

Framework of Guiding Principles for Sustainable Infrastructure Development

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Abstract—Various government organizations and individual authors have been proposed principles for sustainable development (SD) in the past. Amongst these principles, the sustainability principles formulated by Gibson has been used worldwide as a core criteria for both assessment and framing policies to promote SD. But these principles are generic and often need further descriptions and examples to make them more meaningful and useful. To make them more expressive, there is a need to develop guiding principles (GPs) which can be easily operationalize by considering the quantitative parameters for detail explanation of each respective principle. The purpose of this study is to develop the framework of GPs, which act as guideline to facilitate promotion of sustainable practices at various stages of infrastructure project so that SD goal can be achieved.

The study has used content analysis methodology using NVivo10 as the approach for comprehensive literature review. The review of GPs with respect to infrastructure development have been conducted through content analysis and further indicating the importance of GPs using a rating system towards promoting sustainable practices in public-private partnership (PPP) procurement process for infrastructure projects in India.

1. INTRODUCTION

In the search for sustainable policy measures, lists of sustainable principles are frequently generated. These include official versions by governments, principles adopted by organisations, and the principles proposed by individual authors. They usually consist of recommendations for specific changes that would be needed in order to achieve sustainability. The various sets of principles of sustainable development (SD) established by various government organisations are mentioned here. At the international level there is the Rio Declaration on Environment and Development, announced after the United Nations Conference on Environment and Development (UNCED) meeting at Rio de Janeiro in June 1992. This document proposes 27 principles for SD. The principles of the Rio Declaration are generally recognized as the foundation of global sustainability [1]. At the national level, a handful of countries have established sustainability principles. For example, the Australian Government has a National Strategy for Ecologically Sustainable Development (ESD), which consists of a goals,

three core objectives, and a list of seven guiding principles [2]. In the United States, the president's Council on Sustainable Development (PCSD) has drafted a similar set of 15 principles that support a vision of sustainable United States of America [3]. The UK Government has outlined a set of 10 principles that covers a substantial range of the sustainability agenda [4]. These principles act as guideline when developing the government's plan and strategy for improving sustainability.

On the other hand, many researchers have also put forward different sets of sustainability principles as a fundamental laws or rules governing the behavior of a system. For instance, Stanners, et al. [5] have established eight key principles as goals of SD at global level. Abidin [4] has derived ten principles as a guideline of sustainability within the context of construction. Also, Gibson et al. [6] have postulated the eight principles of SD as core criteria for assessment of sustainability. Among these principles, the Gibson's principles have been used worldwide as decision criteria for both assessment and framing policies to promote SD. But these principles are more abstract and vague statements and often need further descriptions and examples to make them more meaningful and useful. Also, these principles need to be operationalize to ease in sustainability assessment for infrastructure development related activities and policies. There is a need to develop guiding principles (GPs) with detail explanation on how to operationalize it. The purpose of this study is to develop the framework of GPs, which act as guideline to facilitate promotion of sustainable practices at various stages of infrastructure project so that SD goal can be achieved. These GPs will help to guide specific decisions, while maintaining the holistic triple-bottom-line balance that is needed throughout the planning, design, implementation and management phases of any project.

The study has used content analysis methodology using NVivo10 as the approach for comprehensive literature review. The Gibson's principles on sustainability have been adopted as

the core criteria, which are then used to ascertain the extent to which the various practices and processes in infrastructure development process promote sustainable development. Review of the various practices and processes in infrastructure development process has been done through content analysis of various online data base, reports and journal articles relating to infrastructure development and management disciplines in order to identify the various GPs. These GPs are then clustered under the three dimensions and core criteria of sustainability. Finally, the importance rating of GPs towards promotion of sustainable practices in each of the four stages of PPP procurement process for infrastructure development in India is highlighted using a three star rating scale.

2. GIBSON'S PRINCIPLES: CORE CRITERIA FOR SD

The principles suggested by Gibson constitute a minimal set of core requirement, all of which would have to be elaborated on and specified for a particular place and application. These principles have been used in the past by various researchers as core criteria for sustainability assessment for urban development proposal [7]; water governance regimes [8, 9]; and critical river basin infrastructures [10]. The description of the eight sustainability principles postulated by Gibson, et al. [6] is mentioned below:

Socio-ecological system integrity: Build human-ecological relations to establish and maintain the long-term integrity of socio-biophysical systems and protect the irreplaceable life support functions upon which human as well as ecological well-being depends.

