Understanding the Need of Project Stakeholders for Improving Sustainability Outcomes in Infrastructure Projects

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Abstract

In today’s competitive construction market, sustainability is often used as a catchword as well as a watchword. Compared to other sectors, research found that little systematic work on the implementation of sustainability agenda has been done in the infrastructure industry. The lack of common understanding among various stakeholders in infrastructure projects is generally perceived to be the primary cause. Opportunistically, the application of sustainable principles in overall infrastructure development and related businesses is surely an advantaged differentiator in the market. More importantly, it also brings about social and environmental benefits. To do so, however, the different levels and types of interests and the needs of various project stakeholders in the infrastructure projects must be looked into and understood. This paper reports the preliminary findings of an on-going project which is being carried out in the Queensland University of Technology (QUT) in Brisbane, Australia. The research was to identify and integrate the different perceptions and priority needs of the stakeholders, along with identifying issues that impact on achieving sustainability objectives, in order to develop integrated decision-making guidelines for improving sustainability outcomes in infrastructure projects. As an integral part of the research, interviews on the definitions of sustainability and project expectations have been carried out with a group of senior infrastructure project stakeholders in the Australian infrastructure industry. The paper discusses the research processes and results to date of this study and provides an insight on how infrastructure sustainability is perceived by the stakeholders and suggestions of ways to improving the sustainability understanding within the industry.

Keywords:
Sustainable development, infrastructure, construction management, project delivery, performance improvement.

1.0 Introduction

Being the key element to drive a nation’s economy and advance its civilization, continued infrastructure development is indispensable. Sound, well-functioning infrastructure in a country is essential for its economic growth, international competitiveness, public health and overall quality of life \([1]\). On the other hand however, the manufacture of their components and the processes and scales of their construction have caused environmental concerns.

Forced by the impact of worsening climate change and depletion of resources, the issue of sustainable development has become more pressing and will continues to dominate development agenda world-wide. Given that infrastructure development accounts for large
consumption of resources and the huge emission of green house gas, it has a significant share on impacts to the environment. Consequently, the task and challenge lies in provisioning infrastructures should not only be economically viable, but also socially and environmentally accountable.

Though the concept of sustainable development as well as associated principles and management rules are increasingly acknowledged by construction industry, their actual application at project level is not substantially tangible [2]. The grandeur of sustainability promises during project conceptualisation is not always delivered in real-life projects through the development and implementation at subsequent stages. Previous literature studies have identified that fragmentation in the industry, lack of common understanding among stakeholders on what constitutes sustainability and different vantage points are part of the factors (Figure 1). Different companies have described different individual and organisational perceptions and definitions of sustainability [3]. Understandably, they are prompted by their own concerns, priorities and interests, resulting different expectations during project delivery. Worst still, it is beset with adversarial culture [4]. In the absence of common understanding among these stakeholders, achieving sustainability outcomes becomes a formidable task.

![Figure 1: Sustainability Focus-Reality Mismatch in Infrastructure Development](image)

The above phenomenon calls for the need to establish new approaches that are able to integrate and synthesize all the dimensions and different point of views for the holistic consideration by various stakeholders in developing sustainable infrastructure project. This can be achieved based on the common understanding by various stakeholders, with individual viewpoints shared, understood and mutual benefits supported.

### 2.0 Infrastructure Project Stakeholders

Infrastructure is commonly known as a high profile sector since it involves multiple stakeholders and has great impact to its surroundings. In general, stakeholders are individuals or organizations that are either affected by or affect the development of the project; and therefore, capturing their input is a crucial component of the project development process [5].

In a broader picture, infrastructure is often discussed in the context of the role and influence it has on public development, community and social issues [6]. Typically, there are numerous issues involved in the infrastructure development process such as planning, providing essential
services to the public and compulsory access to land during construction. For these reasons, governments have the right to provide these services, need to exercise their powers to provide the necessary land and access, and have the responsibility to ensure that they are provided at an acceptable quality and at a reasonable cost to all citizens [7]. Therefore traditionally, government is seen as the primary stakeholder directly involved in the infrastructure development, with others seen as secondary stakeholders.

