

# SUSTAINABLE CONSTRUCTION PRACTICES OF SRI LANKAN CONTRACTORS

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## ABSTRACT

*Construction industry is conversely depleting of natural resources. It impacts on the environment, economy and society, not only during a project's life cycle but also for coming generations. Adhering sustainable principles in construction industry brings the sustainable construction which ensures better quality of life for everyone. The contractor as a key player in the construction industry has to play an imperative role to promote sustainable construction by minimising their negative impact on the environment and society while maximising their economic contribution. Thus, this research intended to examine current sustainable construction practices and issues of contracting organisations to suggest a framework which can be used for the ultimate delivery of sustainable construction in Sri Lanka. Case study research approach was used to collect data among contracting organisations and eight semi-structured interviews were conducted. Four industry expert interviews were conducted to verify the gathered opinions and suggestions on enhancements of sustainable construction practices of contracting organisations. Cross-case analysis was used to analyse multiple cases using code based content analysis technique. Findings revealed that the organisations were at primary stage in sustainable construction practices, namely legal framework, standards, guidelines or policies, design, procurement, technologies, processes and innovations, organisational structure and people, education and training, measurements and reporting.*

**Keywords:** Construction Industry; Contracting Organisations; Sri Lanka; Sustainable Construction; Sustainable Practices.

## 1. INTRODUCTION

The sustainable development includes three broad components; social, environmental and economic (Khalfan, 2002; Persson, 2009) often known as the 'triple bottom line', which brings environmental responsibility, social awareness and economic profitability objectives to the fore in the built environment and facilities for the wider community (Ali and Nsairat, 2009). Previous studies on sustainable materials (Emmanuel, 2004; Mora, 2007) and sustainable indicators (Ugwu and Haupt, 2007) emphasise the importance of national approach which unique to each country to deliver sustainability in their construction industry. Therefore, it is an inevitable need in the Sri Lankan construction industry to grant sustainability with the collaboration of all stakeholders. The contractor as a key player in the construction industry has to play a significant role in promoting sustainability in construction by minimising their negative impact on the environment and society while maximising their economic contribution (Tan *et al.*, 2011).

Accordingly, this study was to examine the current sustainable construction practices of contracting organization and their issues in order to suggest actions which can be taken into the enhancement of sustainable construction practices of contracting organisations to attain sustainable construction in Sri Lanka.

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## 2. LITERATURE REVIEW

### 2.1. SUSTAINABLE CONSTRUCTION PRACTICES

The first definition of sustainable construction was proposed by Charles Kibert during the first International Conference on Sustainable Construction in Tampa, 1994; “*sustainable construction is the creation and responsible management of a healthy built environment based on resource efficient and ecological principles*” (Kibert cited in Murray and Cotgrave, 2007, p.13). Later Plessis came up with a straightforward definition on sustainable construction in 2002 in the discussion document of Agenda 21 for Sustainable Construction in Developing Countries by compelling entirety sustainability image as; “*sustainable construction is a holistic process aiming to restore and maintain harmony between the natural and built environments, and create settlements that affirm human dignity and encourage economic equity*” (Plessis, 2002, p.8). Thus, this definition takes sustainability further than just reducing pessimistic impact, as implied in the earlier definitions, by introducing the idea of restoring the environment.

It may be perceived as a long term exercise carried out by various parties/industries to achieve a sustainable development within the parameters of economic, social and environmental cornerstones. Thus, construction industry, which traditionally focused on time, cost, and quality was shifted into the new paradigm by focusing economic, environmental and social aspects. Such construction would bring environmental responsibility, social awareness, and economic profitability to the fore in the built environment and facilities for the wider community. Sustainability in construction offers first-rate response to the present environmental and socio-economic problems as it is an application of the principles of sustainable development to the comprehensive construction cycle from the extraction of raw materials, through the planning, design and construction of buildings and infrastructure, until their final deconstruction and management of the resultant waste (Yunus and Yang, 2011). The main challenge for the industry is to play an integral part in reducing the impacts of its activities on the environment and local communities. Hence, Owners/Developers who play an important role in developing and financing construction projects for implementation of sustainable construction (Gan *et al.*, 2015), Architects/Engineers who are involved in designing sustainable infrastructures, Contractors as builders of the construction projects, have to take leadership in such transformation.

