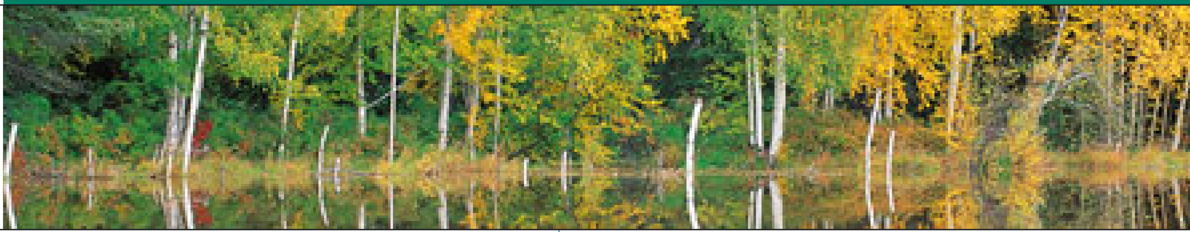
SUSTAINABILITY MANAGEMENT



Project Sustainability Management

INTERNATIONAL FEDERATION OF CONSULTING ENGINEERS

Guidelines

Fédération Internationale des Ingénieurs-Conseils
International Federation of Consulting Engineers
Internationale Vereinigung Beratender Ingenieure
Federación Internacional de Ingenieros Consultores

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foreword

Many owners of projects aim to commit to the principles of sustainable development by building or refurbishing facilities and infrastructure that make more efficient use of resources, protect ecological systems and account for community needs.

However, they need to know if their designs and project delivery processes make a genuine contribution to sustainable development. They ask: "How is the intent to deliver a project that makes a contribution to sustainable development translated into reality, and then measured?"

Goals for sustainable development tend to focus on broad problems and issues facing all of society, such as global warming, biodiversity, access to fresh water, and materials and energy use. While this whole-society focus is absolutely essential, it makes it difficult for project owners to clearly define and specify the requirements for sustainable development.

FIDIC's *Project Sustainability Management Guidelines* address this fundamental issue. In the Project Sustainability Management (PSM) process, the project owner and the consulting engineer balance the owner's project vision against cost and available alternatives, by working together to select appropriate project goals and indicators for sustainable development which are linked back to higher level goals. Stakeholder input is sought throughout the process. Objectives for sustainable development are therefore addressed in much the same way as other project objectives are addressed in the project's quality management plan.

PSM enables project owners and consulting engineers to devise and customize indicators to meet stakeholder concerns and issues, while demonstrating a rigorous, causal link to the fundamental concerns and goals of sustainable development. The approach can be used by firms to demonstrate both their clients' commitment and their own commitment to meeting sustainability objectives. PSM also provides a methodology for benchmarking sustainable development project performance, and for ensuring that advances in one dimension of sustainable development are not accomplished at the expense of another.

FIDIC is proposing PSM as a new area of knowledge management for use on projects, operating in parallel to the conventional areas of quality, risk and business integrity management. Firms will be able to add a new dimension of value to their work by helping clients not only apply new and more sustainable processes, systems and technologies, but also demonstrate effectively their contribution to sustainable development in a way that encourages the sharing of knowledge. It also will help establish an environment for innovation so that all parties can cooperate in an atmosphere of openness, transparency and trust.

FIDIC has had a long and continuing involvement in sustainable development. The Federation has published several guidance documents including *Sustainable development in the consulting engineering industry: a strategy paper* [1] and *Business guidelines for sustainable development* [2]. FIDIC contributed to the United Nations Environment Programme (UNEP) multi-stakeholder consulting engineering industry sector report [3] to the 2002 *World Summit on Sustainable Development*, and sustainable development has been the focus of several FIDIC annual conferences since 1990. Finally, FIDIC collaborates with UNEP, the International Chamber of Commerce (ICC)and the International Council of Local Environmental Initiatives (ICLEI)in the development and dissemination of environment management systems for industrial facilities and for urban administrations.

