DEVELOPMENT OF INDICATORS FOR SOCIAL SUSTAINABILITY ATTRIBUTES ACROSS THE CONSTRUCTION PROJECT LIFE CYCLE

Nurul Elma Kordi[1], Sheila Belayutham and Che Khairil Isam Che Ibrahim

School of Civil Engineering, College of Engineering, Universiti Teknologi MARA, 40450 Shah Alam, Selangor, Malaysia

Sustainability in construction refers to the adherence to the three primary pillars of sustainability, which are environmental, economic, and social practices that influence projects' performance. However, the social pillar is still being side-lined and inadequately defined, owing to its subjective nature, which highly depends on the uniqueness of a site and the surrounding culture and community. Consequently, the question that remains unanswered is, what are the social sustainability indicators that should be considered in construction projects, accounting for the different stakeholders across the construction project life cycle? This study aims to establish the indicators of social sustainability in construction projects, further relating those indicators to the various stages of the construction project life cycle. The methods for this study included literature reviews, focus group discussions, and structured interviews. The findings would enable objective assessment of the social sustainability dimension across the construction project life cycle, subsequently assisting industry practitioners to continuously monitor and improve the social aspect of their project towards achieving sustainable construction.

Keywords: indicators; project life cycle; social sustainability

INTRODUCTION

It has been well acknowledged that the construction industry has a significant contribution to sustainable development. Nonetheless, the activities that occur during the life cycle of a construction project do result in inherent societal consequences (i.e., economic, environmental, and social consequences) (Dong and Ng, 2016). Among the "triple bottom line" principles of sustainable development, social sustainability (SS) is the least explicit dimension, particularly in construction projects (Karji *et al.,* 2020). Meanwhile, Rostamnezhad and Thaheem (2022) also claimed that little literature has been done to investigate the social attributes of construction projects. The term "SS in construction projects" refers to specific social implications of construction projects on the human population that affect how people live, work, interact and organise to meet their needs (Sodangi, 2019). Therefore, SS is an important part of sustainable development and the exclusion of the social attributes in construction project developments will have detrimental short and long-term effects on the entire project life cycle.

[1] elma8207@uitm.edu.my

Kordi, N E, Belayutham, S and Che Ibrahim, C K I (2022) Development of Indicators for Social Sustainability Attributes Across the Construction Project Life Cycle *In:* Tutesigensi, A and Neilson, C J (Eds) *Proceedings of the 38th Annual ARCOM Conference,* 5-7 September 2022, Glasgow, UK, Association of Researchers in Construction Management, 672-680.

Previous researchers have offered different approaches to improve SS in the construction industry, including green innovation technologies of construction methods (Randeree and Ahmed, 2018), development of the fuzzy analytical hierarchy process (FAHP) method to evaluate the social performance of hospital redevelopment projects (Xiahou *et al.,* 2018), development of a quantitative model that uses efficacy index to determine the actual efficacy level of SS (Sodangi, 2019), and implementation of SS-centric analysis techniques for feasibility study (Goel *et al.,* 2020).

Since most of the previous efforts have concentrated on technological or process improvements, which affects only single or several phases in the construction project life cycle, their benefits or impacts on the overall project were limited. On the other hand, researchers have also developed different industrial or national indicator systems to evaluate the sustainability of the construction sector in a country (Dong and Ng, 2016; Randeree and Ahmed, 2018). Although such SS evaluation systems were more comprehensive in assessing certain construction project life cycles, they are less useful for developing effective strategies to improve the overall SS in a construction project. Thus, this study attempts to identify the SS indicators in construction, further designating the SS indicators over the project life cycle in construction. The determination of the SS indicators would be based on the earlier findings by Kordi *et al. (*2021) where 9 main and 20 sub-attributes of SS has been established. The proposed indicators are beneficial for construction stakeholders, to achieve sustainability in a more effective manner throughout the construction project life cycle.

