Project Sustainability Management for design-build projects

Peter Boswell, Sustainable Development Task Force, General Manager, International Federation of Consulting Engineers (FIDIC), Geneva, Switzerland

With designers of infrastructure being held financially accountable for adverse environmental impacts, the construction industry came to be subject to much environmental regulation aimed at the safety of the objects constructed and the construction work involved, land use planning, and environmental protection. However, owing to an increasing number of industrial accidents it was clear that regulatory control instruments were not preventing disasters. Various voluntary environmental management tools were developed, notably the ISO 14001 International Environmental Management (EMS) standard, first issued in 1996, that was designed to help organisations set up an environmental programme. Environmental management and assessment are today integrated contractually into construction projects, together with quality assurance.

By the late-1990's, most industry sectors realised that socio-economic issues required more attention to keep them in balance. Stakeholder concerns about sustainability were also becoming a strong force in the marketplace, along with regulation and the accompanying national strategies and action plans, notably national and local Agenda 21 processes. Today, organisations and individuals often go beyond current regulations and the conventional boundaries of business responsibility in changing the way they manage their operations and infrastructure investments.

Project Sustainability Management

Achieving sustainable development will be a long journey, spanning many decades. It requires a complete overhaul of our existing systems, technologies and infrastructure in a manner that is workable in both developed and less-developed countries. Progress will be made incrementally, project-by-project, driven by project owners applying sustainable approaches to individual projects on a systematic basis through the well-established processes used to deliver projects. The integration of social-economic considerations into project delivery is therefore a natural development of the construction industry's commitment to quality and environmental management.

Project owners and stakeholders generally recognise that sound project delivery combines financial, environmental and social factors with technical feasibility. They are aware of emerging trends and market drivers and of the need to interpret and integrate proposed legislation and policies that affect the built and natural environment. Unfortunately, they have also been exposed to a confusing array of approaches because, in the absence of definitive guidance, many non-governmental organisations and public interest groups have applied their own notions, based on their interests.

Approaches to integrating sustainability into projects must ensure that project procurement and delivery address a broad range of issues such as stakeholder interaction, conflict of interest and legitimacy, the roles of indicators and experts, how the project scope relates to the location of key stakeholders, and ways to measure a genuine contribution to sustainable development through a clear connection between the overall goals of sustainable development and the projects that move society toward the goals.

FIDIC's Project Sustainability Management (PSM) system is based on the concept that four key principles must be applied in order to drive procurement and project delivery towards sustainable outcomes. The PSM principles are:

- Alignment: Use of a core set of project indicators traceable to Agenda 21 to align project goals with global goals, while factoring in local conditions ("align globally; adjust locally")
- Improvement: Continuously improve ways to mitigate resource consumption by seeking new knowledge and information on performance ("raise the bar")
- Education: Trust and engage stakeholders and build their capacity to identify issues, include local values and communicate their experience ("educate, and be educated")
- Innovation: Anticipate the future and enable information by opening organisational borders and reward information sharing ("create an environment for innovation")

Project delivery

Constructing or refurbishing infrastructure usually represents a major investment for an owner. Since the investment is motivated by market demands, it is expected to satisfy objectives specified by the owner and relevant regulations. Most investments are non-speculative, so they are custom made in consultation with the owner.

Project delivery will involve obtaining services from both third parties and in-house providers, in conformance with applicable laws and regulations. It will span the whole project cycle, from identification of needs through to the end of a services contract or the end of the useful life of an asset. Solutions at various phases are integrated to obtain the final outcome.

A clear understanding of the acquisition process, clearly stated objectives and knowing the balance between these objectives are fundamental for owners in deciding which project delivery system yields what is required. Considerations cover many areas, including the quality of the completed asset, the need for independent expertise, time schedules, risk allocation, legal requirements, finance, cash flow, contracting method best suited for the physical construction, whether or not operation and maintenance should be bundled into project delivery, control of the total project cost, etc.

The traditional design-bid-build (DBB) process is widely used and relatively straightforward. Construction is separated into design and physical production as a succession of discrete phases to give an orderly process with clear lines of authority, scope of services and schedules. Designs are completed before construction starts resulting in a high level of certainty of what will be constructed, giving the owner a high degree of control over final design details, the main advantage of DBB.