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contents

1 background

In response to the interest and demands of stakeholders, many organisations in both government and industry are making commitments to the principles of sustainable development. Changes in the way they manage their operations and infrastructure investments demonstrate these commitments. They are starting to build or refurbish facilities and infrastructure using designs and methodologies that make more efficient use of resources and energy, protect ecological systems, and take into account the needs of communities.

As such activities increase in number and importance, several questions arise. How should facilities and infrastructure be designed and implemented in order to make a genuine contribution to sustainable development? How is the intent to deliver projects that make a contribution to sustainable development translated into reality, and then measured? How does one convince stakeholders that true progress toward sustainable development is actually being achieved?

Unfortunately, there is little guidance about what constitutes a sustainable project. For instance, while adding environment-friendly features to a project and increasing stakeholder involvement may improve public relations, they do little to address the real issues of sustainable development.

In the absence of definitive guidance, many non-governmental organisations and public interest groups are applying their own notions about sustainable development to projects and organisations, based on their particular agenda and interests. As a result, project owners, consulting engineers and stakeholders alike have been exposed to a confusing array of indicator systems, each claiming to be a capable gauge of the progress of sustainable development. Regrettably, these systems tend not to provide a clear connection between the overall goals of sustainable development and the projects that move society towards the goals.

1.1 Sustainability management

Recognizing these issues, FIDIC's Sustainable Development Task Force has developed a process for setting project goals for sustainable development and measuring progress towards the goals. Embodied in these *Project Sustainability Management Guidelines*, the Project Sustainability Management (PSM) process ensures that a project's goals for sustainable development are aligned and traceable to goals and priorities that are recognized and accepted by society as a whole. The process is also designed to align goals with local conditions and priorities, and to assist project owners and consulting engineers in achieving and verifying progress toward sustainable development.

1.2 A long journey

Achieving sustainable development will be a long journey, spanning many decades. It will require nothing less than a complete overhaul of our existing systems, technologies and infrastructure, replacing them with approaches that are less energy and resource intensive, use less toxic materials, and protect the environment and society. All this must be accomplished in a manner that is workable in both developed and less-developed countries.

Most of the systems, procedures and technologies needed for sustainable development have yet to be invented. In the absence of major multi-national agreements and investments, progress will be made project-by-project, driven by the objectives, motivations and actions of project owners. It will occur incrementally as new and more sustainable processes, systems and technologies are invented, tested and applied on individual projects.

The retooling of the world's systems, technologies and infrastructure for sustainable development is one of the greatest challenges and opportunities ever offered to the consulting engineering industry. Owners will, by necessity, not only call upon the industry to help them with this conversion, but also expect the industry to provide guidance and services for the assessment of projects.

1 background

A prerequisite for success is an environment for innovation: working conditions in which learning and creativity are fostered and celebrated, where consulting engineers are encouraged to try out new approaches, test new technologies and replace old ways with new and more sustainable alternatives. Openness and transparency are essential ingredients of this environment: engineers and their clients, while observing the achievements of others, must engage their stakeholders in dialogue throughout the project development, design and delivery cycle. To make this engagement an efficient and effective process, the parties must establish a working context based on trust and collaboration.

[We] inhabit the Earth. And we must rehabilitate our one and only planet.
Kofi Annan, United Nations Secretary General

If you don't know where you are going, any road will get you there.
Lewis Carroll

2 introduction

The concept of sustainable development is changing the way people think about development and its effect on the environment and society. It defines a path forward, where society can maintain and improve the quality of life without jeopardizing the ability of future generations to do the same.

The need to make development sustainable is based on sound evidence showing that we are using up critical resources and ecological carrying capacity faster than they can be renewed, replaced or replenished. This is happening at all scales, from local pollution of streams and lakes, to the loss of biodiversity and a warming of the Earth caused by human activities. At the same time, competition for scarce resources involving, for example, water removal from major rivers and aquifers, deforestation and the depletion of fish stocks, causes socio-political conflicts within and between countries. The evidence is viewed by many as sufficient to change our approach to economic growth.

