders comprise the regulators, the public community groups, financing institutions, media, consumers, and other groups with special interests (Manowong and Ogunlana, 2009). These stakeholders, directly or indirectly involved with management of the project, can provide support or resistance to the scheme's management objectives (Walker, 2000). For C&D waste management issues, roles and responsibilities of relevant stakeholders have to be recognized and accepted. As each group of stakeholders may have different interests and objectives, it is important to know their different expectations and level of attention as well as to determine to what extent they could and would exert influences on the C&D waste management program.

5. RESULTS:

Having reviewed literatures in the context of sustainable development, construction waste management, and green construction, a total of 69 variables for every aspect were identified altogether. These theoretical variables were tested for their relevancy by using exploratory factor analysis and then grouped into theoretical constructs by using the CFA method, resulting in a conceptual model in Figure 1. This conceptual model is comprised of two main parts, a measurement component and a structural component. These two components are essential for SEM technique (Byrne, 2001). The measurement model provides first estimation and the correlations between factors or constructs which are used as input for estimating the structural coefficients between latent variables. Due to space limitation, it is not possible to illustrate all details of theoretical variables in Figure 1 and only hypothetical relationships are shown. It was hypothesized that the sustainability aspects have directly influence on CWME, which also directly lead to GSC. Meanwhile, the sustainability aspects have their own inter-relationships.

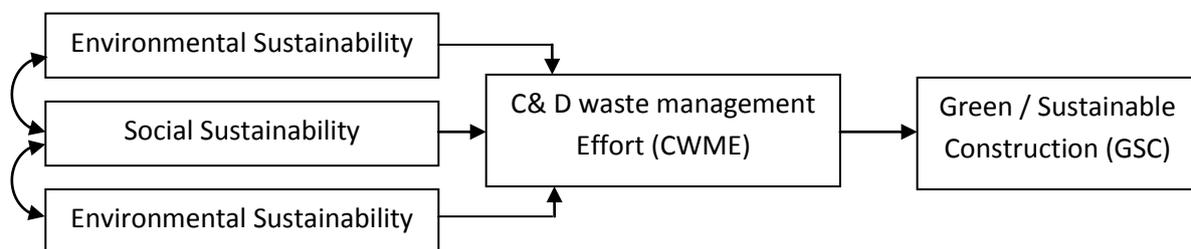


Fig.1 conceptual model

The conceptual model provides a framework for further exploring the relationships among five latent variables. Stakeholders' attitudes and perceptions on each variable were examined. Causal effects between latent variables were analyzed. That is, sustainability concerns upon the stakeholders' waste management effort were investigated in order to find out how stakeholders could influence the prospective green and sustainable construction (GSC). The structural equation model was developed and analyzed by using the statistical software SPSS and AMOS (version 16.0). Model modification indices and theoretical justifications were used until a final satisfactory model was identified. The model was revised through several iterations until the best-fit final structural model was obtained. In this study, the final structural model was found to have a very good fit, with fit indices as show in Table 1.

Table.1 Results of goodness-of-fit indices

Model Fit Indices	Value Required	Final Model Value
Relative Chi-Square (CMIN/DF)	≤ 2.0	1.771
Comparative Fit Index (CFI),	≥ 0.90	0.906
Root Mean Square Error of Approximation (RMSEA)	≤ 0.08	0.045
Incremental Fit Index (IFI)	≥ 0.90	0.907

For better visualization of the values of the significant paths' coefficients, the final structural model is shown in Fig 2.