To better protect their interests in an era of global standards for management and business practice, owners often now take a global view by seeking project delivery systems where a supplier

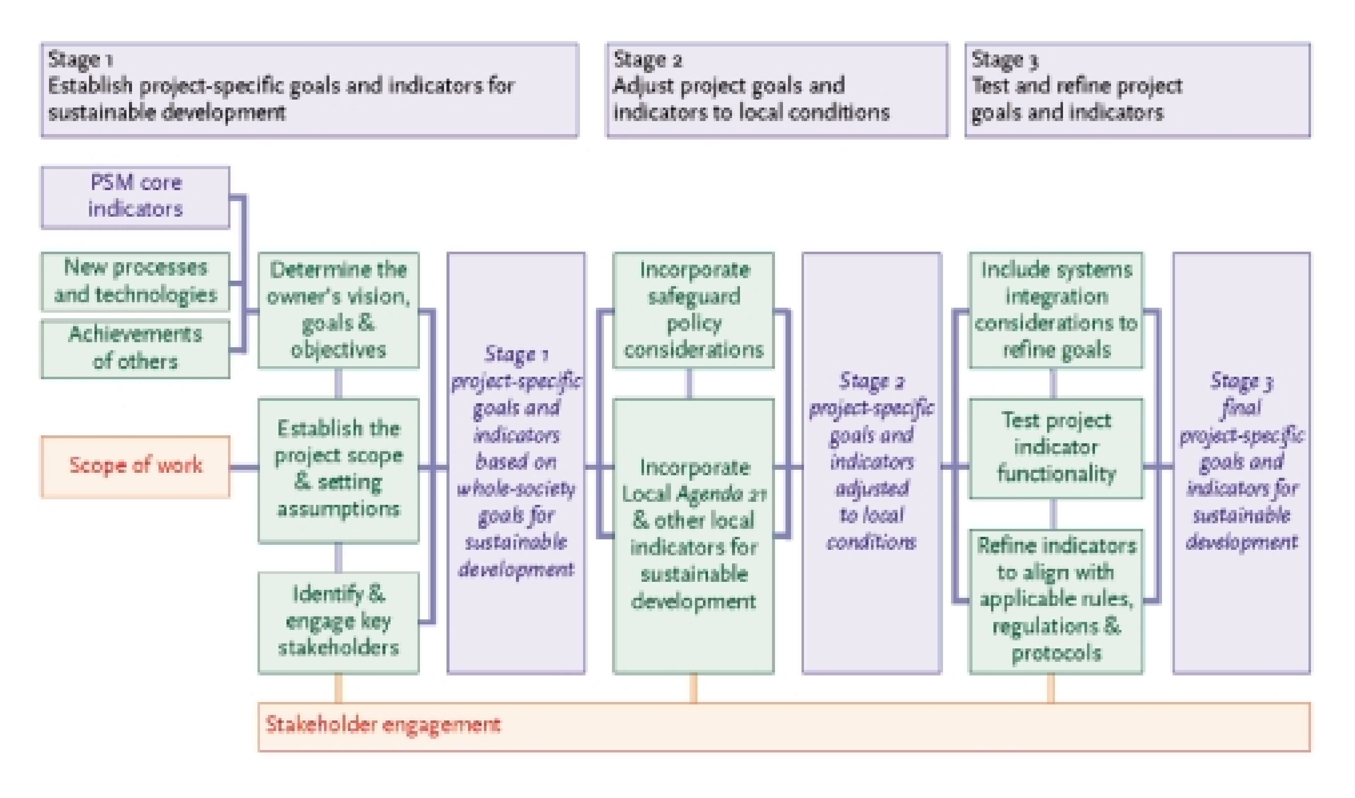

Figure 1. Project Sustainability Management's three-stage procedure for establishing project goals and indicators for sustainable development that are customised to project conditions and requirements yet rigorously referred back to whole-society objectives.

is accountable for total project delivery with fewer disputes and cost and time overruns. Suppliers, on the other hand, seek to provide higher quality, higher valued added services with superior returns by persuading owners to specify more innovative requirements. As a result, the construction industry is moving away from the simple and confined goals of cost and time for construction to focus on the macro issues of overall project outcomes in project delivery, where the outcomes should be used as goals for all project participants.

Many hoped that contractual relationships embodied in DBB could be replaced by long-term relationships based on the outcome, determined by clear measurement of performance, of a process involving sustained improvements in quality and efficiency. However, such arrangements were not sufficiently rigorous, so other methods based on outcome-based delivery were tried, such as the partnering of project teams. Partnering and similar forms of project delivery are based on aligning incentives where team members aim to share in success in line with the value that they add for the owner (the project delivery system apportions profit to the delivering parties according to their ability to produce, replicate or exceed a project's planned requirements). The idea is that owners should not take all the benefits; there should be proper incentives to enable cost savings to be shared so that all members of the team make fair and reasonable returns.