The task facing society is enormous. Achieving sustainable development will be a long journey, requiring a total overhaul of the way we extract resources, produce and consume goods and services, and dispose of unwanted by-products. The foundation of today's economic activity is a huge legacy of facilities and infrastructure: it will take a colossal investment and many decades of the invention and deployment of sustainable processes, systems and technologies to achieve sustainable development.

2.1 The journey towards sustainable development

The journey towards sustainable development was first mapped at the 1992 Earth Summit in Rio de Janeiro. One of the key outcomes from the Summit was *Agenda 21* (see inset). FIDIC believes that the journey will be accomplished incrementally, driven by individual and institutional objectives, international guidance and stakeholder influence. Without an organized, global effort to implement appropriate practices along with substantial technological breakthroughs, progress toward sustainable development will be achieved project-by-project, delivered by project owners and the consulting engineering firms they engage.

Advances will be made by setting and achieving higher and higher levels of project performance. Each new project will build upon the achievements of others; goals will be set by combining experience and innovation, reaching for improved levels of performance. Sometimes the goals will be achieved; sometimes they will be missed. Nonetheless, each attempt will add to society's collective knowledge about what worked and what did not work, enabling it to make the appropriate adjustments.

2.2 Needed: a framework and a process

If progress toward sustainable development is to be achieved, it is essential to develop a framework and a process for setting project goals and measuring progress. The framework ensures that a project's goals are aligned and traceable back to the goals and priorities of *Agenda 21*; the process guides the planning and delivery of projects. The process must:

- Assist the project owner and the consulting engineer in developing practical project goals for sustainable development, striking a balance between the owner's aspirations, stakeholder concerns and the issues of cost and achievability.
- Incorporate substantive stakeholder input throughout the project life-cycle, ensuring that all major issues are addressed.

Agenda 21

Agenda 21 [4] was a 40-chapter, 800-page document which outlined 120 action programmes for achieving sustainable development. The importance of *Agenda 21* was that it detailed for the first time a comprehensive set of goals and priorities for resource, environmental, social, legal, financial and institutional issues. While not legally binding, it was adopted by countries representing 98% of the world's population.

Agenda 21 urged national governments as well as international governmental and non-governmental organisations to identify and develop sustainable development indicators – measures which would enable decision-makers to monitor, assess, diagnose and compare the factors relevant to sustainable development. *Agenda 21* also urged local government to prepare *Local Agenda 21*, "… a plan of action aligned to the problems and issues specific to their communities." By 2001, over 6,000 local authorities in some 100 countries had either made a formal commitment to *Local Agenda 21* or were actively undertaking the process.

- Be open and transparent in terms of goals, stakeholder input and the expectations for project performance.
- Provide mechanisms for feedback, the assessment of results, the benchmarking of sustainability performance, and knowledge sharing.

An essential ingredient for the process is a comprehensive set of goals for sustainable development, and their accompanying indicators, at the project level. These must cover the full range of sustainability issues and enable consulting engineers to measure the specific contributions to sustainable development, all tying back to the goals of *Agenda 21*.

2.3 Critical: an environment for innovation

A prerequisite for success to achieve sustainable development is the creation of an environment for innovation: working conditions in which learning and creativity are fostered and celebrated. In this environment, project owners, observing the achievements of others, are urged to set stretch goals, seeking to establish new and higher benchmarks for sustainability performance. At the same time, consulting engineers are encouraged to try out new approaches, test new technologies, and replace old ways with new and more sustainable alternatives.

Openness and transparency are the essential ingredients of this environment. Project owners and consulting engineers must engage stakeholders in dialogue throughout the development, design and delivery of a project to ensure that stakeholder issues and concerns are fully considered. This process operates in two directions: stakeholders voice their issues and concerns about a project so that they can be incorporated throughout the project life-cycle by the project owner and the engineer; the project owner and the engineer inform stakeholders on the current state-of-the-art and the limitations of what is achievable. To make this an efficient and effective process, all parties must establish an atmosphere of trust and collaboration.

