JURNAL ILMU LINGKUNGAN
Volume 19 Issue 2(2021) : 459-464 ISSN 1829-8907

A Review on Sustainable Construction Regulations in Asian Countries: Savvy Insights for Indonesia

Maria Agnes[1] and Raldi Hendro Koestoer[1,2*]

[1] School of Environmental Science, Universitas Indonesia
[2] Coordinating Ministry for Economic Affairs

ABSTRACT
Infrastructure projects, more specifically the construction, operation and deconstruction phase, are claimed to have the potential to cause profound impacts on the environment. The construction industry worldwide attains to generate the consumption for 40% of total energy production and 16% of the entire sum of water volume available, as well as the production for 25% of greenhouse gas emissions and 30-40% of all solid wastes. This circumstance has led to the rising of global awareness with regards to the importance of sustainability concept implementation in the construction industry which subsequently resulted in the formulation of corresponding laws and regulations in recent years. Indonesia is no exception. Decree of the Minister of Public Works and Public Housing of the Republic of Indonesia No: 05/PRT/M/2015 concerning General Guidelines for the Implementation of Sustainable Construction in Infrastructure Projects Execution has been enacted to provide a direction for sustainable construction implementation that creates sustainable infrastructure, which will eventually contribute to a sustainable development. Based upon the decree, this study conducts a literature review on the implementation process of laws and regulations related to sustainable construction in Asian countries. The review contains exploratory case studies and comparative analysis on general overview of the regulations format and the challenges encountered, as well as strategies taken, during the implementation process. This paper provides a useful reference for policy makers in Indonesia, while simultaneously benefits the construction industry practitioners and other related stakeholders.

ABSTRAK
Penyelenggaraan infrastruktur, khususnya pada tahapan pelaksanaan konstruksi, pemanfaatan dan pembongkaran, memberikan dampak negatif yang cukup signifikan terhadap lingkungan. Sektor industri konstruksi tercatat berkontribusi atas penggunaan 40% total produksi energi di dunia, 16% total jumlah konsumsi air, 25% emisi gas Rumah Kaca (GRK), serta 30–40% dari volume limbah padat dunia. Kondisi ini telah disadari oleh negara-negara di dunia, termasuk Indonesia, sehingga ditindaklanjuti dengan diterbitkannya regulasi-regulasi sehubungan dengan konstruksi berkelanjutan. Peraturan Menteri Pekerjaan Umum dan Perumahan Rakyat Republik Indonesia (Permen PUPR) Nomor: 05/PRT/M/2015 tentang Pedoman Umum Implementasi Konstruksi Berkelanjutan Pada Penyelenggaraan Infrastruktur Bidang Pekerjaan Umum dan Permukiman telah diterbitkan untuk dapat dijadikan acuan bagi para penyelenggara infrastruktur dalam mengimplementasikan pendekatan konstruksi berkelanjutan di Indonesia. Mengacu kepada Permen tersebut, penelitian ini melakukan studi komparasi berdasarkan kajian literatur terhadap proses implementasi regulasi konstruksi berkelanjutan di beberapa negara Asia lainnya dengan tujuan tidak hanya untuk mengetahui format regulasinya namun juga tantangan-tantangan yang dihadapi dan strategi-strategi yang diambil dalam proses implementasinya. Hasil dari penelitian ini diharapkan dapat digunakan sebagai bahan pertimbangan penentuan kebijakan lanjutan sehubungan penyelenggaraan infrastruktur berkelanjutan di Indonesia.

Keywords: environmental regulation, construction, sustainable construction, infrastructure, sustainable infrastructure

Citation: Agnes, M., and Koestoer, R.H. (2021). A Review on Sustainable Construction Regulations in Asian Countries: Savvy Insights for Indonesia. Jurnal Ilmu Lingkungan, 19(2), 459-464, doi:10.14710/jil.19.2.459-464

1. Introduction

The construction industry worldwide attains to generate the consumption for 40% of total energy production and 16% of the entire sum of water volume available, as well as the production for 25% of greenhouse gas emissions and 30-40% of all solid wastes (Berardi, 2013; Darko et al., 2017; Hong et al., 2019; He et al., 2020). This circumstance has led to the rising of global awareness with regards to the importance of sustainability concept implementation in the construction industry (Wang et al., 2014; Kibwami & Tutesigensi, 2016; Darko et al., 2017). Sustainable construction is generally defined as an infrastructure project wherein its execution manages to minimize its negative impacts towards natural environment and human socioeconomic conditions; by which a contribution to a sustainable development can be resulted from, eventually (Darko et al., 2017). In this respect, it is important to note that the sustainable construction concept aims to be comprehensively

* Corresponding author: raldy.hk@ui.ac.id

implemented in the entire phases involved over the course of an infrastructure project execution; starting from the extraction process of raw materials, through the planning, designing and construction process, until the final phase of deconstruction and waste disposal (Chang et al., 2016).