LITERATURE REVIEW

Social sustainability (SS) seeks to address the requirements of people at every stage of a construction project's life cycle, to ensure effective collaborations with stakeholders, suppliers, employees, and local communities for customer satisfaction. Several prior research (Almahmoud and Doloi, 2015; Rohman *et al.,* 2017) have produced assessment frameworks, some of which were focused only on certain indicators of SS. Li *et al. (*2018) provided a breakdown of multi-stakeholder-related SS, whereas Doloi (2018) provided a methodology for assessing community-specific SS. Earlier, Andreas *et al. (*2011) looked at LEED ND, CASBEE, Cascadia, CEEQUAL, and Green Globes to identify indicators for infrastructure system sustainability. Fowler and Rauch (2006) who researched on rating systems around the world found BREEAM, CASBEE, GB Tool, Green Globe US, and LEED to be the most suitable rating systems for General Service Administration (GSA) projects. Nguyen and Altan (2011) reviewed and analysed five well-known grading systems, including BREEAM, CASBEE, LEED, GREEN STAR, and HK-BEAM from various perspectives, and concluded that BREEAM and LEED were the most developed. The recent study on sustainability rating systems was conducted by Karji *et al. (*2020) who identified the SS indicators from reviewing the existing systems. Nonetheless, the limitations of the previous studies stem from the lack of comprehensive breakdown of SS indicators into objectively measurable and reliable taxonomy for the entire process project life cycle. Some of the SS indicators also included economic and environmental indicators, which were not the focus of SS. These limitations place researchers, policy makers, and practitioners in a tough position; they must conceive and expand on the conceivable hierarchies of SS to conduct an appropriate and representative analysis of the social implications of a construction project (Rostamnezhad and Thaheem, 2022). Nevertheless, not all components of SS were represented, and certain significant

features run the risk of being overlooked due to the limited space-time views and considerations from the relevant decision-makers. This lacking imposes additional work on practitioners and decision-makers in locating existing frameworks and compiling a comprehensive breakdown of SS for the entire project life cycle. The inherent shortages on the coverage and concentration of SS justifies the need for additional efforts regarding this subject matter, which coincides with the intention of the current study.

METHOD

This study started with the conduct of literature reviews in identifying the relevant SS indicators across the construction project life cycle. This was followed by focus group discussion and structured interviews with expert panels for the review and verification of the SS indicators. The three main methods are described as follows:

(1) Literature review

The study was planned for the identification of relevant SS indicators in construction projects through literature reviews. The process of identification was guided by the main and sub-attributes established from the previous study by Kordi *et al. (*2021). Subsequently, thematic analysis was conducted by defining the relevant themes and sub-themes. During the development of the indicators, the researchers have brainstormed on the potential inconsistencies, different thoughts or ideas that could arise from having various interpretations of the data until reaching the point of consensus on the developed indicators, regarding the main and sub-attributes.

(2) Focus groups discussion (N=15)

The purpose of conducting focus group discussion, in the form of an open interview was to create an environment with opportunities to impart and discuss the identified SS indicators with the experts. The indicators identified from the literature were grouped into the three stages of construction life cycle: namely, pre-construction, construction, and post-construction. Afterwards, the grouped indicators were sent to the expert panels one week before the focus group session, as an initial reference. This has allowed the panels to preview and familiarise themselves with the SS indicators before the focus group session.

The recommended size for a focus group is often between five to twelve participants (Ho *et al.,* 2021), to allow for maximum interaction between the participants and to elicit as much information from the participants. In total, 15 expert panels were selected for the focus group discussion that were conducted in September 2021. All the expert panels had at least ten years of working experience with 7 panels having more than 20 years of working experiences. During the session, the expert panels with diverse backgrounds were further divided into three groups (5 experts in one group) to ensure the discussions were more focused (Table 1). Each of the focus group sessions lasted between one to two hours.

Regarding the focus group session's protocol, the facilitator has started by describing the goal of the study, the meeting's ground rules (e.g., participants are welcome to make comments and share their experiences), and the preservation of panels' anonymity. The 48 indicators were then presented to the panels. Throughout the discussion, participants were directed to refer to the indicators' definitions (with application examples) with guidance from the facilitator.