However, different stakeholders have different levels and types of investment and interest in construction projects and can be seen as multiple clients or customers for the project in which they are involved [8]. Failing to acknowledge such dynamic, especially in an infrastructure project that involves various parties with vested interest would potentially jeopardize the project objectives and its smooth implementation. Successful completion of construction projects is therefore dependent on meeting the expectation of stakeholders [9].

Project stakeholders are groups or individuals who have stake in, or expectation of, the project’s performance and include clients, project managers, designers, subcontractors, suppliers, funding bodies, users and the community at large [8]. They are interdependent and in one way or another affect each other when undertaking a project. Nevertheless, their interdependence varies according to different development phases over the life of a project. Similarly, the interests of stakeholders also vary accordingly.

El-Gohany et al. [5] modeled actors of infrastructure projects as stakeholders, consultants, advisors, or program staff. He further categorized stakeholders as follows:

- **Responsible Stakeholder** refers to an organization or individual who has some degree of responsibility or liability with regard to the development process;
- **An Impacted Stakeholder** refers to an organization or individual who is directly or indirectly affected by the development process; and
- **An Interested Stakeholder** refers to an organization or individual who is not directly impacted by the project, but who would like to participate and provide his opinion in the infrastructure development process.

Morris [10] pointed out that it is important for the project’s objectives mesh with its “stakeholders‘”, and that they continue to fit stakeholders’ interests as the project evolves, conditions change and the interdependencies of key systems, stakeholders and their objectives change. Experience has shown that a positive involvement with stakeholders can be a decisive factor that can ‘make or break’ a project [5]. In the case of sustainable infrastructure development, therefore, understanding stakeholders’ need and identifying their concerns on sustainability issues and integrates them into the design and delivery of a project becomes crucial.

To achieve a collaborative sustainable infrastructure project development that typically involves a multiple parties, it is important to gauge the stakeholders’ opinion, concerns and interest in this regard to better facilitate the delivery of the project that will meet the sustainability objectives, and at the same time, satisfying the needs of those stakeholders.

### 3.0 Evolving Nature of Sustainability Development

The concept of sustainable development is the result of the growing awareness of the global links between mounting environmental problems, socio-economic issues to do with poverty and inequality and concerns about a healthy future for humanity [11]. According to Sage [12], it refers to the fulfillment of human needs through simultaneous socio-economic and
technological progress and conservation of the earth’s natural systems. The fundamental driver is that all parties agree that there is a need to change for better. However, as to ‘how to change’ and ‘what needs to change’ remain open for interpretation and rooms for debates thus far.

Accordingly, it is widely acknowledged that sustainability is a vague, uncertain and polymorphous concept [13]. To different people, sustainability could mean differently [14]. In a survey, when asked to provide definition of sustainability, the participating companies have described different individual and organizational perceptions and definitions of sustainability [3]. On the other hand, the question whether social, economic and environmental concerns have to be treated equally and simultaneously or whether protecting natural life support systems is of utmost importance and thus, environmental dimension of sustainability dominates the others, is still controversially discussed [15]. Yet, others suggest sustainability could mean anything that is being encapsulated in the equation of ‘n Bottom Line’. Above all, whatever scenario it might present itself, the emphasis should be on implementing a process which seeks to achieve consensus among interested parties on which principles are more, and which are less, important to be applied in an infrastructure project.

Despite on-going debates, the universally accepted set of principles of sustainable development is named the Triple Bottom Line (TBL) that includes broad components; social, environmental and economic aspects of sustainability. This international set of sustainability metrics is often used to gauge the success of a particular development project [16]. It is treated as a basic start-point for sustainability initiatives.

4. Sustainable Infrastructure Development

Premised on the understanding that sustainable construction can be construed as a construction process which incorporates the basic themes of sustainable development [12] [14] [17], sustainable infrastructure simply means the application of basic sustainable principles into infrastructure development process. In other words, an infrastructure is sustainable when it responses to the conventional environmental challenges of depletion of resources, addresses social and cultural needs and practices, as well as generating economic empowerment.