Livelihood sufficiency and opportunity: Ensure that everyone and every community has enough for a decent life and that everyone has opportunities to seek improvements in ways that do not compromise future generations' possibilities for sufficiency and opportunity.

Intra-generational equity: Ensure that sufficiency and effective choices for all are pursued in ways that reduce dangerous gaps in sufficiency and opportunity (and health, security, social recognition, political influence, etc.) between the rich and the poor.

Intergenerational equity: Favor present options and actions that are most likely to preserve or enhance the opportunities and capabilities of future generations to live sustainably.

Resource maintenance and efficiency: Provide a larger base for ensuring sustainable livelihoods for all while reducing threats to the long-term integrity of socio-ecological systems by reducing extractive damage, avoiding waste and cutting overall material and energy use per unit of benefit.

Socio-ecological civility and democratic governance: Build the capacity, motivation and habitual inclination of individuals, communities and other collective decision-making bodies to apply sustainability requirements through more open and better informed deliberations, greater attention to fostering reciprocal awareness and collective responsibility, and more integrated use of administrative, market, customary and personal decision-making practices.

Precaution and adaptation: Respect uncertainty, avoid even poorly understood risks of serious or irreversible damage to the foundations for sustainability; plan to learn; design for surprise; and manage for adaptation.

Immediate and long-term integration: Apply all principles of sustainability at once, seeking mutually supportive benefits and multiple gains.

The last criterion of Gibson principles demands that all principles of sustainability should be applied at once in order to get mutually supportive benefits, and multiple gains. In other words, sustainability can only be delivered if all principles are adequately addressed or attained. But these principles are more abstract and indistinct statements than quantitative parameters and often need further descriptions and examples to make them more meaningful and useful.

3. REVIEW OF GUIDING PRINCIPLES FOR SD

What is sustainable business? How should a socially responsible company conduct its affairs? What are the most appropriate indicators of sustainability in the private sector? These are the fundamental questions an individual business firm may feel ill-equipped to tackle. To find answers to such questions, many companies have turned to organizations like CERES (the Coalition for Environmentally Responsible Economies), which have drawn up charters, or lists of principles. As well as signing up to general statements of intention, many business houses have endorsed more specific concepts like 'triple bottom line' accounting and the 'factor four' model of eco-efficiency. A company may also be seeking accreditation, in order to give its stakeholders hard proof of its commitment to sustainability principles, and not merely bland assurances [11].

A comprehensive literature review has been carried out using content analysis technique to explore the GPs. The literature on SD practices by various engineering organisations related to infrastructure development has been the focus of the content analysis. Based on the content analysis, a set of 20 GPs derived from literature review have been summarized in Table 1. Brief description of all the GPs is given below:

Table 1: GPs for sustainable infrastructure development

Guiding Principles	References
Environmental protection	[1,11-21,22,24-26,28-29]

Polluters pay	[1,11,13,18,22,25,29]
Quality of life	[12,15,23,24]
Creativity	[1,12-13,17-18,21,25,28]
Up-gradation	[1,17,18,25]
Affordability	[23,15-16,29]
Social justice & poverty alleviation	[1,16-17,19, 23-25,29]
Equitable distribution of resources	[1,16-18,22,25-26,28-29]
Long-term strategic planning	[13,15,17,19,23,28]
Maintenance of natural resources	[11, 12, 14-16, 18, 23]
Value for Money	[12,13,15,17,18,23,27]
Efficient project delivery	[11,12,15,17,23]
Public participation	[1,11-17,19,23-25,27,28]
Institutional capacity	[11-13,15,18,27]
Accountability	[13-16,23,24,27]
Risk Management	[11,16,18,27]
Adaptability and Resiliency	[11,13,15,26]
Precautionary	[1,11,13,16-18,21-25,28]
Multidimensional	[18, 23,26,27,29]
Continuum	[17, 23, 26]

Environmental protection: Protecting, preserving and restoring the natural environment and maximize environmental benefits and reduce or eliminate negative environmental impacts.