Tan *et al.* (2011) stated that contractors have to play significant role in promoting sustainable development within the context of the construction industry by assuming the responsibility to mitigate their negative impact on the environment and society while maximise their economic contribution which gives multiple benefits to contractors by implementing sustainable practices. Sustainability makes good business sense because it is increasing importance to the efficient, effective and responsible operation of business while such sustainable business practices in construction organisations give competitive advantage to their organisations (Ebner and Baumgartner, 2006). Thus, focus on sustainable construction practices of contracting organisations, where contractors play their role immensely, is very important to bring sustainability in the construction industry as it ultimately contributes to sustainable development in globally.

Table 1 summarized the previous studies which can be rehearsed to contribute sustainable development in the construction industry.

Table 1: Sustainable Construction Practices of Contracting Organisation

Sustainable practices	Principles
<b>Sustainable legal framework</b>	Organisation can comply with the legal frame work of the country which leads to sustainable construction, including the environmental requirement and social responsibility, to improve economic advancement (Pitt <i>et al.</i> , 2009; Tan <i>et al.</i> , 2011).
<b>Sustainable construction standards, guideline or policies</b>	Organisation can proceed with establishing or their own sustainable standards, guideline or policies to minimising environmental, economic and social risk associated with construction practices (Krigsvoll <i>et al.</i> , 2010).

<b>Sustainable design</b>	Organisation can improve the project's whole life value through green design and ensure the buildability with efficient use of resources, sustainable materials, minimum wastage, resilient, adaptable and attractive (Tan <i>et al.</i> , 2011; Akadiri <i>et al.</i> , 2013).
<b>Sustainable procurement</b>	Organisation can promote green supply chain throughout the project life cycle to ensure the sustainability (Vanegas <i>et al.</i> , 1996; Tan <i>et al.</i> , 2011; Shaharudin and Ismail, 2015).
<b>Sustainable technologies, processes and innovations</b>	Organisation can increase the sustainability of both the construction process and its resultant assets via sustainable technologies, processes and innovations which includes lean principles (Tan <i>et al.</i> , 2011; Booth <i>et al.</i> , 2012; Liang <i>et al.</i> , 2014; Salifu-Asubay and Mensah, 2015).
<b>People and organisational structure</b>	Organisation can arrange the organisation and project structure to facilitate the implementation of sustainable policy and strategy and increase in organisations awareness and committing sustainable construction (Tan <i>et al.</i> , 2011; Liang <i>et al.</i> , 2014).
<b>Sustainable education and training</b>	Organisation can increase organisation's commitment to sustainable construction through better education and training of every staff in the organisation or project (Tan <i>et al.</i> , 2011; Liang <i>et al.</i> , 2014).
<b>Sustainable measurement and reporting</b>	Organisation can have measurement and reporting system or use existing benchmarks to evaluate environmental, economic and social performance and identify the areas to be improved (Persson, 2009; Pitt <i>et al.</i> , 2009; Tan <i>et al.</i> , 2011; Liang <i>et al.</i> , 2014).

## 2.2. SUSTAINABLE CONSTRUCTION IN SRI LANKA

Sri Lankan history shows how our forefathers built great cities, irrigation systems and religious monuments that coexisted with nature and yet provided a sustainable economy and lifestyle to the citizens (GBCSL, 2010). However, Sri Lanka suffers from not only the environmental but also economic and social issues due to unsustainable development happened during past decades and happening currently. This timely requirement has been identified, revealed and has acknowledged distinctive sustainable approach to meet its sustainable desires. The Ministry of Environment and Natural Resources (MENR) in Sri Lanka had put a step forward to contribute to sustainable development in Sri Lankan context by introducing a guideline. MENR (2007) declared that the guideline for establishing National Sustainable Development Strategies (NSDS) stated that NSDS is not just a document, but also a country based and country owned system. Further, Green Building Council established in 2010 as one of the humble steps to take our society to that glorious past which people are still proud of as Sri Lankans. In addition, Tsunami reconstruction projects were in line with after the Tsunami Sustainable Building Guideline for South-East Asia, which provides numerous environmental, safety and financial benefits through sustainable reconstruction management guideline (UNEP, 2007). There are few building projects which were recorded in the industry as sustainable buildings, for instance Kandalama Hotel which is one of the first Leadership in Energy and Environmental Design (LEED) Bronze rated hotels in the world (rated in year 2000), MAS Intimates Thurulie - Clothing Factory in Sri Lanka which is the first LEED Platinum rate newly built manufacturing factory in the world. Even though such preliminary steps were taken still there are gaps in sustainable construction practices to attain environmental, (The Sunday leader, 2014) economic and social sustainability in Sri Lanka. Studies of Abeysundara *et al.* (2009) identified that significant environmental impact in the Sri Lankan context due to unsustainable development as nutrient enrichment, acidification and global warming, while most of the impact on society and economy were silent in several studies.