Previous studies had been conducted to gain insights in relation to main influential factors which can positively and negatively affect the implementation process of sustainable construction in countries across the globe. The findings of these studies indicated numerous positive and negative factors which varied according to country's location and region. Nevertheless, it can be concluded that one most influential and dominant factor which had garnered a lot of attention in connection with the subject matter is 'government regulations and policies' (Darko et al., 2017); and it can be seen from the escalating number of regulations and policies issued by countries over the past few years (Andelin et al., 2015). This prevalent phenomenon has no longer occured only within United States and European countries, but it has started to take place in Asian countries, such as China, Singapore, Hong Kong, and India (Darko et al., 2017). China is the pioneer in the region, it is the first Asian country which has instigated the implementation of sustainable construction. It all started when in the 1980s the Chinese government legitimized the first sustainable building regulation for the northern residential sector (Ye et al., 2013).

Though a bit delayed compared to several Asian countries, the implementation of sustainable construction principles in Indonesia was finally and officially set in motion when Decree of the Minister of Public Works and Public Housing of the Republic of Indonesia No: 05/PRT/M/2015 concerning General Guidelines for the Implementation of Sustainable Construction in Infrastructure Projects Execution has been enacted. The decree is intended to exercise as a guidance for project owners, practitioners and other related stakeholders of the construction industry in Indonesia when implementing the sustainable construction principles into projects execution. Based upon the decree, this paper conducts a comparative literature review on the implementation process of laws and regulations related to sustainable construction in Asian countries, with the expectation of acquiring insightful understandings in connection with challenges encountered, as well as strategies taken, during those implementation process.

2. Research Method

The approach used in this research is a qualitative approach with a qualitative descriptive method. The use of a qualitative approach in this study aims to gain understanding in connection with the implementation process of laws and regulations related to sustainable construction. This research was conducted based on facts and supporting data obtained from the existing literature and related sources. The method of this research is to conduct exploratory case studies from the existing research results for benchmarking and comparative analysis. The analysis will not merely focus on the regulations format, but it will also emphasize on the challenges encountered, as well as strategies taken, during those implementation process.

One of the main articles reviewed, titled *'Sustainable construction practices in the execution of infrastructure projects. The extent of implementation.'* by Willar et al (2021), had adequately presented an evaluation on the implementation process of sustainable construction regulation in Indonesia, specifically on the Decree of the Minister of Public Works and Public Housing of the Republic of Indonesia No: 05/PRT/M/2015. The authors of the article firmly stated that the implementation process of sustainable construction regulation in Indonesia will not be advancing effortlessly. The implementation process will encounter various challenges, such as higher project costs, lack of subject matter experts, etc. Similarly, other articles also indicated that the implementation process of sustainable construction laws and regulations in other Asian countries such as Malaysia, China and Singapore, is not free from challenges as well.

As a result of the case studies, Section 3 of this article presents an elaboration with regards to the general overview of the regulations format and the challenges encountered, as well as strategies taken, during the implementation process in those countries.

3. Result and Discussion

With reference to literature review carried out to the implementation process of sustainable construction laws and regulations in Malaysia, China and Singapore, Table 1 summarizes notable points resulted from the comparative analysis, whereas detail commentaries can be found in subsections below respectively.

3.1. Case Study: Malaysia

Malaysia Construction Industry Development Board (CIDB) was established in 1994 under the Construction Industry Development Act (Act 520). It is a Malaysian government agency under the Ministry of Works (*Kementerian Kerja Raya*) which has a mandate to regulate, develop and facilitate the Malaysian construction industry in delivering quality, productive and sustainable built environment. In accordance with its mission, this institution is quite proactive in addressing issues related to sustainable construction. In June 1999, CIDB set up a technical committee with its main task to conduct research on the development of good environmental practices in the construction industry. This technical committee, more commonly referred to as TC9, consists of a group of environmental experts from government agencies, professionals, academia and industry associations. Despite the fact that it took years for TC9 to formulate the strategic

recommendations for the improvement of environmental practices in construction industry, CIDB had eventually managed to publish these recommendations in the year 2007, followed by a meeting between CIDB and industry stakeholders in 2010 to formalise the strategic direction related with the implementation of sustainable construction in Malaysia (Kamar & Hamid, 2011).