To better understand how an infrastructure project relates to the sustainability principles, Sahely [18] argued that the first crucial step in this process includes definition of overall goals, system boundaries and sustainability criteria and indicators. Indicators are useful for monitoring and measuring the state of the environment by considering a manageable number of variables or characteristics [19]. On the other hand, a sustainability criterion is the yardstick against which a sustainability indicator is measured.

Based on TBL, Sahely et al. [18] proposed set of criteria and generic sub-criteria for sustainable infrastructure systems, with an addition of engineering criteria that pertinent to infrastructure project development. However, Engineers Australia [20] contends that an infrastructure is sustainable if it meets the following sustainability criteria:

i) Environment sustainability – reducing greenhouse emissions, lowering pollutant levels in storm water and effluent discharge into rivers and oceans. Resources are limited and need to be managed through conservation, reuse and renewable strategies;
ii) Social sustainability – reducing commuter times, increasing road safety, improving air quality and providing access to broadband communication to all citizens.
iii) Economic sustainability – ensuring that taxation and regulatory systems promote new private sector investment in all infrastructure capable of generating adequate returns of investment.

In a recent research of identifying Key Performance Indicators (KPI) for infrastructure in South Africa construction industry, Ugwu and Haupt [21] have developed a comprehensive list of key sustainability items and its indicators. These constructs incorporate the internationally accepted TBL metrics, and as suggested by the industry, it also draws in other performance-based indicators such as health and safety, resource utilization and aspects related to project management.

Proper understanding of infrastructure development phases is equally important, ranging from conception to construction and finally disposal. If an infrastructure project were to be sustainable, every phase of its development must be guided by the principles of sustainable development (Figure 2).

**Figure 2: Conceptual Framework of Developing Sustainable Infrastructure Project**

In this respect, close monitoring of these processes and checking them against sustainable principles during project implementation is required in order to ensure and enhance sustainability outcomes in infrastructure development. To do so, however, the different levels and types of interests and needs of various project stakeholders in the infrastructure projects must be looked into and understood before hand. While the above research initiatives provide a good basis for establishing infrastructure sustainability criteria and indicators, they do not probe...
into understanding the various needs of the stakeholders which is fundamental to improving sustainability outcomes in infrastructure projects.

5.0 An Australian Research

A research project aimed at identifying and integrating the different perceptions and priority needs of the stakeholders, along with identifying issues that impact on achieving sustainability objectives in infrastructure projects is being undertaken at QUT. The on-going project employs a combination of face-to-face interviews with industry professionals, Delphi study among experienced practitioners and academics, and case study techniques to collect expert opinions as well as real-life project information. The final outcome is expected to include a set of integrated decision-making guidelines for improving sustainability outcomes in infrastructure projects.

As an leading but integral part of the research, face-to-face interviews have been carried out with a group of 20 senior and high-ranking infrastructure project stakeholders in the Queensland infrastructure industry in Australia. Due to the recent resource boom and interstate migration, the state of Queensland is under significant pressure to upgrade and further develop many segments of infrastructure. The interviewees represented government departments, financier/bank, environmentalist, community consultant, contractor/builder, designer, engineer, project manager, town planner and cultural heritage expert. Collectively, these high-ranking professionals possess a wealth of experience in diverse range of infrastructure projects such as roads and highways, rails, ports, airport and dam, both domestic and in overseas. On an average, the recorded open-minded interviews lasted 1½ hours each and were conducted over a two month period from November 2007 to January 2008.

6.0 Preliminary Analysis of Research Data

The discussion here is limited to two examples of findings in the above mentioned interviews. The first is about infrastructure stakeholders’ perspectives on sustainability. The second is about what drives them in pursuing sustainability agenda in their infrastructure projects.