Design-Build

Partnering appears to be having a limited success because it merely relies on best endeavours and acts of faith; partners simply tell each other that they will act reasonably and fairly while expressly disavowing any legal obligation to do so. The trend, therefore, for project delivery by a multidisciplinary, integrated team is towards greater use of more traditional methods based on Design-Build (DB) and engineering-procure-construct (EPC)/turkey contracts. In DB, the project owner, having defined the initial expectations, executes a single contract for both design services and construction thus focussing final design and construction responsibility through a design-build entity which may be a design firm, a construction company, or an integrated design-build firm (in the terminology of FIDIC's widely used *Plant and Design-Build Contract*, "the Contractor designs and provides in accordance with the Employer's requirements").

For an EPC/Turnkey project, a single entity (in FIDIC's *EPC/Turnkey Contract*, "the Contractor") takes total responsibility for the design and execution of the project by carrying out all engineering, procurement and construction to provide a fully equipped facility ready for operation at the "turn of the key". This gives the owner a higher degree of certainty that the agreed contract price and time will not be exceeded.

In both design-build and turnkey procurement, the contractor or design-build team takes full responsibility for the design, profiting from long-standing strategic and synergistic relationships between team partners. The client, meanwhile, is guaranteed a defect-free finished works and is freed from having to provide technical skills. The greater involvement of the contractor in the economic cycle of the project leads to larger returns (through enhanced innovation, overlapping design and construction activities and lump sum payments that reduce the requirements for measurement, documentation and claims).

Owners selecting DB and EPC/Turnkey project delivery will face increased challenges as compared with traditional DBB:

a) **Tender design specifications**

Owners will have to live with the project as defined in specifications and the scope of work, and appreciate that they have virtually no control over the design process after a design-build team has been awarded a contract.

Owners should provide sufficient design services to scope the project accurately and to prepare the design-build request for proposals, otherwise the design will be insufficiently developed:
i) To identify the disciplines needed in the design-build team;
ii) to set a fixed price as one of the selection criteria;

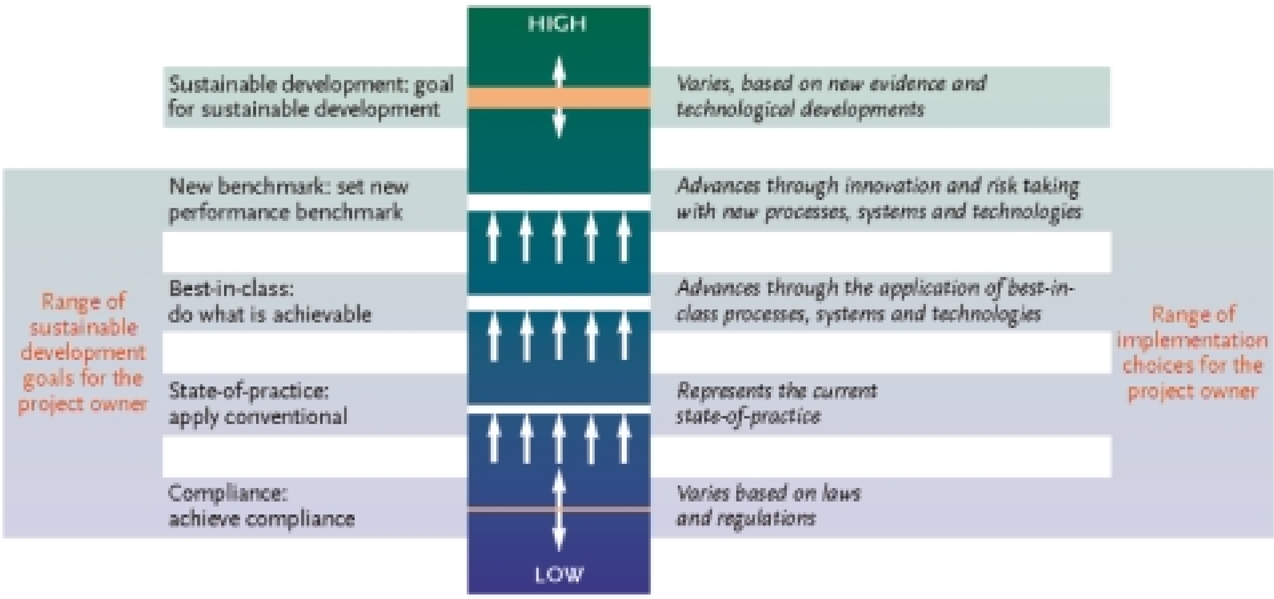

Figure 2. Project Sustainability Management's 42 core project goals and indicators each range from achieving compliance to setting a new performance benchmark.