Consecutively, aligned with the Malaysian government's schemes to reduce dependency on foreign workers and to maximize the utilization of sustainable construction technologies, CIDB adopted the Industrialized Building Systems (IBS). The fundamental concept of IBS is to transfer the work that was predominantly executed on-site to a more controlled environment such as manufacturing plant. The rationale for the concept is due to the fact that a more controlled production environment is deemed to be able to minimize the use of energy and construction materials, as well as the volume of waste it generated. From that perspective, IBS is therefore regarded as one of the stimulants which can boost the sustainable construction concept up. Hence, in 2008, IBS was made compulsory and a regulation requiring a minimum usage of 70% IBS components and/or materials in the construction process of a public building was issued simultaneously (Kamar & Hamid, 2011).

Up to the present time, numerous regulations and policies related to the concept of sustainability in the construction industry have been issued by the Malaysian government, but at the same time, the implementation process of sustainable construction still encounters various barriers, whereof pertaining to a study conducted by Klufallah et al. (2019), those barriers are as shown in Figure 1. Most of those barriers, viz. lack of public awareness, lack of public interest/demand, lack of government support, lack of building codes, lack of incentives and local authority enforcement are all closely linked to government regulations and policies.

3.2. Case Study: China

At a global scale, China construction industry is one of the largest which had managed to grow rapidly and book a revenue equivalent to USD 1.049 trillion in 2020 (ITA USDC, 2021). Due to its size and potential impact towards the environment, the Chinese government had taken the lead in legitimizing the first sustainable building regulation since 1980s (Ye et al., 2013).

Table 1. Summary of Comparative Analysis

	Malaysia	China	Singapore
Cover environmental, social and economic aspects	Still emphasizing on environmental aspect	Still emphasizing on environmental aspect	Still emphasizing on environmental aspect
Availability of associated technical guidelines	No	Yes	Yes
Cater all phases involved in the execution of an infrastructure project	No	No	Yes
Classified based on regional economic development	No	No	No
Availability of stimulus, including economic incentives and financing programs	No	Yes	Yes

.

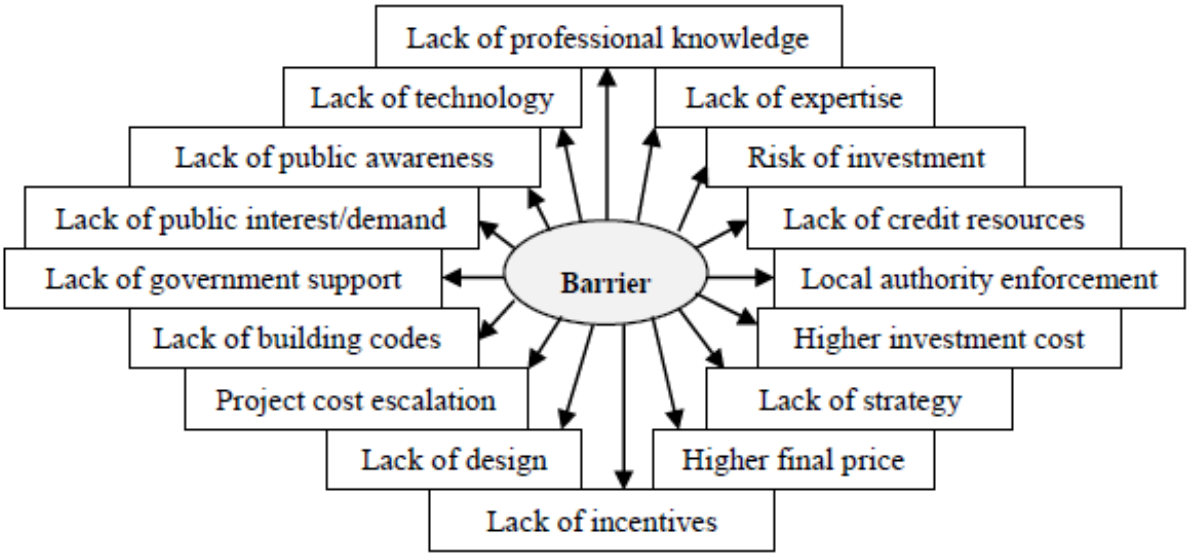

Figure 1 Barriers to Sustainable Practice (Source: Klufallah et al. 2019)