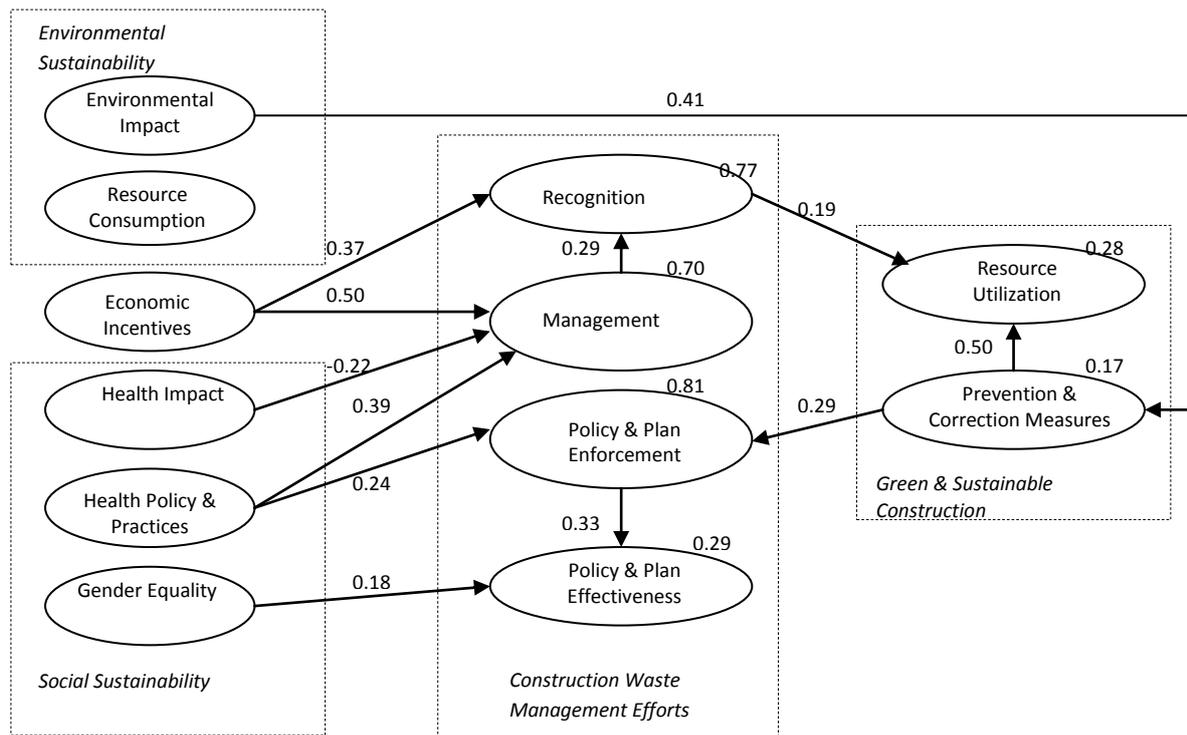


Fig.2 Final structural model

In the final SEM model, only significant path coefficients are illustrated. It can be seen that the environmental sustainability construct is mainly measured by the environmental impact and resource consumption variables as the stakeholders considered these two factors are most important in the environmental sustainability issues. The SEM analysis result yields that the resource consumptions have no significant influence on construction waste management efforts. This reflects the fact that Thailand is still rich of natural construction materials so that there is no effort to utilize waste as substituting materials. However, the model shows that concerns on environmental impacts has direct significant influence (path coefficient = 0.39) on the GSC by having prevention/correction measures for adverse impacts.

When considering the social sustainability, impact on stakeholders' physical and mental health had significant influence on their C&D waste management effort. This SEM results support the surveyed responses indicating that health and safety issues are very significant issues, particularly for construction workers who are directly exposed to construction waste (negative path coefficient = -0.22 indicates that the more unsafe conditions leads to the less efforts exerted). The availability of policy and practices concerning health and safety of stakeholders was also found to have significant influence on success of enforcement and management of C&D waste policies and plans (path coefficient = 0.39 and 0.24). An interesting factor that has significant influence on C&D waste management efforts is the gender equality (path coefficient = 0.18). Manowong and Perera (2008) previously suggested that women are more sensible in managing construction waste so that they should be more empowered and assigned to be in charge of construction waste management duties.