Table 1: Details for the group of experts (N = 15)

Group 1		Group 2		Group 3	
ID	Position	ID	Position	ID	Position
A2	Associate Professor	A1	Senior Lecturer	A-5	Senior Lecturer
I-6	Civil Engineer	A-4	Senior Lecturer	A-3	Senior Lecturer
I-7	Senior Manager	I-11	Managing Director	I-14	Project Manager
I-8	Director Manager	I-13	Architect Manager	I-15	Design Manager
I-9	Architect Manager	I-12	Director of Facility Management	I-16	Senior Structural Engineer

The panels were persuaded to engage in open discussion about SS issues relevant to their own personal project's experience in order to assess the robustness of the indicators. Each SS indicator was brainstormed to allow the retrieval of additional information from the experts. Modifications were made until agreement were achieved among the expert panels. Based on the 'theoretical saturation' (Saunders *et al.,* 2018) concept, we have continued the session until reaching the point of no additional or relevant insights into the research issue. Comments and suggestions from all the groups were consolidated and incorporated in the final version of the SS indicators.

(3) Structured interview (N=25)

As suggested by Yeung *et al. (*2009), quantitative measurements allow for objective assessments of indicators. Outcome from Stage 2, which was the consolidated set of SS indicators were then placed in the form of a questionnaire survey for the conduct of structured interview. The structured interviews were aimed to obtain objective assessment of the consolidated indicators from the previous stage. The structured interviews were conducted with industry practitioners who had prior experiences in sustainable construction projects, particularly SS.

Finally, 25 expert respondents were selected for the structured interviews conducted over the span of two months (October - November 2021). During the structured interview, the experts were required to indicate the appropriateness of the social sustainability indicators in measuring the practice of social sustainability in projects. The experts were then asked to rank the level of suitability in accordance with the following 5-likert scales: (1) definitely not suitable; (2) probably not suitable; (3) unsure; (4) probably suitable; (5) definitely suitable. Once the appropriate level of suitability was identified, the final set of social sustainability attributes and indicators is established. The general workflow of the process is illustrated in Figure 1.

FINDINGS

Profiling of Respondents

The expert panels in Stage 2 were identified among experienced academicians and construction industry practitioners. There were five experts from the academics and ten from the construction industry for the focus groups. One expert was a senior manager, seven were project managers, and two were engineers from the industry. The respondents' backgrounds were diverse, including main contractors (n = 4), developer (n = 1), government departments (n = 2), and consultants (n = 3).

For the respondents in Stage 3, 30 relevant experts were initially contacted, where 5 of them claimed that they were not qualified to participate due to their limited knowledge and experiences with sustainability projects. Therefore, the list of interviewees was

cut down to 25. Among the 25 interviewees, 16 were industry professionals (11 property developers and 5 planners), 4 were government officials (from planning departments), and 5 were scholars (from 2 public universities).