## 3. RESEARCH METHODOLOGY

Under qualitative case study research approach, three contracting organizations were selected (refer Table 2) to appraise the current sustainable construction practices and issues of the contracting organisation in Sri Lanka. An organisation was selected as the unit of analysis among C1 grading contracting

organisations that have been engaged in sustainable development up to a certain level in the Sri Lankan construction industry as they are mega scale contractors who are representing the voice of construction sector in Sri Lanka. Eight semi-structured interviews were conducted (refer Table 2) within the case studies by considering ‘individuals’ as a unit of data collection. Individuals who have experience in sustainable construction have taken part in those semi-structured interviews and were conducted using interview guideline and tape-recorded (with permission of the interviewee) to secure an accurate account of the conversations and avoid losing data since everything cannot be written down during the interview. Those semi-structured interviews enable sufficient flexibility to approach different respondents, covering the same areas of data collection while enable to adapt the questions necessary, clarify doubts and ensure that the response is properly understood by repeating and rephrasing the questions. Ultimately, interview transcripts were developed to generate a sensible adaptation of interviewed data.

Since the research contained three case studies, during the analysis, broad themes and patterns were looked for, rather than narrow, precisely variables of qualitative research. Cross-case analysis was used as it is the most preferable method of analysing multiple cases (Yin, 2009). Code based content analysis was used to analysis large set of gathered data in the simplest way as it produced a uniform schema of categories (Flick, 2006), which facilitates comparison of different cases. The each individual case was analysed based on the main themes, namely; sustainable construction practices of contracting organisations and issues in order to identify actions which can be taken into enhancement of sustainable construction practices of contracting organisations to attain sustainable construction in Sri Lanka.

Table 2: Profile of the Case Interviews

Cases	Type of construction	Agent	Designation
Case A	Buildings, Roads, Infrastructures, Batching plants and quarries	A1	Head of HR/ Team Leader of Sustainability Committee
		A2	Engineer Progress Monitoring
		A3	Project Manager
Case B	Buildings, Roads, Infrastructures, Batching plants and quarries	B1	Director Engineering
		B 2	Project Coordinator
		B3	Director / Sustainability reporter
Case C	Buildings and Roads	C1	Project Manager
		C2	Engineer Design

In addition to that four interviews were conducted with industry experts who engaged in the development of sustainable construction in order to verify and gather opinions and suggestions on enhancements of sustainable construction practices of contracting organisation as illustrated in Table 3. Interviewees represented environmentalist, sustainability consultant, contractor/builder, designer, engineer, project manager. These high-ranked participants influenced a wealth of experience in varied of construction projects such as factories, roads and highways, buildings. On an average, the recorded open-minded interviews lasted for one and half hours each and were conducted.

Table 3: Profile of the Expert Interviews

Designation of expert	Agent	Sector	Experience on sustainable
Advisor	E1	Government sector	Have experience more than 5 years in sustainable construction
Senior lecturer	E2	Government sector	
Managing Director	E3	Private sector	
Managing Director	E4	Private sector	

Accordingly, next section discusses the findings of the research study.

## **4. RESEARCH FINDINGS AND DISCUSSION**

### **4.1. CURRENT PRACTICES OF CONTRACTING ON SUSTAINABLE CONSTRUCTION**

Findings reveal that organisations are at the primary stage of adopting sustainable practices. Contracting organisations are currently observed and strictly enforced the law of the country because of its significant impacts of construction activities on society and the environment (Tan *et al.*, 2011). Similarly, in Sri Lanka, contractors are enforced to comply with the legal framework which ensures sustainable construction, unlikely not in the form of sustainable practices. The research study of Krigsvoll *et al.*, (2010) revealed sustainability in construction has a short developing history in terms of guidelines, standardisations and policy making in world content. It can be a one of the reasons to have very few organisations who practicing inbuilt sustainable policies within their organisations. Ding (2008) revealed that sustainable design is a best practice to have at the very earliest project stages and this involves not just considering what is being built, but how it is being built, with which products and methods and which functions the project will perform or facilitate, once completed. Thus, as the current demand for sustainable design from all stakeholders is very important to have sustainable construction. However, unlikely in other countries, Sri Lankan demand for sustainable construction is very poor.