Polluters pay: Take responsibility for any harm we cause to the environment by making every effort to fully restore the environment and to compensate those persons who are adversely affected.

Quality of life: Develop local skill and capability; enhance public health and safety; minimize noise; improve community mobility and site accessibility; and preserve history, culture and heritage.

Creativity and promote innovation: Encourage for innovative solutions to problems in project development; and share the important information and knowledge with sub-ordinates.

Up-gradation of knowledge: Promote education and public awareness of SD through higher education, training, participation and awareness programs.

Affordable user charges: Service providers should pay special attention to providing public services to segments of society that are normally excluded, such as the poor, migrants, lower castes, or tribal people, because they systematically have greater difficulty accessing regular services.

Social justice and poverty alleviation: Improving the well-being of all residents in a community, and not just benefiting the powerful or the rich. Economic development must be equitable, environmentally sound and socially just.

Equitable distribution of resources: SD wants to ensure that current and future generation can enjoy an acceptable quality

of life. There should also be an equitable distribution of resources between and among communities and generations.

Long term strategic planning: Ensures that the long-term integrity and productivity of our economy, our environment, our natural resources and safeguards our human health.

Maintenance of natural resources: Use maximum of renewable natural resources, such as water, soils and forest and conserve non-renewable natural resources through efficient use and careful planning.

Value for money: Improvement, quality, cost and access to infrastructure, and ensuring the financial viability of infrastructure at minimum cost to Government.

Efficient project deliver: Developing and following proven best practices in budgeting, scheduling, bid/contract management, and asset management, returns can be substantively improved.

Public participation: Engagement of stakeholders to bring their different views, perceptions, knowledge and skills to bear on the challenge being addressed.

Strong organization and leadership quality: These organizations must establish clear plans and rules for service provision; regulate and monitor service quality; coordinate infrastructure project development; and deliver services efficiently and equitably.

Transparency and accountability: Setting clear standards, ensuring monitoring; and practice fairness and transparent to be responsible for our decisions.

Balance risk allocation: A successful contract will balance the risk between the Government and the operator or private partner.

Adaptability and resilience: It is necessary to adapt to the changing needs of societies and generations over time and consider future urban growth of city.

Precautionary: Take a precautionary approach where there is objective scientific uncertainty in order to avoid potential damage to people’s health or to the environment and take preventive action.

Multidimensional: The three dimensions of SD, social equity; economic development; and environmental stewardship are interrelated and must be simultaneously addressed to meet the needs of current and future generations.

Continuum: Promote coherence between all government policies and coherence between local, regional, national and

global actions in order to increase their contribution to sustainable development.

Classical content analysis has been carried out using NVivo 10 for review of GPs. The results on the number of times items were coded in specific categories and how many time they were coded for each article is summarized in Table 2. The GP ‘environmental protection’ has seventeen quotes, so it can be concluded that 17 out of 20 articles (85%) mentioned GP as environmental protection. Furthermore, this GP has the highest value of number of quotes among the other GPs while the lowest (15%) referenced GP is ‘continuum’. GPs such as ‘public participation’ and ‘precautionary’ having coded values of 80% and 55% are ranked second and third highest GP, respectively. The ‘intergenerational equity’ has been found to be the fourth highest coded GP with 45%.

Table 2: Sources and references of GPs

Guiding Principles	Sources	References*	% of articles coded
Environmental protection	17	41	85
Polluters pay	7	7	35
Precautionary	11	12	55
Adaptability and Resiliency	4	4	20
Risk Management	4	4	20
Quality of life	4	5	20
Creativity	8	10	40
Up-gradation	4	5	20
Affordability	4	4	20
Social justice & poverty alleviation	8	12	40
Equitable distribution of resources	9	9	45
Long-term strategic planning	6	6	30
Value for Money	7	7	35
Maintenance of natural resources	7	10	35
Efficient project delivery	5	5	25
Public participation	16	25	80
Institutional capacity	6	6	30
Accountability	7	8	35
Multidimensional	5	5	25
Continuum	3	3	15

(*The number of times the respective principle was coded by various sources/articles)