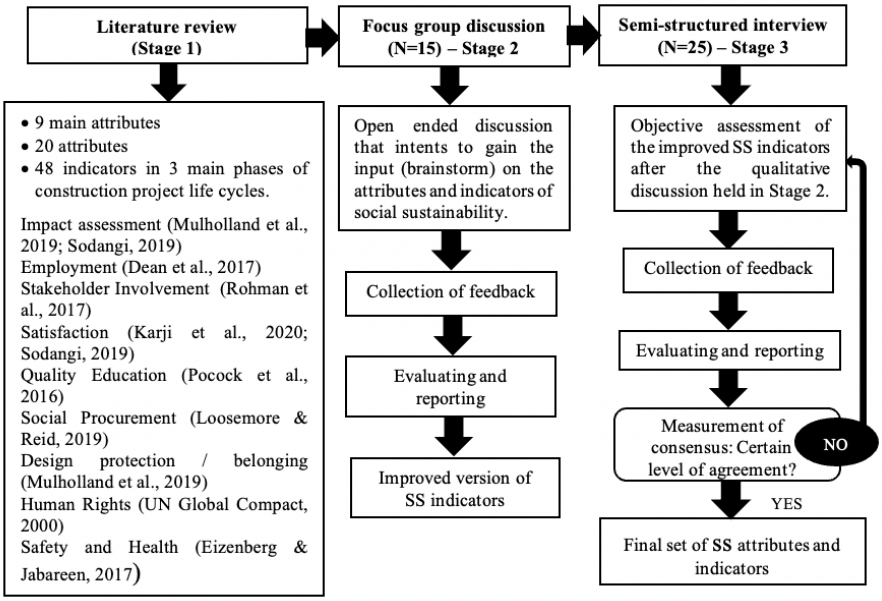

Figure 1: Key steps of the method

Social Sustainability Attributes and Indicators

Findings from the literature review and focus group discussion have resulted in 48 SS indicators, which were further acknowledged its practicality and suitability by 25 practitioners through structured face-to-face structured interviews. The average score given by the 25 practitioners regarding the established indicators was 4.84, out of 5. The high score indicates that the SS indicators were appropriate and fit to be applied as a SS assessment measure in construction project life cycle. Table 2, Table 3, and Table 4 shows summary of the finalised list of SS main attributes, attributes, and indicators categorised in accordance with the three phases of construction project life cycle. In summary, 25 indicators are placed in the construction phase, 19 in the pre-construction phase and another 4 in the post-construction phase.

In the pre-construction phase, planners need to clearly and systematically provide a plan to minimise disruption that could occur during the construction phase. The development of the Social Impact Assessment (SIA) report may require identifying the impacts of construction to the user and the projection of employment (job creation, job stability, et cetera). In this phase, the organisation must plan for employment opportunities that will be advantageous to the community, such as job opportunities to local people, employee benefits programs, ethical aspects of employee appointments, and gender diversity within the organisation.

Opportunities to obtain professional certification and annual funds to support employees' continuous professional development (CPD) training programs may motivate future employees towards SS. In order to ensure the SS of a project, the organisation must identify and engage a team that may deliver SS in a project, such as being capable of doing design quality and producing socially sensitive design that also protects the cultural heritage. The organisation must be willing to interact and engage with other stakeholders on SS implementation in projects. The timeliness and transparency of communication are key in addressing projects' SS (Kordi *et al.,* 2021).

Table 2: List of social sustainability main attributes, attributes, and indicators for the pre-construction phase

Main Attributes	Attributes	Indicators
Impact Assessment (IA)	User consideration	1. Plan to minimise disruption
	SIA	2. SIA documentation
Employment (E)	Job creation	3. Job opportunities
	Job stability	4. Full-time employment
		5. Turnover rate
	Professional ethics	6. Deviation from a gender-balanced labour force
		7. Process and documentation
		8. Policy on integrity
	Employee performance plan	9. Performance plan
	Employee social benefit program	10. Benefit program
Stakeholder Involvement (SI)	Stakeholder participation	11. Collaboration
	Team formation	12. Selection of team
Satisfaction (S)	Design Quality	13. Design quality survey
Quality Education (QE)	Education and training	14. Policy to obtain and maintain professional
		15. Annual fund for professional development
Social Procurement (SP)	Social procurement	16. Policy on engage with disadvantages group when tendering
Design protection / belonging (DP)	Cultural heritage	17. Collaboration
	Socially sensitive designs	18. Element of inclusive design in project life cycle
Human Rights (HR)	Human rights	19. Following the United Nations Global Compact principle and International Labour Law

Therefore, a policy requiring the involvement of the construction team with disadvantaged groups during the tendering process may be necessary in the social procurement process. The project must strictly follow the United Nations Global Compact principle and International Labour Law by abiding to all the stated principles. The consideration of SS indicators at the pre-construction phase acts as the basis for the incorporation of SS in the construction and post-construction phases.

As for the SS indicators in the construction phase, 14 indicators were placed under the Safety and Health category. During construction, the organisation needs to purchase healthcare security coverage for site-based employees, prepare proper welfare facilities, consideration of employees' wellbeing, safety plan and safety training. Organisation should also report any injuries or fatalities involving worker or public at the construction site, as well as having awareness on public safety and health. Respondents also articulated the importance of creating local employments among local communities, locally supplied material, and work-life balance at the operational levels.