A) Infrastructure Stakeholders’ Perspectives on Sustainability

The stakeholders provided the following remarks when they were asked to comment on what constitutes sustainability according to their respective profession and organization:

<table>
<thead>
<tr>
<th>STAKEHOLDER</th>
<th>MAJOR REMARKS</th>
<th>SUSTAINABILITY PRIORITY</th>
</tr>
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<tbody>
<tr>
<td>GOVERNMENT DEPARTMENTS</td>
<td>“...it achieves our policy objectives which are no cost and no risks to government, the industry created promotes growth under their own stem within a community that is able to sustain the development; and make money out of it by leasing and selling of the land. There is also political element to it. If the projects don’t stake up there will be political as well as financial embarrassment.”</td>
<td>Economic/ Finance, Political &amp; Institutional, Environment, Community, Social, Cultural, Health &amp; Safety, Public &amp; Community Expectation.</td>
</tr>
<tr>
<td></td>
<td>“Balance between economic and green sustainability. They can’t be dealt with in isolation.”</td>
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<td></td>
<td>“… the construction performance has minimal impact on”</td>
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<tr>
<td>Role</td>
<td>Quote</td>
<td>Disciplines</td>
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<tr>
<td>FINANCIER/BANK</td>
<td>&quot;...it achieves economic and financial objectives set and at the same time, it achieves environmental objectives established.&quot; &quot;It is economic and environmental sustainability. Some people use financial viability instead of sustainability. Financial sustainability means a project with its own cash flow such as toll road.&quot;</td>
<td>Economic/Finance, Political &amp; Institutional.</td>
</tr>
<tr>
<td>ENVIRONMENTALIST</td>
<td>&quot;Sustainability is a state that can be maintained at a certain level indefinitely. In environmental usage, it refers to the longevity of vital human ecological support systems, such as the planet's climatic system, systems of agriculture, industry, forestry, fisheries, and human communities. To me, it's about effective and efficient use of resources and to leave enough resources for future generation - the concept of intergenerational equity.&quot;</td>
<td>Environment, Community, Health &amp; Safety, Resource Utilization &amp; Management, Community.</td>
</tr>
<tr>
<td>COMMUNITY</td>
<td>&quot;It’s about maintaining the current situation but I would like to see some enhancing as well whether it has to do with environment, community and social aspect of sustainability. From communication point of view – ensuring community can survive. Not destroying our environment, maintaining habitat and all the environmental component of it.&quot;</td>
<td>Community, Environment, Social, Cultural, Health &amp; Safety.</td>
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<tr>
<td>CONTRACTOR</td>
<td>&quot;Sustainability is the same as making profits. Sustainability is sustaining profits because that’s all it’s about.&quot; &quot;Sustainability is re-use of products or materials for the long-term use of a project.&quot; &quot;Building a project in the right location, for the right people, for the right outcomes and using right method. So planning, planning and planning.&quot; &quot;To produce environmental, social, economic (and probably others) impacts that are acceptable to my customer and stakeholders.&quot;</td>
<td>Economic, Enterprise Development, Resource Utilization &amp; Management, Project Management, Health &amp; Safety, Community, Engineering.</td>
</tr>
<tr>
<td>DESIGNER</td>
<td>&quot;Innovative design that is flexible, able to cater for change, long lasting with low maintenance.&quot;</td>
<td>Environment, Resource Utilization &amp; Management, Health &amp; Safety, Community, Engineering.</td>
</tr>
<tr>
<td>ENGINEER</td>
<td>&quot;From a hard engineering perspective, sustainability is about low maintenance, whole of life costing and value for money that your product will last for a long period. I am talking more on physical material sense, sustainability also means that products that you used are robust in terms of fitness of purpose.”</td>
<td>Engineering, Economic, Resource Utilization &amp; Management, Health &amp; Safety, Project Management</td>
</tr>
<tr>
<td>PROJECT MANAGER</td>
<td>&quot;...it delivers for our community a functional project or facility that fits for purpose and ensures that the environmental aspects of the location are not diminished and delivers social outcomes to the community that enhances and benefits society in ways other than simple functionality. In order words, it’s delivery against the broad definitions of TBL.&quot;</td>
<td>Engineering, Environment, Resource Utilization &amp; Management, Health &amp; Safety, Project Management</td>
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<tr>
<td>TOWN PLANNER</td>
<td>&quot;Sustainability is about integrating land use (land, water and air) planning and transport planning in a wise and conservative manner, when it achieves the safety and access objectives.&quot;</td>
<td>Political &amp; Institutional, Environment,</td>
</tr>
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manner to the environment so that we have a sustainable outcome.”