4. FRAMEWORK FOR INTEGRATING SUSTAINABILITY PRINCIPLES IN INFRASTRUCTURE DEVELOPMENT

A GPs based framework has been developed based on a hierarchical system of three dimensions and core criteria of SD in order to give a structured approach to assess the sustainability of infrastructure projects. This framework has been based on the basic outline of three levels of principles to assess the sustainability used by Karl-Henrick Robert [30]. The three levels which are used to interpret the proposed framework are summarized in Table 3. The first level relates to the principles to describe the constitution of the system which

can be interpreted in terms of the three dimension of SD (social, environmental and economic); second level relates to the principles for a favorable outcome of planning with the system with Gibson’s core criteria of SD; and third level focuses on the principles for process to reach SD outcome through the GPs summarized in this study.

Table 3: Three hierarchical levels for SD principles

Level	Robert’s three hierarchical principles levels for SD	Interpretation of principles for proposed framework
I	Principles for the constitution of the system (e.g. ecological and social principles)	Three dimensions of SD – Social, environmental; and economic
II	Principles for a favorable outcome of planning within the system (e.g. principles for SD)	Gibson’s principles of SD – Eight core criteria for SD
III	Principles for the process to reach this outcome (e.g. to meet principles for SD)	GPs – Twenty GPs to fulfill the core criteria and dimensions of SD

The proposed framework for integration of sustainability principles in infrastructure development has been developed based on the three levels of principles proposed by Robert (2000). Table 4 shows the proposed framework. In the proposed framework, the principles at the first level is associated with the three dimensions of sustainability, the core principles of sustainability (core criteria) postulated by Gibson are positioned at the second level while the GPs are mapped with the eight core criteria.

Table 4: Framework of GPs with core criteria and three dimensions of SD

Level I: 3D of SD	Level II: Core Criteria	Level III : GPs
Environmental Sustainability	Socio-ecological system integrity	Environmental protection
		Polluters pay
	Precaution and adaption	Adaptability and Resiliency
		Precautionary
		Risk Management
Social Sustainability	Livelihood sufficiency and opportunity	Quality of life
		Up-gradation
	Intragenerational equity	Affordability
		Social justice and poverty alleviation
	Intergenerational equity	Equitable distribution of resources
		Long-term strategic planning
Economic Sustainability	Resource maintenance and efficiency	Maintenance of natural resources
		Value for Money
		Efficient project delivery
	Socio-economic civility and democratic governance	Public participation
		Institutional capacity
		Accountability
All SD	Immediate and long	Multidimensional

	term integration	Continuum
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5. APPLICATION OF GPS IN INFRASTRUCTURE DEVELOPMENT PRACTICE THROUGH PPP MODE

This section provides guidance on how sustainability considerations and a SD approach to infrastructure development through PPP mode must influence decision-making at each stage. The GPs of sustainability therefore have to be applied at every stage in PPP procurement process for infrastructure development practices in India. The relationship between the GPs and the four stages is presented in a table at the end of this section.

The Indian government has established the procurement framework for infrastructure development through PPP route in order to facilitate private sector participation. As per the framework, the process of procurement of PPP projects involves through the following four stages [31]. Fig. 1 below shows flow diagram for each stage of PPP process with various activities and tools involved.

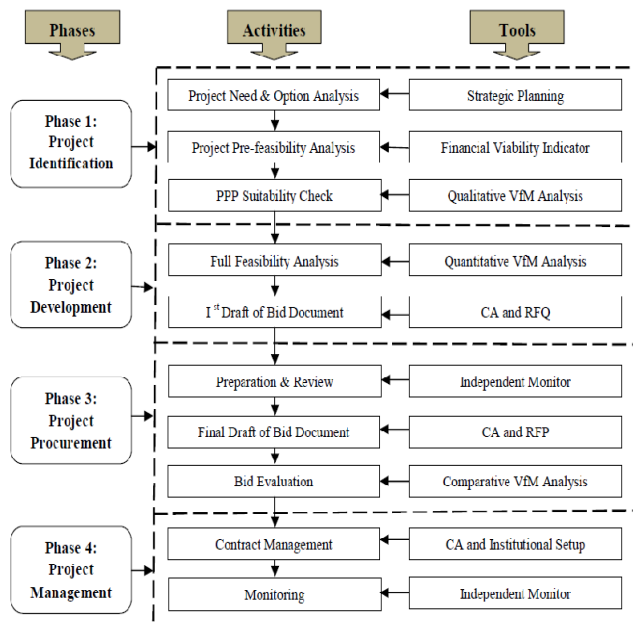


Fig. 1: Phases of PPP procurement process in India

The various activities and procurement related processes being practiced in each of the project phase is discussed in brief in the following sub-sections. These sub-sections also explain in brief the key issues relating to the GPs that need to be given more importance during each phase in order to ensure that the process is leading to progress towards sustainable development goals.