Progress is governed by the ability of engineers to innovate: to imagine, invent, develop, test and apply new processes, systems and technologies. However, in the case of sustainable development, defining the problem is elusive, driven as much by public perceptions as by technological fact. In these changing conditions, progress will be marked by a series of fits and starts, triggered by events and politics, and by investments and accomplishments. The role of the engineer is crucial, contributing logic and structure in a climate of uncertainty and confusion.

2.4 The role of project indicators

While project goals set the direction, project indicators provide the means to measure progress. They enable owners, engineers and stakeholders to gauge progress toward sustainable development by comparing the performance achieved on a project with the intended performance. A comprehensive set of project indicators is also an essential tool for measuring accomplishments, demonstrating transparency to stakeholders and building a knowledge base for professionals. The purpose and use of indicators for sustainable development are summarised in Appendix B.

To function properly, a set of indicators for sustainable development must be:

- grounded in the overarching principles, goals and priorities of sustainable development;
- sufficiently comprehensive to cover all relevant aspects of sustainable development;
- of a size that is manageable and effective for communication;
- capable of being customized in order to align with local requirements and conditions using a process which is open and transparent.

As shown in Figure 1, a project goal can be represented on a sliding scale. Conditions of sustainability are achieved somewhere in the high range, at a goal that varies depending on local conditions, evidence about resources and carrying capacity, and any technological developments that could alter the definition of sustainable development for this particular goal. For example, new knowledge of limitations to ecological carrying capacity could shift the goal to higher levels. In contrast, the invention of a low-cost, energy-efficient desalination technology could alter dramatically the availability of fresh water, and thus reduce the goal to a lower level.

In setting project goals for sustainable development, the project owner has several choices. The owner may do nothing more than apply conventional technology, directing the engineer to implement the current state-of-practice, defined as procedures and technologies normally applied by engineering professionals. In some cases, the state-of-practice often lies on the sliding scale just above some compliance level defined by global treaties, and by local and national laws and regulations. However, in many if not most cases, there are no laws, regulations or treaties associated with project indicators for sustainable development.

The project owner may decide to make a contribution to sustainable development by applying processes, systems and technologies that perform substantially better than conventional approaches. In this case, the owner and the engineer may assess:

- what others have accomplished on similar projects;
- new processes, systems and technologies that hold promise for setting new levels of performance.

Once this assessment is complete, the project owner and the engineer can set goals for performance in one or more aspects of sustainable development, as measured by the corresponding indicators. Here, they may decide to match what others have accomplished on similar projects. Alternatively, they may attempt to set new levels of performance using new, but relatively untried, approaches. As the project progresses, the indicators will enable the owner and the engineer to measure and record performance.

Each success in the application of more sustainable processes, systems and technologies will raise incrementally the definition of the best-in-class. With repeated use, applications once considered advanced are reclassified as state-of-practice, driving up the specification of the state-of-practice. Over time and given the right environment, the range of implementation choices moves towards the high end of the scale, eventually achieving sustainable development.