| CULTURAL HERITAGE | “Ensuring historical features remain after project completion or if need to be impacted the impact is minimized.” |

| Economic, Community, Social, Cultural, Health & Safety, Community. |

| Cultural, Social, Community |

Table 1: Infrastructure Stakeholders’ Remarks on Sustainability Challenge

The key findings can be synthesized as:

1. **Rising awareness on sustainability:** Sustainability awareness is generally high among all stakeholders. Given wide publicity in media and political debates on climate change in Australia, there is a rising public consciousness on sustainability. Besides, Australians are used to and hence expect high quality of infrastructure. This pressures the stakeholders to take on sustainability approach in developing infrastructure projects. ‘Business as usual’ mentality is slowly giving way to considering sustainability issues as a-must-go-through process when developing infrastructure projects that typically involve multiple aspects of community and environment.

2. **Skeptical but acknowledging its importance:** The word ‘sustainability’ is described by the stakeholders as broad word, buzz word, catchword, watchword, ambiguous, incorrect, out of context, panacea, elixir, over-used catch phrase, misused word, new badge and some commented that it simply sounds good. Generally, they are not sure on what constitutes sustainability. Most of them are pessimistic on the achievability of absolute sustainability. However, in principal, all do agree that sustainability is an important agenda that deserves due attention by all. Sustainability is good for all, now and future.

3. **Dual approach in defining sustainability:** There is a duality of approach among the stakeholders in defining ‘sustainability’; personal and organizational. Personal views on sustainability are generally broader and voluntary. General concerns such as survival of human race, inter-generational equity, improving quality of life, individual and community well-being were talked passed. In contrast, organizational perspective is more project-specific and business oriented. Issues such as health and safety, greenhouse emissions, pollution reduction, resources utilization and management and engineering were frequently pointed.

4. **Profession-led perceptions on sustainability:** In comparison with other professionals, government – being the state custodian has a broader and over-arching sustainability focus. The understanding and expectation of sustainability is mostly motivated by their respective discipline of profession among the stakeholders. There is a lack of interdisciplinary understanding of each other. As a result, respective stakeholders are lack of a holistic picture on how sustainability could be achieved collectively. The four domains identified which contribute to different definitions of sustainability are:

   I. Individual personality (eg. up-bringing, people think differently etc);
   II. Professional leaning (eg. education background, professional jargon etc);
   III. Nature of business (eg. different interest, business specialization etc);
   IV. Nature of industry (eg. fragmented industry, food chain hierarchy etc).

5. **Equation of sustainability as nBottom Line:** TBL – environment, social and economic, is still the most commonly used sustainability yardstick. It is recognized as the start point of any
sustainability initiatives in infrastructure projects. Nonetheless, areas such as community expectation and governance, health and safety, and risk management are beginning to be acknowledged as distinctive priorities in recent development. As the complexity of public concerns increases, new elements on sustainability are expected to be added into its equation. However, this will differ and depend on project-by-project basis.

6. Paradigm shift from minimizing impact to improving environment: It is noted that there is a rising paradigm shift from the conventional sustainability mentality of minimizing impacts to the environment to improving and off-setting the environment as the start point of sustainability thinking. The stakeholders commented that this would normally costlier and it depends on client to approve the forward-thinking measures.

7. Sustainability is not a commonly used word in contract document: Though some initiatives by the stakeholders are clearly satisfying sustainability criteria, the word ‘sustainability’ is often not used to describe such (eg. financial viability instead of financial sustainability). Thus far, sustainability is not a common word used in contract document or project specifications. Respectively, most terms are professional jargons.