iii) to enable the design-build team to fulfil its professional and ethical obligations. As a guide, the extent of design input necessary to provide a reasonable level of tender accuracy will be in the range of 15 – 30% of a full design.

b) **Design flexibility and loss of design control with reduced outcomes**

Owners should ensure that the design-build team focuses on quality, life-cycle cost and other sustainability considerations, and not solely on profit.

c) **Selection**

Owners will need to carefully decide upon the optimum selection process for a complex tender package involving both design and construction services. They will need to consider: The quality and track record of the team:

i) including the design professionals, the quality of planning and design – how well the project will work;
ii) the quality and durability of materials offered;
iii) life cycle costing;
iv) constructability.

d) **Review**

Owners face greater challenges in coordinating design reviews with multiple outside agencies owing to the accelerated nature of DB projects.

They should ensure that there is sufficient capacity to handle more intense interaction with stakeholders.

Specific PSM tools for design-build

PSM aims to provide tools that help the owner's advisor meet the challenges. As an example, consider challenges raised in setting tender design specifications. Contractors will aim to select the team which gives the best chance of coming up with a winning bid which can subsequently be converted into a successful project. Consulting engineers will often be selected to produce the tender design that is to be accurate in all respects.

The technical and economic feasibility of alternatives will be compared at the strategic and concept planning and project programming phase in order to select the best possible project. Decisions made at the beginning of the project life cycle have a far greater influence than those made at later phases since they influence the continuing operating costs and, in many cases, revenues over the project's lifetime. The total project cost is clearly the most important consideration and the one most immediately affected by sustainability issues. It includes life-cycle costs and the initial construction cost ("first cost"), where saving small amounts of money during construction may not be worthwhile if the result is much larger operating costs or not meeting the functional requirements for the project.

It is preferable to introduce sustainability criteria up front to avoid potential conflict later on between purchasing sustainable products and services and securing value for money. Prior to setting a specification, there is little in terms of policy or legislation that limits the scope for taking sustainability into account. Owners, both public and private, have a great deal of scope in drawing up specifications. They can be innovative; they do not need to specify the cheapest product, and are able to purchase environmental-friendly products such as green electricity or energy-efficient equipment in accordance with their own policies and objectives, subject to the need to ensure efficient and effective use of financial resources.

PSM provides tools that assist owners in establishing specification processes which respond to sustainability requirements. It does this by taking established processes and identifying procedures that need to be reinforced or adapted to ensure the application of the four PSM principles:

i) Goal alignment;
ii) Continuous improvement trough information;
ii) Education to empower stakeholders;
iv) Environment for innovation).

For example, for goal alignment, PSM uses a three-stage process (see Figure 1) to establish, adjust and test goals and indicators for the project using a framework which maps back to the whole society issues, goals and priorities of Agenda 21, and the corresponding sustainability indicators developed by the United Nations Commission on Sustainable Development. The project goals and indicators, Figure 2, are made consistent with the vision and goals of the project owner, compliant with Agenda 21, and tailored to local issues, priorities and stakeholder concerns. In other words, they are customised to actual project conditions and requirements while retaining their whole-society scope.

Aside from tender design specifications, specific tools to implement the four PSM principles in project delivery are being developed to handle design flexibility and design control, bid selection and project review in DB projects. Taken together they will ensure that multidisciplinary, integrated design-build teams have the capability to identify and adapt the process needed to ensure delivery of a sustainable project that meets the owners' expectations in terms of quality, cost and performance.

Generic PSM tools for project delivery

In addition to PSM tools for specific procedures, sustainability is incorporated into project delivery by extending general procedures such as those for the auditable general and specific requirements of the ISO 9001:2000 environmental management of projects standard.

Process identification forms the first of the general requirements. It involves a systematic review of processes according to their properties using standard tools such as a process map. PSM requires that all processes address the four PSM principles.