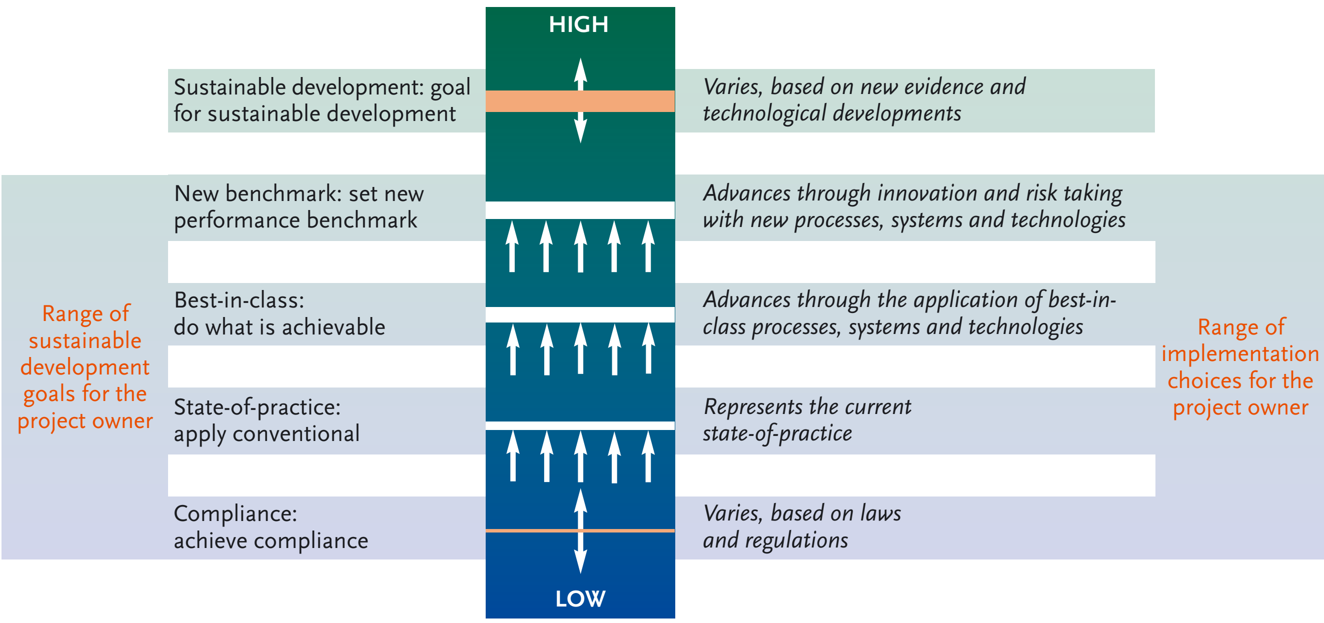


Fig. 1: Project goals for sustainable development

2.5 The FIDIC approach

Following the Earth Summit, the United Nations empowered its Commission on Sustainable Development (CSD) to develop a set of indicators for sustainable development to measure and calibrate progress towards goals based on the issues, goals and priorities identified in *Agenda 21*. The CSD created a list of indicators organized according to a framework of themes and sub-themes that could be traced back to *Agenda 21* [5]. The CSD indicators aimed to translate the *Agenda 21* goals into a form accessible to decision-makers at the national level, to be used as guidance in crucial decision-making.

If progress toward sustainable development is to be made on a project-by-project basis, then the CSD indicators must be translated into project-level indicators which are comprehensive and contain all of the key components of sustainable development. Omission of any one of these components will distort the evaluation and call into question the project's value and contribution. As an example, a project might reduce the amount of water used by increasing energy consumption or the quantity of toxic materials. So the failure to include all of the components would achieve one sustainability goal at the expense of others, resulting in minimal or negative progress.

While ensuring that progress in one aspect of sustainable development is not made at the expense of others, project sustainability indicators also serve as guideposts and benchmarks, showing what others have achieved, and inspiring everyone to set new and higher levels of performance.

2.6 Status of sustainability indicators

Organisations including the United Nations, standards institutions, labour unions, national and regional governments, local authorities, financial organisation's and public interest groups have understood that new measures and criteria on which to gauge the current status and progress will be required if society is to advance sustainable development. Many have proposed sets of indicators based on *Agenda 21*, but reflecting their needs and perceptions.