B) Sustainability Motivation

Generally, there are two distinct ways in which the call of sustainability is heeded by the stakeholders. They are:

1) External Pressure
   (Global pressure, government requirement and business survival)
2) Internal Volition
   (Human survival, community expectation and individual volition).

1. Global Pressure: On-going concerns on climate change, global warming and other environment disasters, coupled with high profile call by United Nations and world organizations had prompted Australian to seriously consider sustainability issues. This is positively fuelled by recent signing of the Kyoto international treaty that calls for a greater commitment to reduce green house gas emissions etc. On the other hand, the global depletion of resources means one has to innovate in order to sustain. The world is a global village. The suffering of one is the suffering for all. Sustainability is no more a matter of choice but a must-do agenda which requires collective participation.

2. Complying Government Requirements: Being the state custodian, government assumes the responsibility to oversee and approve infrastructure development projects which often concern the public, community and social issues. To deliver government’s priorities and policies, and to ensure infrastructure services are provided at the satisfaction of the public and at the same, minimal impacts to the environment, government legislations were enacted for compliance by parties involved. For infrastructure projects, these legislations were translated into contract document and project specifications to be complied by contractors or builders throughout the project implementation.

3. Business Survival: Competitive infrastructure market means stakeholders are forced to keep up with latest trend and be in consistent with current requirement to ensure business survival. Sustainability is currently being seen as a new cutting-edge business commodity. Forward-thinking medium and large companies have started to dedicate specific department to look into sustainability development. They hope to be seen as good corporate citizen in the market. Projects with sustainability focus often win merits honored by the government and fond by the
community. Sustainability branding is a market differentiator that boosts company profile and in return, yields financial benefits.

4. Human Survival: Stakeholders generally agreed that sustainability initiatives will ensure long-term survival of human family and in particular, their children and future generations. Each member in these interconnected nations of “the earth, our home” has equal rights and privileges to this planet. Equally, each one is assumed with the duties and responsibilities to concerns itself with the use of natural resources, protection of the environment and strengthening of community life. However, only when the concepts of “our common humanity”, “our common future” and recognition of “world citizenship” are being up-held, can a sustainable global society be erected.

5. Community Expectation: Intangibly, community as the major stakeholder in infrastructure development exerts some influence in the overall decision-making. Generally, Australians are used to high quality infrastructure services, coupled by the rising awareness on sustainability. Therefore, community expectation on quality infrastructure delivery is high. This pressures engaging stakeholders to look for economically feasible, socially viable and environmentally responsible project outcomes. In this respect, community engagement and participation in infrastructure projects becomes crucial and necessary, and is being prioritized by the stakeholders.

6. Individual Volition: Education and training, and proper up-bringing have direct impact on individuals in taking up sustainability initiatives voluntarily. Some are proud to be a good citizen and are not prompted by material incentives; others motivated by job security and status or simply fear of extinction. In this manner, sustainability becomes a self-conscious agenda.

Though in general there are six motivation factors identified, complying to government requirement, business survival and community expectation are the three main factors that drive sustainability initiatives among the stakeholders in infrastructure projects development. Sustainability is categorically addressed as a powerful market differentiator in winning bids and convincing consumers. Business drive precedes voluntarism. Sustainability is often discussed in light of business.

7.0 Conclusion

Implementing the principles of sustainable development in the infrastructure sector requires close orientation and focus on the interests and needs of the major stakeholders concerned. When conformance to government requirements is assured, business survival and community expectation have been identified as key motivation factors driving sustainability initiatives in infrastructure projects. Understanding drivers of sustainability and integrating different perceptions and priority needs of infrastructure stakeholders helps improve sustainability outcomes in these types of project, as proven in the research discussed here, through the interviews with high ranking stakeholders of infrastructure projects. Along with arresting arising issues during project development stages, the QUT research is aimed at developing a framework of integrated approaches to decision-making on the practical implementation of sustainability strategies during infrastructure project delivery. Accordingly, applying such a framework during infrastructure project development will facilitate collaboration, consultation and communication among key decision-makers to improve the consistencies of sustainable outcomes.
References