Table 3: List of social sustainability main attributes, attributes, and indicators for the construction phase

Main Attributes	Attributes	Indicators
Safety and Health (SH)	Employees' health and well-being	1. Physical / medical check-ups
		2. Insurance plan
		3. Welfare facilities at construction sites
		4. Platform for sharing session
		5. Policy of well-being program
	Safety provisions at the workplace	6. Formal safety plan
		7. Occupational Safety and Health (OSH) training
		8. Reportable injuries involving worker
		9. Reportable fatal involving worker
	Public safety and health	10. Project progress
		11. Accessibility for public safety
		12. Safety and engagement session
		13. Reportable injuries involving public
		14. Reportable fatal involving public
Impact Assessment (IA)	User consideration	15. Precautionary notification
		16. Channels for complain
	SIA	17. SIA documentation
Employment (E)	Local employment	18. Workforce hired locally / foreign
	Local community	19. Involvement of local community
		20. Involvement of local supplied material
	Employee work-life balance	21. Practices
Satisfaction (S)	Public satisfaction	22. Channels for complain
		23. Numbering of complain
Quality Education (QE)	Education and training	24. Numbering professional license or certificate
		25. Hours for training

Table 4: List of social sustainability main attributes, attributes, and indicators for the post-construction phase

Main Attributes	Attributes	Indicators
Satisfaction (S)	End-user satisfaction	1. Channels for complain
		2. Timing for complaints resolved
Quality Education (QE)	Innovation	3. Management support on R&D
		4. Grant / incentive

User consideration, SIA, public satisfaction, and the opportunity for workers to obtain and maintain professional certification during construction were generally identified as key indicators in promoting SS in the construction project.

At the post-construction stage, the indicators of assessing satisfaction through feedback channels are required to assess public/end-user satisfaction to ensure timely resolving of complaints. To encourage research and development (R&D), organisation have to give support by providing initiatives, such as grants and incentives for knowledge transfer, training, and information sharing.

CONCLUSIONS

This article contributes to the current gap in knowledge by establishing the SS indicators associated with the project life cycle, namely, pre-construction, construction, and post-construction. Most of the identified indicators were at the construction stage as this stage involves the most numbers and types of stakeholders (design team, owner, engineers, supplier, authorities, society, site workers) through various encounters. Thus, the reason for the domination of SS indicators at the construction stage, as compared to the pre-construction and post-construction stage.

The establishment of specific SS indicators at every phase of a project life cycle encourages and improves the value, understanding and adoption of SS in construction, further inspiring construction stakeholders to build back wiser in achieving long-term effective and sustainable construction. This study highlights that the subjective criteria or nature of SS could be objectively addressed, thus providing a realistic and alternative approach for measuring and monitoring SS throughout the construction project life cycle that fits the needs of stakeholders in achieving sustainable construction.

A project's social projection should be systematically planned by producing comprehensive SIA report at the core of the planning and monitoring by Social Monitoring Report and Social Audit Report. Therefore, SS can be used to improve project safety and health, justice, wellbeing, productivity, and transparency while also considering the present and future needs. The findings presented here could be generalised, as the experts providing diverse perspectives come from various institutions and organisations. The current findings are significant because there were no previous study conducted on this, even within a particular organisation, group, profession, or country. Additionally, this research has provided various levels of information for diverse stakeholders, allowing for future interactive interpretations. Thus, these findings should be of interest to both practitioners and academic communities.

REFERENCES

Almahmoud, E and Doloi, H K (2015) Assessment of social sustainability in construction projects using social network analysis, *Facilities*, **33**(3-4), 152-176.

Andreas, G, Allen, J, Farley, L, Kao, J K and Mladenova, I (2011) *Towards the Development of a Rating System for Sustainable Infrastructure: A Checklist or a Decision-Making Tool?* Water Environment Federation, Availble from https://research.gsd.harvard.edu/zofnass/files/2013/05/COF-2010_5B_Georgoulias.pdf [Accessed 17th June 2022].