Not likely in developed countries, there is no proper organisational or institutional procedure for green supply chain, in Sri Lanka, where materials and equipment are supplied in a green manner (Vanegas *et al.*, 1996). As sustainability is a key concept in the world, Booth *et al.* (2012) stated that the contracting organisations have increased their organisational capacity in terms of technologies, processes and innovations towards sustainable construction by identifying their vital responsibility. Anyhow contracting organisations in Sri Lanka, rarely follow when only client's demand. Tan *et al.* (2011) further explored the importance of having awareness of sustainable construction within the people and top management at contracting organisations to the positive contribution from contracting organisations towards sustainable construction. However, there is no sufficient awareness in Sri Lanka about sustainable construction which ultimately cause to no proper education and training on sustainable construction to employees in all levels unlikely in global content. Further, without necessary skill sets, construction will be ill-equipped to meet the challenge of the sustainable construction agenda. As a result, although there are several sustainable measurements and reporting tools available which critical to the development of corporate sustainability and to help organisations to manage towards sustainability, Sri Lankan practices on sustainable measurements and reporting at infancy level.

### **4.2. ISSUES ON SUSTAINABLE CONSTRUCTION PRACTICES OF CONTRACTING ORGANISATIONS**

Issues in existing sustainable construction practices of selected contracting organisations were discussed in this section to enhance the current sustainable construction practices of contracting organisations. Five major issues were identified as below via the case studies, namely; Legal framework and enforcement, Institutional intervention and coordination, Commitment of the people, Cost Factor, Education and Experience.

The study of Abeynayake (2010) revealed that the Sri Lankan legal system has sufficient provisions to protect the environment as well as a good system procedure for physical planning. However, empirical investigations stated that there are several gaps in the legal system in Sri Lanka as it is not identified real concept of sustainable construction. Although there are provisions within the legal framework in Sri Lanka to accomplish environment sustainability, there are less provisions for economic and social aspects. However, outdated Acts and Ordinances are still governed by law without necessary amendments to suit sustainable construction. Furthermore, there is an immense problem with enforcement of the legal provisions which leads to sustainable construction due to political issues and the less awareness of the stakeholders. It indicates the levels of legal enforcements are varied from project to project.

There were several issues in the institutional intervention and the coordination of sustainable construction practices in Sri Lanka. Although, there were published national strategies for sustainable development, there are no any published national strategies which focus on the construction industry. At the same time

there is neither national platform nor coordination committee to promote sustainable construction while even no coordination between organisations, government or the research and development units in Sri Lanka. There are very few social responsible organisations to take leadership to promote sustainable construction for an example Green Building Council and the Sustainable Energy Authority and they are started recently. Thus, current institutional intervention, even in the government level is fairly less and as a result of that, there is no any agenda or the setup to follow the contractors or other stakeholders.

The reasonable commitment of the stakeholders in the construction industry is an essential element in promoting sustainable construction. Empirical records showed that there are issues with the commitment of the people due to lack of aware of the significance of sustainable practices due to problem in their attitudes. Finding revealed that the client's demand is not sufficient and demand for the sustainable project should arise from the client side rather than conventional. The pointing figure is another problem as many stakeholders believe that the role of 'promoting' and 'encouraging' sustainable practices falls on other shoulders as well such as designers, consultants, contractors or the Government.

Cost of implementation of sustainable technologies is ridiculous. Thus, sustainable construction practices are believed to increase project cost as they need to have higher capital upfront. When the client does not demand the sustainable project, the contractor is not welcome in the sustainable construction as he is losing in the competitive bidding. The cost of sustainable approaches which are costly than the other conventional techniques (new technologies BIM, training cost) has to bear by the contractor which helps to minimise the impact to the environment.

Empirical data highlighted that there are many players in the construction industry and mostly are not professionally qualified. The implementation of sustainable construction practices can be improved if various construction players, including Engineers, Architect and Quantity Surveyors play their role in advising the developers on the merits of pursuing sustainable practices. If the consultants can come up with a good design within the project budget that can sustain the environment and give a good business return, then the developers will be inclined to accept the proposal. At the same time there is quite few educated and experienced construction professionals in sustainable construction and most of the employees are neither have the education nor experience on sustainable construction and even they are not looking to continuous development as requires in the industry time to time.