Some of these indicator sets, classified by the intended purpose, are listed in the inset below. Some aim to measure whole-society conditions of sustainability. Others are used as investment tools, where a firm's commitment and performance with respect to sustainable development are seen as leading indicators of financial performance. Still others are used to measure an organisation's

Sustainable development indicator classifications

Name	Description	Examples
Whole-society indicators: sustainability of a particular geographic region or political unit		
Global	Overall assessment of the current state of the world, mapped to *Agenda 21*	UN CSD, PAGE, Millennium Assessment, Ecological Footprint,
Regional/local	Response to Local *Agenda 21*: assessment of factors determined to be important for the local population	Pastille, Sustainable Seattle, Santa Monica, NRTEE
Organisation-based indicators: sustainability of the operations of an organisation		
Industry/NGOs	Indicators of how an organisation is performing in terms of a set of indicators for sustainable development	Global Reporting Initiative
Investor-based indicators: correlation of corporate sustainability with financial performance		
Project risk assessment	Principles, processes and indicators for assessing project risk	The Equator Principles
Financial performance	Any published index that tracks the financial performance of companies that have committed to sustainability principles	Dow Jones Sustainability Index FTSE4Good, Innovest, EcoValue21
"Green" funds	Funds holding investments in companies which they believe will have better than market returns owing to commitment to sustainability	Domini Social Equity Fund, Triodos Bank, SAM
Project-based indicators: assessment of a project's contribution to sustainability		
Project screening	Indicators for screening projects as to their likelihood of achieving sustainability outcomes	World Bank, The Equator Principles
Project performance	Contribution a project makes towards sustainable development Includes efforts made in the construction phase	SPeAR, CRISP, BEQUEST, LEED, CH2M HILL's 4-step screening

performance against its vision of sustainable development. Finally, indicators based on a qualitative rating of projects are used to highlight areas of exceptional performance or needing improvement. All of these indicator sets have an appropriate place and application. However, they do not explicitly and fully connect projects back to the fundamental issues, goals and priorities of *Agenda 21*.

2.7 Project Sustainability Management

In relating whole-society sustainability indicators to project-level indicators, FIDIC has recognized that sustainable development:

- Demands a whole-society concept
  Any attempt to measure a project's contribution to sustainable development must be based on complete and accepted principles of sustainable development.
- Represents a moving target
  Perceived problems and issues will be altered substantially by the course of events and the emergence of new knowledge. Furthermore, it is likely that changes will occur within the life-cycle of typical projects. Thus, both the quantitative magnitude of an indicator and the indicator itself that are established at the start of a project will likely be very different from those found later at deconstruction, decommissioning or renovation.
- Depends on the location
  Many issues and impacts for sustainable development that are significant in one part of the world may be unimportant in another. Others such as climate change, ozone depletion and deforestation are ubiquitous.
- Requires an environment for innovation
  Progress can only be made if consulting engineers have the freedom to explore, invent, test, apply and evaluate promising processes, systems and technologies that offer better and more sustainable performance. This requires a high degree of openness and transparency in order to foster understanding among the stakeholders, and knowledge development and sharing among engineers.

These *Project Sustainability Management Guidelines* describe how project owners and engineers can incorporate the principles of sustainable development into individual projects. FIDIC's Project Sustainability Management (PSM) system has two components:

- A framework of goals for sustainable development and the corresponding indicators, both of which map back to the issues, goals and priorities of *Agenda 21*.
- A process for setting and amending project goals and indicators, making them consistent with the vision and goals of the project owner, compliant with *Agenda 21*, and tailored to local issues, priorities and stakeholder concerns.