In terms of the economic sustainability, willingness of construction operators and their motivation to implement 3Rs (reduction, reuse, and recycle of C&D waste) scheme were found to have high influence on C&D waste management efforts while the other remaining factors has moderate influence. The economic incentives significantly influence (path coefficient = 0.37) the C&D waste management efforts by increasing waste problem recognition and facilitating the waste management process (path coefficient = 0.50).

It can be implied that the effective enforcement of C&D waste management policies and plans is most influenced by compatibility of such initiatives and actual situations faced by stakeholders. Consultations among major groups of stakeholders such as government, industry, and public sectors also have high influences on the enforcement of C&D waste management policies and plans. Level of C&D waste management efforts is also significantly driven by the introduction of prevention and correction measures for solving waste problems and achieving green and sustainable construction practices. Such measures also significantly influence the resource utilization in construction activities such as effective use of materials, energy, and water. It is also shown that resource utilization is moderately influenced by recognition on worthiness of C&D waste management plan.

6. DISCUSSION AND RECOMMENDATIONS

Results from the final SEM model in this study suggest that concerns on environmental sustainability had currently no direct influence on C&D waste management efforts exerted by stakeholders. Rather, it was found to have a significant influence directly on the concerns of green and sustainable construction. This reflects that the campaign on environmentally sustainable development focuses only on promoting end achievement without adequate recognizing and exerting effort on important practices of C&D waste management. Hence, future improvement should focus more on the means than the end product. For example, with higher recognition, particularly within the construction projects, the C&D waste management effort can be increased by development and improvement of workers' skills for safer handling of wastes on-site. More alternatives for C&D waste management should be provided and supported so that the construction operatives feel more comfortable and effort.

Findings also suggest that the development will be socially sustainable through motivated and encouraged participation in C&D waste management when the health and safety of stakeholders, particularly those in operational level, are well protected. However, the other groups who have power to make decision in construction projects must also be satisfied by adequate economic incentives such as increased revenues and/or reduced expenditures.

Findings in this study yields similar results of research in other developing country by Kulatunga et al. (2006), which indicates that the extent of waste management practices can be limited by stakeholders' negative attitudes and behaviours. Moreover, the C&D waste management process, such as recycling, is discouraged by additional costs incurred. This kind of economic reason causing such discouragement in waste recycling conforms to findings in research by Duran et al. (2006). When stakeholders are socially encouraged and economically motivated, they tend to recognize more on C&D waste problems and exert more of their efforts. Hence, wide range of social benefits and economic incentives should be initiated.

It is recommended that improvement of strategy to promote higher level of C&D waste management efforts from stakeholders should not focus only on providing incentives. Regulations must be properly established and maintained, inappropriate norms must be changed, construction stakeholders must be educated and trained so that they can induce their cognition and consequently eliminate their cultures of ignorance on C&D waste problems. As stakeholders' influences were found significant for improvement of C&D waste management problems in Thai construction industry, stakeholder participation in specific C&D waste management process/procedures (particularly in construction site) needs to be identified. Furthermore, stakeholders need to be highly motivated and continuously encouraged through all possible means, with particular emphasis on economic incentives and social benefits, in order to attain their cooperation and coordination in complying with the introduced C&D waste management plan.

5. CONCLUSION

The C&D waste management initiatives cannot be successfully achieved without consent, coordination, and cooperation from relevant stakeholders. Before engaging stakeholders into C&D waste management practices, it is essential to understand their needs and expectations. In order to attain effective stakeholders' participation, using enforced regulations alone is not adequate. Attention must be paid on balancing stakeholders' interests based on core values of sustainable development including economic and social incentives as well as environmental concerns. In order to successfully and effectively engage other groups of stakeholders, in C&D waste management scheme, the policy makers should realize the significance of stakeholders' influences.

The factors and their interrelationships identified in this study should provide useful insights for establishing effective C&D waste management strategies in the future. Although this study was conducted concerning situations of Thai construction industry, the results should be applicable in other developing countries with similar contexts. Through re-institutionalization, it should be noted that not only a change of the stakeholders' norms and introduction of strong regulations that are important but also the stakeholders' awareness and willingness to participate. Success of the C&D waste management scheme cannot be achieved without considering the stakeholders' interests and attaining their institutional commitment.