Achieving sustainability goals depends on how well these issues are well handled. Accordingly, next section discusses the suggestions which can be used to identify issues in current practices.

#### **4.3. SUGGESTIONS TO OVERCOME ISSUES IN SUSTAINABLE CONSTRUCTION PRACTICES OF CONTRACTING ORGANISATIONS**

There were several attributes highlighted through the literature synthesis and expert interviews which would be better to suggest for improvement of sustainable construction practices of the contracting organisation for the ultimate delivery of sustainable construction industry in Sri Lanka. The study emphasises the delivery, sustainability in the construction industry is a long term process which needs to address with the support of all stakeholders.

It is an essential to have an effective legal framework which ensures the sustainable construction within the country. Accordingly, the government has to directly intervene to the development of sustainable construction practices in the construction industry. Further, the studies of Majdalani *et al.* (2006) stated that the legislative body has an important role to play in preparing the necessary legal infrastructure to protect the interest of all parties and to prompt a wider adaptation of sustainable construction practices. This can only be achieved if the government takes a leadership role in this regard. However, all the stakeholders should participate and try to balance the long term benefits with the short-term resources. Accordingly, all the parties should abide these legislations and regulations by looking at the macro scale level of the industry and try to establish best practices that serve current and future interests of all. Both government and private sector contractors can be motivated by introducing intensives, low taxes, low interest rates, discounts for materials, for adhering of sustainable principles. Thus, responsible institutions must involve in helping the government to shape the construction industry.

Institutional intervention and coordination have heavily contributed to sustainable construction and can play a key role within the industry, it is needed to take leadership by responsible institutions and put step forward to promote sustainable construction via proper agenda by introducing , sustainable design criteria, Eco labelled materials, green supply chain, lean concepts, benchmarking, sustainable assessment and sustainable consulting. It requires to enhance research and development which brings sustainable technologies, processes and innovations. Thus, having proper coordination and collaboration among academic and technical institutions will speed up the achieving sustainable desire.

Stakeholders' awareness of the sustainable construction can improve via media as it assists in direct communication to the people while the awareness level of the employees enhance by giving awareness programme in each level of the employees with practical scenarios. Moreover, Pitt *et al.* (2008) revealed that this is crucial if sustainable practices are to be adopted over and above the requirements of building regulations. Thus, client's knowledge and awareness on sustainable construction is particularly important as they are the principal stakeholder in determining and committing sustainable construction practice.

The cost factor as far more highlighted issue within sustainable construction practices, findings avowed that to compete with this high cost associated with sustainable construction, it needs to well aware of these concepts by all the stakeholders in the construction industry. Further, it needs to change the mind-set of the people to think of the whole life cycle cost than current benefit. As the cost factor negatively, strongly affect to the sustainable construction, it can be managed by introducing evaluation criteria which gives high credits to sustainable contractors in the selection process of the contractors. It creates that the contractors naturally tend to practice sustainable construction where the cost of it is shared by the client.

Not only construction professionals, entire people need to have knowledge and awareness on sustainable construction practices from their childhood and should have a proper agenda to share the knowledge on sustainable construction within the organisations. Further, best solution for that is to cross training among the employees. It will be benefited to share the one's experience and the knowledge among many others. Therefore, empirical investigation, specially identified significant of having experience employees who positively contribute to sustainable development in the construction industry and rehearsing innovative technologies like BIM where all the stakeholders working on same platform and talk same langue which minimise construction waste, increase build ability and achieve stakeholder interest (Wu and Zhou, 2014).

Accordingly, sustainability in the Sri Lankan construction industry can be delivered effectively via contracting organisations by adopting and focusing following developed conceptual framework (refer Figure 1) namely; Legal framework, Standards, guidelines, Design, Procurement, Education and training, Measurement and reporting, People and organization structure, Technologies, process and innovation.

## 5. CONCLUSION

The impact caused by construction activities heavily affect to our environment, society and the economy. Thus, there is a big responsibility within all stakeholders in the construction industry to take part of this challenge, including contractors as a key player in the construction industry. Studies revealed that contracting organisations were at the primary stage of adopting sustainable construction practices such as Legal framework, Standards, guidelines, Design, Procurement, Education and training, Measurement and reporting, People and organization structure, Technologies, process and innovation.

Legal framework and enforcement, institutional intervention, commitment of the people, cost factor and education and experience, were identified as key issues in an existing sustainable construction practices of contracting organisation. Therefore, several aspects were captured through experts' opinions and literature synthesis which would be guided for better enhancement of sustainable construction practices of contracting organization in Sri Lanka.