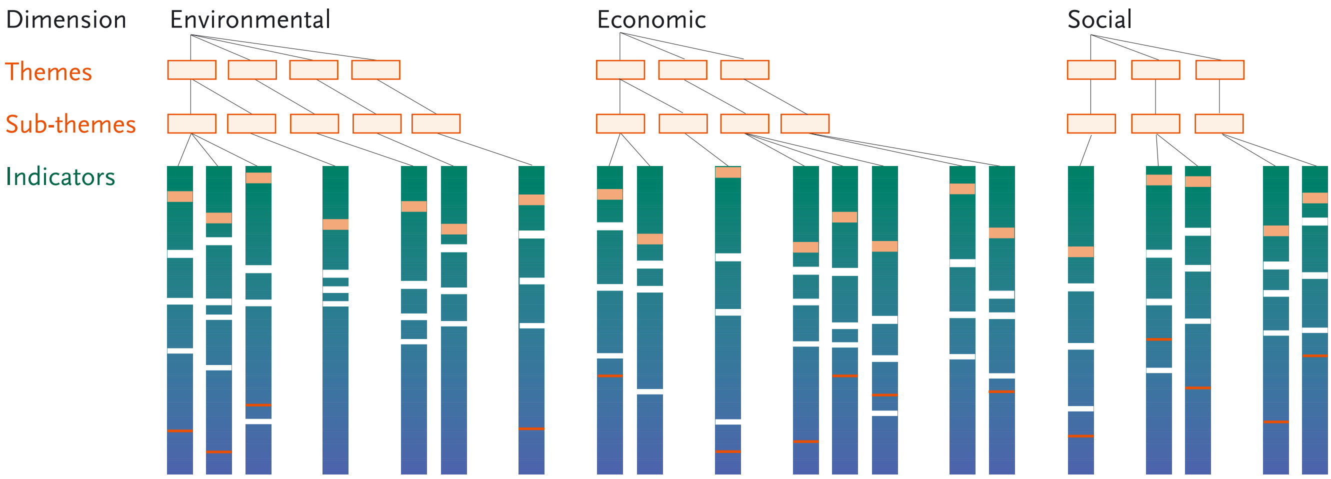


Fig. 2: Conceptual framework for sustainable development project indicators

FIDIC has therefore developed:

- A set of core project goals and indicators for sustainable development, organized in a framework which aligns with *Agenda 21*.
- A process to amend these goals and indicators, allowing them to be customized to actual project conditions while retaining their link to *Agenda 21*. The process addresses the life-cycle of the project, from concept development through to design, construction, operation, deconstruction and disposal. In this sense, project sustainability goals and indicators become part of the overall project delivery process.

The PSM framework is illustrated in Figure 2. Sustainable development issues are divided into dimensions: environmental, economic and social. For each dimension, the issues are organized into themes and sub-themes. Each sub-theme is associated with one or more indicators of sustainable development, where each indicator is characterised by a sliding scale referenced to to the current state-of-practice, applicable laws and regulations, and goals. PSM differs from other approaches in that:

- A user can customize the set of project indicators based on an indicator's relevance to the project scope, conditions and context while maintaining a close connection to the whole-society issues, goals, and priorities of sustainable development.
- The process takes into account advances in the state-of-practice, and the setting of new benchmarks for sustainable performance, through invention and successful application leading to changes in the capabilities of processes, systems and technologies.
- The process provides a mechanism for establishing performance benchmarks, comparing the achievements of others and setting ever higher goals. It therefore recognizes that although sustainability issues are well established, approaches for dealing with them are evolving very rapidly.

2.8 Why use PSM?

For a project to make a valid and verifiable contribution to sustainable development, it must be designed and delivered in a way that produces a measurable, net, positive impact across all dimensions of sustainability throughout the project life-cycle. This is not an easy task. In the absence of overall guidance, governments, NGOs, public interest groups and others have produced many measuring systems for sustainable development. Being based on a narrow focus, they are difficult to relate to the balancing of alternatives that takes place in real projects, and may even create conflicting targets. In contrast, PSM starts with a broad set of goals and indicators, grounded in the widely accepted principles of sustainable development. Using PSM in conjunction with quality assurance and project management, project owners and their engineers can modify the goals and indicators to reflect local conditions, as well as the range of potential solutions.

The value of PSM to a project owner is substantial. The starting point – the core set of goals and indicators – is virtually unassailable because it is founded on the original concepts of sustainable development. Moreover, it recognizes the realities of sustainable development:

- The fact that progress will be incremental and perfection elusive.
- It focuses on achieving incremental improvements based on the accumulation of knowledge and experience through innovation.
- It allows the project owner to demonstrate a contribution to sustainable development in a way that is both transparent and verifiable.