Dean, K, Trillo, C and Bichard, E (2017) Assessing the value of housing schemes through Sustainable Return on Investment: A path towards sustainability-led evaluations? *Sustainability*, **16**(3), 136-141.

Doloi, H (2018) Community-centric model for evaluating social value in projects, *Journal of Construction Engineering and Managemen*t, **144**(5), 04018019

Dong, Y H and Ng, S T (2016) A modelling framework to evaluate sustainability of building construction based on LCSA, *International Journal of Life Cycle Assessment*, **21**(4), 555-568.

Eizenberg, E and Jabareen, Y (2017) Social sustainability: A new conceptual framework, *Sustainability*, **9**(1).

Fowler, K M and Rauch, E M (2006) *Sustainable Building Rating Systems Summary, No. PNNL-15858*. Pacific Northwest National Lab (PNNL), Richland, WA, USA, 1-55.

Goel, A, Ganesh, L S and Kaur, A (2020) Social sustainability considerations in construction project feasibility study: A stakeholder salience perspective, *Engineering, Construction and Architectural Management*, **27**(7), 1429-1459.

Ho, A M Y, Lai, J H K and Chiu, B W Y (2021) Key performance indicators for holistic evaluation of building retrofits: Systematic literature review and focus group study, *Journal of Building Engineering*, **43**(March), 102926.

Karji, A, Namian, M and Tafazzoli, M (2020) Identifying the key barriers to promote sustainable construction in the United States: A principal component analysis, *Sustainability*, **12**(12).

Kordi, N E, Belayutham, S and Che Ibrahim, C K I (2021) Mapping of social sustainability attributes to stakeholders' involvement in construction project life cycle, *Construction Management and Economics*, **39**(6), 513-532.

Li, H, Zhang, X, Ng, S T, Skitmore, M and Dong, Y H (2018) Social sustainability indicators of public construction megaprojects in China, *Journal of Urban Planning and Development*, **144**(4), 04018034.

Loosemore, M and Reid, S (2019) The social procurement practices of tier-one construction contractors in Australia, *Construction Management and Economics*, **37**(4), 183-200.

Mulholland, C, Ejohwomu, O A and Chan, P W (2019) Spatial-temporal dynamics of social value: lessons learnt from two UK nuclear decommissioning case studies, *Journal of Cleaner Production*, **237**, 117677.

Nguyen, B K and Altan, H (2011) Comparative review of five sustainable rating systems, *Procedia Engineering*, **21**, 376-386.

Pocock, J, Steckler, C and Hanzalova, B (2016) Improving socially sustainable design and construction in developing countries, Procedia Engineering, **145**, 288-295.

Randeree, K and Ahmed, N (2018) The social imperative in sustainable urban development: The case of Masdar City in the United Arab Emirates, *Smart and Sustainable Built Environment*, **8**(2).

Rohman, M A, Doloi, H and Heywood, C A (2017) Success criteria of toll road projects from a community societal perspective, *Built Environment Project and Asset Management*, **7**(1), 32-44.

Rostamnezhad, M and Thaheem, M J (2022) Social sustainability in construction projects - a systematic review of sustainability social sustainability in construction projects - a systematic review of assessment indicators and taxonomy, *Sustainability,* **14**(9), 5279.

Saunders, B, Sim, J, Kingstone, T, Baker, S, Waterfield, J, Bartlam, B, Burroughs, H and Jinks, C (2018) Saturation in qualitative research: Exploring its conceptualisation and operationalisation, *Quality and Quantity*, **52**(4), 1893-1907.

Sodangi, M (2019) Social sustainability efficacy of construction projects in the pre-construction phase, *Proceedings of the Institution of Civil Engineers - Engineering Sustainability*, **172**(2), 57-67.

UN Global Compact (2000) *The Ten Principles of Global Compact*, New York: United Nations Global Compact.

Yeung, J F Y, Chan, A P C and Chan, D W M (2009) A computerized model for measuring and benchmarking the partnering performance of construction projects, *Automation in Construction*, **18**(8), 1099-1113.