The level of importance of each of the GPs in ensuring that the practices and processes associated with each phase is leading towards sustainable development is shown in Table 5. A three star rating scale is used to explain the degree of importance of each GP. As per the rating scale, two stars indicate that the GP is strongly connected with the stage and the GP is of highly important in this stage to ensure successful delivery of the stage in question; one star indicates that the GP has a definite connection with the stage but the principle is of low priority in successful delivery of the project; and no star indicates that the GP is not connected with the stage and the GP is likely to not applicable in the stage under consideration. The brief explanation of each stage PPP process and need of GPs for SD have been discussed below and summarized in Table 5 through rating of each GP with respect to each stage of PPP procurement process.

Phase 1: Project Identification

The typical procurement process for PPP projects starts with the identification of a project, wherein the need of particular infrastructure facilities is first identified through strategic planning. Pre-feasibility analysis for the identified projects is carried out along with the financial viability indicator model to analyse financial viability of the project. The identified projects are then assessed for suitability of developing the project through various PPP models using value for money (VfM) analysis. The importance of GPs towards SD perspective for each activities involved in this phase is discussed below.

- Strategic planning:** The need for a particular infrastructure facility is identified, normally by the government or more often by the project executing organization. The need for a particular infrastructure facility is established through a needs analysis for the infrastructure services and an option analysis for providing the services (including whether assets are required). A set of potential projects are then identified for provision of the infrastructure services through strategic planning process. It identifies infrastructure needs across a whole sector or geographically bounded parts of a sector; and assess whether the existing infrastructure for its ability to deliver the currently needed services and the service requirement expected for the future. The strategic planning process should be carryout to prepare future plans and actions to address short and long-term and to ensure that the long-term integrity and productivity of our economy, environment, natural resources and safeguards our human health. This approach through effective strategic planning will be leading to SD with respect to principle ‘long term strategic planning’. Proper strategic planning will also ensure that current and future generations can enjoy an acceptable quality of life, thereby fulfilling the requirement of the principle ‘equitable distribution of resources’.

- **Pre-feasibility study:** The aim of this stage is to assess specific needs and consider service delivery options, and to test if an identified project is feasible and worth developing further. The financial viability indicator can be used at this stage to make a preliminary assessment of the likely viability of the project for the private sector. It includes an assessment of the level of user charges or other payment needed to make the project attractive to the private sector and further test whether and how much government support is likely to be needed (for example, through VGF funding). During this analysis, the focus should be on designing affordable user charges so that it will lead to improvement in the well-being of all residents in a community. This approach will help to fulfill the requirement of the principle 'affordability and social justice and poverty alleviation' (intragenerational equity) for SD.
- **PPP suitability check:** These potential projects are evaluated both for feasibility of financing the projects with budgetary resources and their suitability for development as PPP project using a preliminary qualitative PPP test. The test evaluates the qualitative factors that have an impact on the ease or difficulty of developing the project through PPP route. The suitability filter is made up of a series of questions about the important factors that impact on the suitability of the project for being a PPP. The answers to each question are scored, and the final result from all questions is presented on a scale of ease or difficulty of developing the project further as a PPP. This check would be carried out by review committee within the sponsoring authority. This approach will help to fulfill the requirement of the principle 'institutional capacity' and 'accountability' for SD.

Phase 2: Project Development

The potential PPP model that was considered suitable in previous phase is studied in detail in the development phase through feasibility study and PPP due diligence. Feasibility study and PPP due diligence includes project appraisal activities such as market analysis, social and environmental feasibility, technical feasibility, financial and economic feasibility, risk studies, financial and economical viability, and quantitative VfM analysis. Feasibility study is normally carried out through engagement of stakeholders to bring in their different views, perceptions, knowledge and skills in order to meet the challenges of the project. Involvement of the stakeholders in the feasibility will help to meet the requirement of the principle on 'public participation'. The importance of each activity involved in this phase in promoting SD by fulfilling the requirements of GPs is discussed below.