Thus, it is required to rehearse identified sustainable construction practices and adopt made suggestions in the Figure 1, rather it becomes as future menace. Consequently, this research contributes on sustainable construction practices of contacting organisations related to the construction industry openings and broader view on the current practices and issues and suggestions to overcome. In such situation, all the stakeholders in the construction industry have great responsibility to contribute and make this into a

competitive advantage in future by furnishing awareness to implement or the enhancement of sustainable practices.

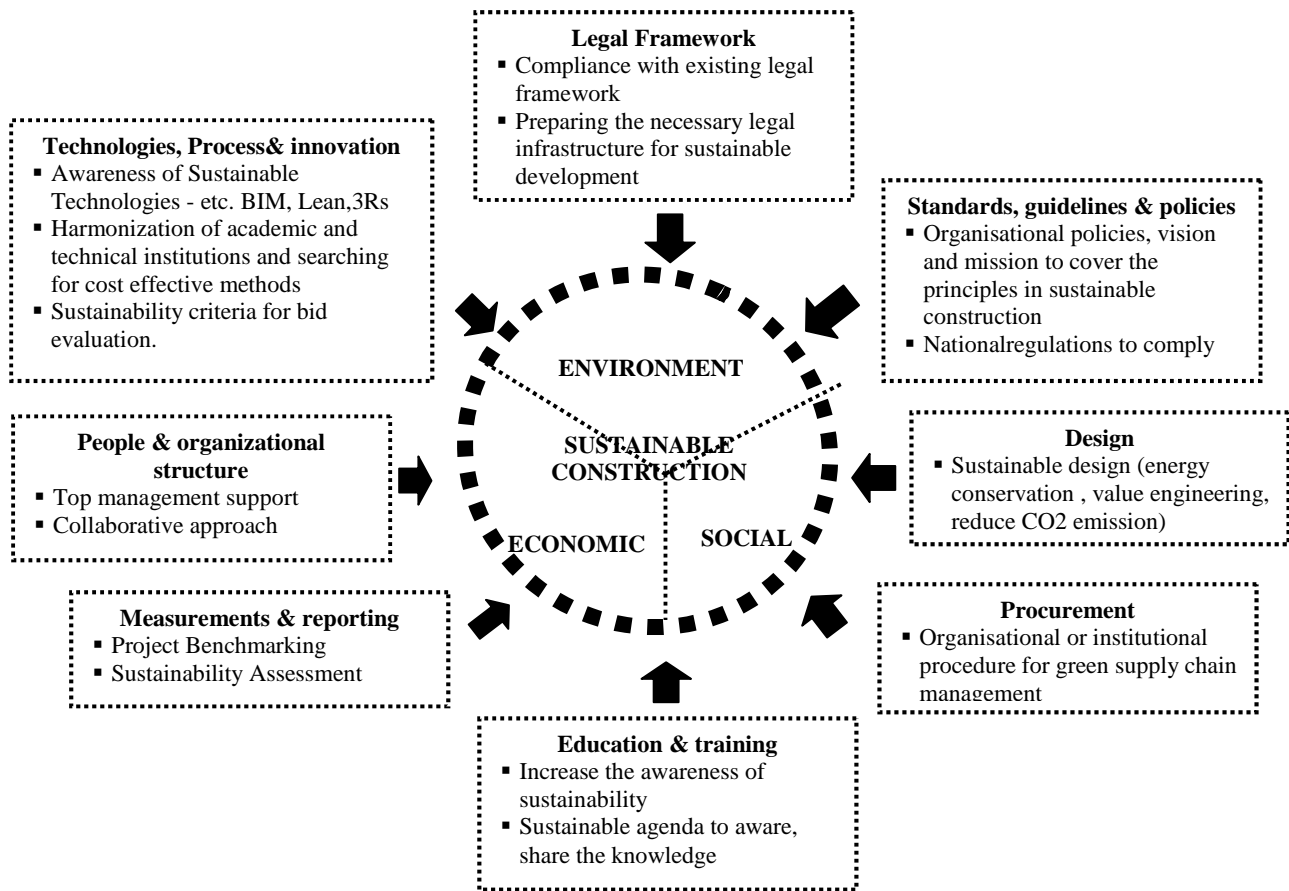


Figure 1: Developed Conceptual Framework

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