References

1. Byrne B. M. (2001). **Structural Equation Modeling with AMOS: Basic Concepts, Applications, and Programming**. Lawrence Erlbaum Associates, Inc., Mahwah, NJ.
2. Commissioner for Environmental Sustainability (CES), Victoria, Australia. (2006). From CES publications: <http://www.ces.vic.gov.au/CES/wcmn301.nsf/childdocs/-441BB07721D61152CA256F250028C5FB?open> (accessed July 1, 2008).
3. Chen, Z., Li, H. and Wong, T.C. (2000). **Environmental management of urban construction projects in China**. *Journal of Construction Engineering and Management* 126(4), 320-324.
4. Chung, S.S. and Lo, W.H.C. (2003). **Evaluating sustainability in waste management: the case of construction and demolition, chemical and clinical wastes in Hong Kong**. *Resources, Conservation and Recycling*, 37, 119-145.
5. Cole, R.J. (2000). **Building environmental assessment methods: assessing construction practices**. *Construction Management and Economics*, 18, 949-957.
6. Duran X., Lenihan H., and O'Regan B., (2006). **A model for assessing the economic viability of construction and demolition waste recycling—the case of Ireland**. *Resources, Conservation and Recycling*. 46, 302–320.
7. Gibson, K. (2000). **The moral basis of stakeholder theory**. *Journal of Business Ethics*, 26(3), 245-257.
8. Jergeas, G.F., Williamson, E., Skulmoski, G.J., and Thomas, J. L (2000). **Stakeholder management on Construction Projects**. *AACE International Transaction*, 12.1-12.5.
9. Kulatunga U., Amaratunga D., Haigh R., and Rameezdeen R., (2006). **Attitudes and perceptions of construction workforce on construction waste in Sri Lanka**. *Management of Environmental Quality: An International Journal*. 17(1), 57-72.
10. Manowong, E. and Brockmann, C. (2010). **Construction waste management in newly industrialized countries**. *CIB World Congress 2010, Salford, Manchester, 10-13 May 2010, United Kingdom*.
11. Manowong, E. and Perera, R.P. (2008). **Construction Waste Management from a Gender Perspective**. *GMSARN (Greater Mekong Sub-region Academic and Research Network) International Journal*, 2(3), 91-100.
12. NHS Purchasing and Supply Agency (NHS PASA) (2008). **Social sustainability**. From NHS publications <http://www.pasa.nhs.uk/PASAWeb/NHSprocurement/Sustainabledevelopment/Socialsustainability/LandingPage.htm> (accessed July 1, 2008).
13. Scott W (2001). **Institutions and Organizations**, Thousand Oaks, Sage.

14. Shen, L.Y., Tam, V.W.Y., Tam C.M., and Drew, D. (2004). **Mapping approach for examining waste management on construction sites**. *Journal of Construction Engineering and Management*, 130(4), 472-481.
15. Suchman, M. C. (1995). **Managing Legitimacy: Strategic and Institutional Approaches**. *Academy of Management Journal*, 20(3), 571 - 610.
16. Tam, V.W.Y., Tam, C.M., Yiu, K.T.H., and Cheung, S.O. (2006). **Critical factors for environmental performance assessment (EPA) in the Hong Kong construction industry**. *Construction Management and Economics*, 24, 1113-1123.
17. Teo, M.M.M. and Loosemore, M. (2001). **A theory of waste behavior in the construction industry**. *Construction Management and Economics*, 19(7), 741-749.
18. Walker, D.H.T. (2000). **Client/Customer or stakeholder focus? ISO 14000 EMS as a construction industry case study**. *TQM Magazine*, 12(1), 18-25.
19. World Health Organization (WHO) (2005). **World Summit Outcome Document**. WHO publications <http://www.who.int/hiv/universalaccess2010/worldsummit.pdf> (accessed January 16, 2010).