For implementation, the second general requirement, "plan-do-check-cycles" ensure the availability for each process of resources to support operation, monitoring and continual improvement. Once again, the resources available must meet the requirements of the four PSM principles.

Documentation, the third general requirement, calls for three types of documents covering process identification, implementation and the documentation itself. For PSM, documentation will need to show that PSM principles have been interpreted and implemented correctly.

The specific requirements of the ISO standard address processes in four areas, namely strategic processes, personnel management, project realisation and measurement, and analysis and improvement. For each requirement, it is relatively straightforward to identify the process that need to be modified in order that the requirements also cover the four PSM principles.

For strategic processes for establishing, implementing and maintaining a quality management system that meets process-oriented requirements involving the eight ISO quality management principles (customer focus, leadership, etc.), PSM requires that the processes address the four PSM principles. For instance, estimates and allocations specified in resource plans, resource reviews and input verification will be developed using resource management planning and control processes. PSM's education principle requires the introduction of new processes arising from the incorporation of socio-economic issues which are difficult to quantify and subject to the precautionary principle, where resources are set aside in the short term to handle long-term risk. The processes will need to provide: Enhanced input verification, extension of information sources beyond the scope, time scale and geographic scale normally associated with a project, and enhanced networking extending well beyond the conventional project cycle of project conception to demolition or re-commissioning.

As a second example, consider personnel management. This involves the organisational structure, capacity building and allocation of personnel. A project's organisational structure is designed to encourage effective communication and cooperation between all participants using a matrix that defines the structure and shows the stakeholders, the participating organisations and their functions; job or role descriptions, including assignments of responsibility and authority, the quality management function and its relationship to other project functions and stakeholders. PSM's education principle requires that the analysis of projects goals and objectives across all the dimensions of sustainability is organisationally embedded in the project so that all stakeholders can actively participate. Fundamental is the ready availability of accurate information. PSM therefore requires adjustment of all personnel management functions (e.g., the role and tasks of the quality management function must be adjusted to handle interaction between stakeholders), and the resource plan, resource review and input verification must include consideration of the resources needed to organise and develop persons not directly involved in the project.

The complete application of PSM principles to quality management systems for projects provides a powerful and practical approach for implementing sustainability at the project level during all phases of the project cycle. FIDIC's Project Sustainability Management system thereby helps ensure that consulting engineers deliver design-build projects which meet an owner's needs and expectations while making a demonstrable progress towards whole-society goals for sustainable development.

ABOUT THE AUTHOR AND THE ORGANISATION

Peter Boswell has been the General Manager of the Internal Federation of Consulting Engineers (FIDIC) based in Geneva, Switzerland, since 1999. He was born and educated in Kenya and received an MA from Cambridge University, UK, in 1967 and a PhD from MIT, Cambridge, MA, USA, in 1971, both in materials engineering. He worked as an engineer for Boeing and Ford Motor before spending five years in the mining industry as an Australian Research Grants Fellow. He was then Principal Engineer at Johnson Matthey, UK, an Anglo-American company, and head of materials processing at Battelle, Geneva, before joining the European Physical Society, Geneva, as Publications Manager.

FIDIC, the International Federation of Consulting Engineers, was founded in 1913 to internationally represent suppliers of technology-based intellectual services for the built and natural environment. Based at the World Trade Centre 2, Geneva Airport, Switzerland, the federation is charged with promoting and implementing the industry's strategic goals on behalf of 73 national Member Associations representing most of the private practice consulting engineers in the world. These number some 650,000 professionals working in 44,000 firms that provide services on a fee for service basis in a industry with an annual turnover of some US$ 170 billion. Member firms endorse FIDIC's statutes and policy statements and comply with FIDIC's Code of Ethics which calls for professional competence, impartial advice and open and fair competition. FIDIC is widely recognised as the main provider of standard forms of contract for infrastructure and consulting services. These complement a broad range of business practice publications, the organisation of the industry's premier annual conference and a major programme of capacity building training courses and seminars. FIDIC is also charged with representing the industry in contacts with multilateral development banks and international agencies.

ENQUIRIES

Dr Peter Boswell
FIDIC, International Federation of Consulting Engineers
World Trade Center 2, Geneva Airport
29 route de Près-Bois
Box 311
CH-1215 Geneva 15
Switzerland

Tel: +41 22 799 49 00
Fax: +41 22 799 49 01
E-mail: fidic@fidic.org
Web site: www.fidic.org