In spite of this, current situation indicates that in some way, the implementation process of sustainable construction concept has not yet furnished satisfactory results and requires significant improvement (Sha et al., 2000; Chang et al., 2016), specifically during the period of year 2000-2010. During this period, contrary to the expectations, research found that China's unit energy consumption was instead almost threefold of the unit energy consumed in developed countries (Zhang & Dong, 2011). Consistent with that, the result of a research conducted by Xue et al. (2014) relating to the energy consumption of China's construction industry reaffirmed that Guangdong was the only province succeeded in achieving energy efficiency during the period of year 2004-2009. On top of that, circumstances on the ground also demonstrated a low level of awareness from contractor companies in connection with the concept of sustainability. This observation was validated by a research conducted by Qi et al. (2010) which presented a disappointing result, whereof only 2.44% of contractor companies implemented sustainable construction practices.

Previous studies resulted with a conclusion that regulation is the most crucial factor for the successful outcome of sustainable construction implementation (Cheah & Chew, 2005), yet it may become the greatest challenge as well. In China case, Zhang & Dong (2011) identified incomplete legal system, lack of guidance, unclear legal liability and poor law enforcement as the main problems correlated with regulations and policies implementation. At that point in time, articles concerning sustainable construction were still scattered in segregated laws, which was of course quite difficult, both for the regulators and construction companies. In addition, existing laws, regulations and policies were still primarily focused on controlling the production process and the waste disposal. Hence, regulations which comprehensively catered all phases involved in the execution of an infrastructure project were certainly needed (Zhang & Dong, 2011).

Acknowledging the shortcomings discovered in the implementation process, combined with the strong determination to succeed, the Chinese government started to issue additional laws, regulations and policies related to sustainable construction. Starting from the year 2011, a number of regulations had been enacted, including the regulation regarding stimulus and economic incentives. Those regulations can therefore be categorized into (1) framework policies, (2) supporting regulations and (3) specific instructions (Chang et al., 2016). The result of a research conducted to evaluate the implementation outcome of these new regulations revealed that it was in fact able to contribute a positive impact to the implementation process of sustainability concept into China's construction industry. Nonetheless, a study conducted by Chang et al. (2016) still identified several major challenges and opportunities for improvement in relation to the subject matter. Two most important points need to be taken into consideration are as follows: (1) China's existing sustainable construction regulations are still predominantly focused on environmental aspects only and seem to disregard the social and economic aspects; (2) China's existing sustainable construction regulations are implemented homogeneously across the board regardless the economic development of respective region, thereby implementation is becoming almost unrealistic for those regions with low economic growth such as Guizhou and Gansu.

3.3. Case Study: Singapore

Singapore's numerous achievements in the context of sustainable construction implementation, consequently depicted Singapore as one of the world's leading countries in the area. One of its greatest achievements was evidently the accomplishment to increase the number of green buildings from less than 20 in 2005 to over 2,100 by 2014 (Shan et al., 2017). It was undoubtedly the positive impact associated with the issuance of the Building Control (Environmental Sustainability) Regulations in 2008. The rationale for its effectiveness was due to the fact that within the same year the Code for Environmental Sustainability of Buildings, Green Mark Scheme and Green Mark Incentive Scheme (GMIS) were also issued to flourish the implementation process. The Green Mark Scheme is a green building rating system which was developed by Singapore Building and Construction Authority (BCA) in collaboration with the National Environment Agency.