- **Social and environmental feasibility:** As part of the feasibility study, the impacts of the projects on the

environment and society are assessed through an EIA and SIA. Infrastructure projects will often have significant social and environmental impacts arising from their construction and operation, which can be both positive and negative. Protecting, preserving and restoring the natural environment and maximizing the environmental benefits and reducing or eliminating the negative environmental impacts on society through EIA will lead to fulfillment of the requirement of the principle on 'environmental protection and maintenance of natural resources'.

- **Quantitative VfM:** This analysis is done with the objective to determine whether the value of risks transferred to private capital under a PPP arrangement is justified considering the cost that private sector will charge for assuming those risks. The analysis compares the life cycle cost of the PPP alternative which will include the cost of private finance alongside other costs, with the life cycle cost of providing the service conventionally. This test should carry out to improve quality, cost and access to infrastructure, and ensuring the financial viability of infrastructure at minimum cost to government, which will be leading to SD by fulfilling the requirement of principle 'value for money' for SD.
- **Risk studies:** The implementing agencies should identify the different types and degree of risks that could arise during the project life cycle, and configure appropriate mitigation measures. The objective would be to optimally allocate the project risks, rather than maximize their transfer to the private sector. The attempt would be to allocate risks, taking into account the legitimate concerns of the stakeholders, to the entity that is best suited to manage the same. It is necessary to design optimal risk allocation in order to fulfill the requirement of the principle on 'risk management' for SD. It is also necessary to adapt to the changing needs of societies and generations over time; and consider future urban growth of city and the risk allocation framework should be able to tackle these issues. Designing a framework to address the changing needs of society and future urban growth will help in meeting the requirement of principle 'adaptability and resilience' and ensure progress towards SD.

Phase 3: Project Procurement

The goal of this phase is to select the best private sector partner for the PPP project and conclude contracting with that partner. Once the government has decided to proceed with PPP route, the next step is formation of procurement team to lead procurement and evaluation; reviewing project information and making necessary updates; and appointment of monitor to ensure quality and process oversight. The role of each activities involved in this phase in promoting SD by fulfilling the requirements of GPs is discussed below.

- Formation of procurement and evaluation (P&E) team:** Sponsoring authority should appoint a P&E team who will carry out and manage the procurement process. The team can further engage external technical advisors for specific tasks as needed. Each member of the P&E team and advisor must be required to declare that they have no conflict of interest in the project and to disclose any conflict that arises during the procurement process. This will help in bringing clarity in the roles and responsibilities of the team members and will help in achieving long and sustainable results. This approach of establishment of procurement team with proper allocation of role and responsibility will help to fulfill the principles of ‘institutional capacity’. The appointment of external advisor or monitor would be oversee the process and ensure transparency in tendering and public budget allocation processes, thereby strengthening the procurement team’s capacity to take transparent and fair decision. This will lead to SD by fulfilling the requirement of principle ‘accountability’.
- Preparation of bid documents:** Key documents included in procurement stage are request for qualification (RFQ), request for proposal (RFP), and concession agreement (CA).The RFP is the comprehensive request for proposals from shortlisted firms or consortia. It is the most important communication to bidders of the sponsor’s requirements. The RFP would typically include several sections detailing the essential aspects of the project. The procurement team should develop and abide by an environmentally and socially responsible procurement policy through RFQ and RFP that emphasizes long-term values and will become a model for other public as well as private organizations. Adoption of such a policy in preparation of RFQ and RFP will fulfill the requirement of principle ‘efficient project delivery’.
- Bid invitation and evaluation:** The potential bidders for the project are identified through invitation for expression of interest and the potential bidders are shortlisted through RFQ process. The qualified bidders are then requested to submit the bids through RFP process. The P&E team evaluates the bids and select a number of preferred bidders for negotiation, during which the terms of the project will be discussed and redrawn, if necessary. This approach of inviting private sector for negotiation through pre-bid meeting will promote the principle of ‘public participation’. While, maintaining transparency in procurement preparation and bid evaluation through public disclosure will promote the principle of ‘accountability and institutional capacity’. The opportunity to promote for innovation by private sector by inviting cost effective bid through re-negotiation contract provision will fulfil the requirement of principles ‘creativity’ and ‘up-gradation’.
- Award of contract:** This phase concludes with award of the contract to the bidder that best conforms to the defined bidding criteria. The final CA is then drawn defining the