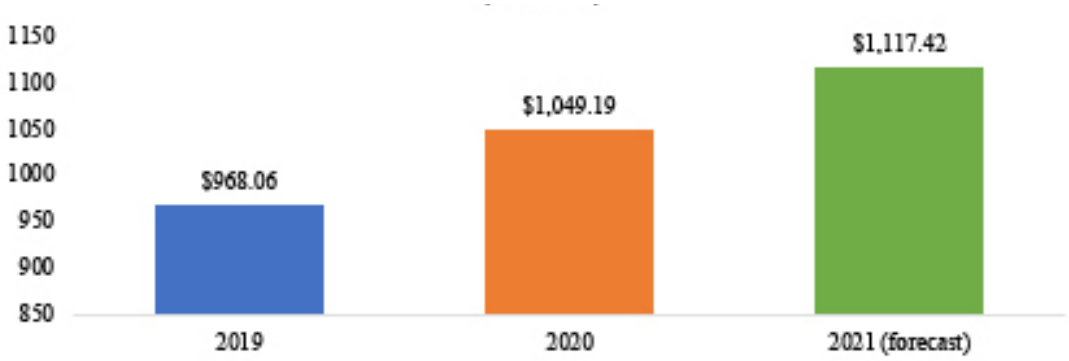

Figure 2 China Construction Industry Revenue Value in Billion USD (Source: ITA USDC 2021)

As a result, the rating system was formulated based on the following five key criterias of environmental aspect only: energy efficiency, water efficiency, environmental protection, indoor environmental quality and green features (Yin et al., 2018). Yet, the scheme already taken planning, designing, constructing and operations phases into account (Low et al., 2009).

BCA understood that issuing regulations solely would never be sufficient to stimulate industry practitioners in implementing sustainable construction practices. Therefrom, in addition to the incentives offered through GMIS (Low et al., 2009), government financing programs are also available to facilitate the sustainable construction implementation (Shan et al., 2017).

3.4. Sustainable Construction in Indonesia

The issuance of the Minister of Public Works and Public Housing Decree No: 05/PRT/M/2015 concerning General Guidelines for the Implementation of Sustainable Construction in Infrastructure Projects Execution positively marked Indonesia government's commitment in regard to sustainable construction implementation. However, experts viewed that unavailability of associated technical guidelines which should be supplemented the decree to be one of the biggest barriers for the implementation process of sustainable construction in Indonesia (Willar et al., 2019). Moreover, similar with those challenges encountered by other developing countries, experts also considered the ministerial decree to be particularly emphasized on the environmental aspects and has not yet encompassed the social and economic aspects (Susanti et al., 2019); though implementation related to environmental aspects, such as energy and water efficiency, as well as waste reduction, is still lacking in day-to-day practices of infrastructure projects in Indonesia (Willar et al., 2019).

4. Conclusion

The concept of sustainable construction is somewhat perceived as new and foreign concept in Indonesia. Case studies conducted from countries which had initially implemented the concept, such as Malaysia, China and Singapore, would undeniably benefit the concept's implementation progress in Indonesia. Abundant lessons can be obtained from experiences undergone by those countries, yet, most essential lesson to be learned from is that effective implementation process of sustainable construction regulations requires at least 5 (five) of the followings: First, associated regulations and policies containing technical guidelines, along with criterias, indicators and minimum requirements. Second, regulations and policies which comprehensively formulated to cater all phases involved in the execution of an infrastructure project starting from the extraction process of raw materials, through the planning, designing and construction process, until the final phase of deconstruction and waste disposal. Third, classification based on regional economic development thereby implementation in regions with low economic growth is feasible. Fourth, stimulus, including economic incentives and financing programs. Fifth, strict supervision and monitoring from relevant government agencies.

Further, the result of this study also showed that the implementation process of sustainable construction is far from easy and an ongoing process. Undoubtedly, continuous improvement is very much needed to the already existing regulations and policies.

REFERENCES

Andelin, M., Sarasoja, A. L., Ventovuori, T., & Junnila, S. (2015). Breaking the circle of blame for sustainable buildings – evidence from Nordic countries. Journal of Corporate Real Estate, 17(1), 26-45. DOI:10.1108/JCRE-05-2014-0013.

Berardi, U. (2013). Clarifying the new interpretations of the concept of sustainable building. Sustainable Cities and Society, 8, 72–78. https://doi.org/10.1016/j.scs.2013.01.008.

Building and Construction Authority (BCA). (2008). Building Control (Environmental Sustainability) Regulations.

Chang, R., Soebarto, V., Zhao, Z., & Zillante, G. (2016). Facilitating the transition to sustainable construction: China's policies. Journal of Cleaner Production 131, 534-544. http://dx.doi.org/10.1016/j.jclepro.2016.04.147.

Cheah, Y.JC., & Chew, A.S.D. (2005). Dynamics of strategic management in the Chinese construction industry. Management Decision 43 (4), 551-567. DOI 10.1108/00251740510593558.

Darko, A., Zhang, C., & Chan, A.P.C. (2017). Drivers for green building: A review of empirical studies. Habitat International, 60, 34–49. https://doi.org/10.1016/j.habitatint.2016.12.007.