roles and responsibilities of the parties to the contract through various contractual provisions.CA needs to clearly define who should take theresponsibility for any harm caused to the environment and make every effort to fully restore the environment and compensate those persons who are adversely affected. Inclusion of such provision will fulfill the requirement of polluter pay principle.Furthermore, transparency is an important issue in procurement and the documents relating to PPP projects and the procedures followed for awarding PPPs should be made available for review. The comptroller and auditor general of India have published public auditing guidelines for PPP projects. These guidelines are intended to provide a framework for auditing PPP projects to determine whether Government and other public authorities have got the best possible value for money. This approach of auditing of PPP projects will help to fulfill the SD principles ‘accountability’ and ‘value for money’.

Phase 4: Project Management

This phase covers project implementation and monitoring through contract management over the life of the PPP project. Contract management is not a passive box ticking/reporting exercise: it is an active process that involves a wide range of skills. Projects are not static, conditions change and the capability of the public authority at the interface with the private sector party is therefore crucial. The contract manager needs to be empowered to take action responsively and effectively and escalating up only those issues that cannot be managed at the project interface. This calls for effective and efficient governance processes and people with the right mix of skills (or at time access to skills) including project management, commercial expertise and negotiation skills. This approach of effective and efficient governance to handle the project without dispute will lead to fulfillment of the principles ‘institutional capacity’ and ‘accountability’. During the entire project management process, sincere efforts should be made to enhance public health and safety; minimize noise; improve community mobility and site accessibility; and preserve history, culture and heritage. Adopting such approach to provide better service to society through infrastructure development by protecting surrounding environment may lead to fulfillment of the requirement of principles ‘quality of life’ and ‘environmental protection’.

Table 5: Rating of GPs for four stages of PPP process

Guiding Principles	*Stages of PPP procurement process			
	1.	2.	3.	4.
Environmental protection	*	**		*
Polluters pay			**	*
Adaptability and Resiliency	*	**		
Precautionary	*	**		
Risk Management		**	*	
Quality of life			*	**

Creativity		*	**	
Up-gradation		*	**	
Affordability	**	**	*	
Social justice & poverty alleviation	**	**	*	
Equitable distribution of resources	**	*		
Long-term strategic planning	**	*		
Maintenance of natural resources	*	**		*
Value for Money	*	**	**	
Efficient project delivery		**	**	
Public participation	*	**	*	*
Institutional capacity	*	*	**	**
Accountability	*	*	**	**
Multidimensional	*	*	*	*
Continuum	*	*	*	*

(* 1. Identification, 2. Development, 3. Procurement, 4. Management)

6. CONCLUSIONS

The study elaborated the need of GPs for guiding the specific decisions to accomplish sustainability of infrastructure projects. Thorough literature review study was carried out to explore the GPs to promote sustainability for infrastructure projects, which makes the principles more meaningful through detail explanation of each principle. The mapping of GPs with Gibson's principle and three dimensions of SD conformed that all the GPs satisfies the core criteria of SD and triple-bottom-line balance. Further, the role of the GPs towards promotion of sustainable development has been highlighted by indicating the importance of each GP using a three star rating system towards promoting sustainable practices in each of the four stages of PPP procurement process for infrastructure development in India. The GPs could prove to be a useful tool for promoting SD while maintaining the holistic triple-bottom-line balance that is needed throughout the identification, development, procurement, and management phases of PPP process practices in India for infrastructure projects.

The current study has focused on developing the GPs framework for the infrastructure projects. The preliminary framework of GPs that has been derived from thorough literature review needs to be subjected to further study in order to increase the usefulness and enhance the applicability for practitioners. Further study through focused interviews with the key stakeholders involved in PPP transaction will need to be carried out to validate the framework.

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