He, Q., Wang, Z., Wang, G., Zuo, J., Wu, G., & Liu, B. (2020). To be green or not to be: How environmental regulations shape contractor greenwashing behaviors in construction projects. Sustainable Cities and Society, 63, Article 102462. https://doi.org/10.1016/j.scs.2020.102462.

Hong, J., Zhong, X., Guo, S., Liu, G., Shen, G. Q., & Yu, T. (2019). Water-energy nexus and its efficiency in China's construction industry: Evidence from province-level data. Sustainable Cities and Society, 48, Article 101557. https://doi.org/10.1016/j.scs.2019.101557.

International Trade Administration, U.S. Department of Commerce. (2021). China Design and Construction Services Sector. https://www.trade.gov/country-commercial-guides/china-design-and-construction

Kamar, K.A.M., & Hamid, Z.A. (2011). Sustainable construction and green building: the case of Malaysia. WIT Transactions on Ecology and The Environment, Vol 167. doi:10.2495/ST110021.

Kibwami, N., & Tutesigensi, A. (2016). Enhancing sustainable construction in the building sector in Uganda. Habitat

International, 57, 64-73. https://doi.org/10.1016/j.habitatint.2016.06.011

Klufallah, M., Ibrahim, I.S., & Moayedi, F. (2019). Sustainable practices barriers towards green projects in Malaysia. IOP Conf. Series: Earth and Environmental Science 220 012053. doi:10.1088/1755-1315/220/1/012053.

Low, S. P., Liu, J.Y., & Wu, P. (2009). Sustainable facilities: Institutional compliance and the Sino-Singapore Tianjin Eco-city Project. Facilities Vol. 27 No. 9/10, pp. 368-386. DOI 10.1108/02632770910969612.

Qi, G.Y., Shen, L.Y., Zeng, S.X., & Jorge, O.J. (2010). The drivers for contractors' green innovation: an industry perspective. Journal of Cleaner Production, Vol. 18, Issue 14, 1358-1365. https://doi.org/10.1016/j.jclepro.2010.04.017

Sha, K., Deng, X., & Cui, C. (2000). Sustainable construction in China: status quo and trends. Building Research and Information, Vol. 28, Issue No. 1, pp. 59-66. https://doi.org/10.1080/096132100369109

Shan, M., Hwang, B., & Zhu, L. (2017). A Global Review of Sustainable Construction Project Financing: Policies, Practices, and Research Efforts. Sustainability, 9, 2347. doi:10.3390/su9122347

Susanti, B., Filestre, S.F.H., Juliantina, I. (2019). The Analysis of Barriers for Implementation of Sustainable Construction in Indonesia. IOP Conference Series: Earth and Environmental Science 396, 012033. doi:10.1088/1755-1315/396/1/012033

Wang, L., Toppinen, A., & Juslin, H. (2014). Use of wood in green building: A study of expert perspectives from the UK. Journal of Cleaner Production, 65, 350-361. https://doi.org/10.1016/j.jclepro.2013.08.023

Willar, D., Waney, E.V.Y., Pangemanan, D.D.G., & Mait, R.E.G. (2019). Sustainable construction practices in the execution of infrastructure projects. The extent of implementation. Smart and Sustainable Built Environment Vol. 10 No. 1, pp. 106-124. DOI 10.1108/SASBE-07-2019-0086

Xue, X., Wu, H., Zhang, X., Dai, J., & Su, C. (2014). Measuring energy consumption efficiency of the construction industry: the case of China. Journal of Cleaner Production, 107, 509-515. https://doi.org/10.1016/j.jclepro.2014.04.082

Ye, L., Cheng, Z., Wang, Q., Lin, W., & Ren, F. (2013). Overview on green building label in China. Renewable Energy, 53, 220-229. https://doi.org/10.1016/j.renene.2012.11.022

Yin, B.C.L., Laing, R., Leon, M., & Mabon, L. (2018). An evaluation of sustainable construction perceptions and practices in Singapore. Sustainable Cities and Society, 39, 613–620. https://doi.org/10.1016/j.scs.2018.03.024

Zhang, W., & Dong, J. (2011). Research on Laws and Regulations of Sustainable Construction in China. International Journal of Humanities and Social Sciences Vol:5, No:6. DOI: doi.org/10.5281/zenodo.1327610.