The value of PSM to consulting engineers is also substantial. In order to effectively respond to the challenge of sustainable development and to meet project owner needs, the engineer gains a deep understanding of a project owner's objectives over a project's entire life-cycle. This creates a close relationship with the client, and an innovative environment that enables the engineer to deliver services which are based on quality and a special knowledge of sustainable practices and technologies. PSM also adds a new dimension of project management covering processes related to indicator development and application, and operating in parallel with the established areas of cost, time, scope, human resources, risk, procurement, communications and quality management. It expands the engineer's scope of services, enabling the industry to add sustainable development to its portfolio of client service offerings.

3 Project Sustainability Management

Project Sustainability Management (PSM) offers a process for establishing, demonstrating and verifying a project's contribution to sustainable development. If a project owner wishes to incorporate goals for sustainable development into a project, PSM provides a process by which the goals can be credibly established in concert with accepted whole-society goals and priorities. Progress towards the goals can be measured and verified against the underlying social issues, problems and priorities.

The process is designed to be highly transparent in order to create and maintain stakeholder trust. It is recognized that progress towards sustainable development will only happen if project owners, engineers and stakeholders work together, creating and applying new and more sustainable processes, systems and technologies.

PSM addresses a broad range of issues (see inset). The management of these issues integrates naturally with project management systems based on the ISO 9001:2000 international standard for quality management. Such systems are process oriented, so incorporating the processes which are required for the successful development and implementation of project indicators is simple and direct.

3.1 Project indicators

Indicators are observed or calculated parameters that show the presence or state of a condition or trend. They are the tools for measuring and monitoring progress towards goals, providing a basis for judging the extent to which progress has been made, or corrective action is required. They are also an important management tool for communicating ideas, thoughts and values. As the United Nations CSD observed, "We measure what we value, and we value what we measure." The role and characteristics of indicators are summarised in Appendix B.

Indicators for sustainable development are typically built in a two-step process. The first step involves mapping goals for sustainable development to the themes and sub-themes that will be addressed. The framework therefore ties indicators for the various themes to overall objectives defined in the global context. Such a framework helps in:

- stimulating proposals about what should be measured;
- categorizing issues and organizing ideas;
- establishing a common vocabulary.

The second step uses a series of conceptual models to map themes and sub-themes to indicators, thus ensuring that indicators refer back to global objectives, but are project specific in detail. The models describe the performance of the project for each sub-theme in terms of measurable parameters. These parameters summarise the cause and effect relationships within the context of the project, and ensure that the selected indicators measure project performance. Indicators are chosen for a particular project if they influence outcomes and respond to changed external factors.

As an example, the framework for a global objective of improved health might include the sub-theme *Drinking water*, with a conceptual model that, if safe drinking water were available to a larger percentage of the population, global health would improve. The indicator then becomes *The percentage of the population having access to clean drinking water*. For a project in the developed world, this would involve issues related to maintaining the quality of water coming out of taps in each building. For the developing world, the level of improvement might be more rudimentary, perhaps involving a community source of clean water. For the latter, it would clearly be advantageous to engage the community in a dialogue about the feasibility and applicability of the systems and approaches to be used, and the indicators that would be chosen to describe the outcome of the project.

Project Sustainability Management issues

- How to integrate a project owner's goals for sustainable development into a project.
- How to show the connection between the achievements of a specific project and whole-society goals and priorities.
- How to create and maintain transparency in the development of goals and indicators.
- How to incorporate the goals and needs of a wide range of stakeholders.
- How project goals and indicators affect project objectives and design.

Core project indicators

The starting point for PSM is a core set of themes, sub-themes and project indicators for sustainable development, derived from national and international goals and targets, tied to the original whole-society objectives of *Agenda 21*, reworded and adjusted to make them relevant to projects.

The framework is the same as the UN CSD framework comprising four dimensions: social, economic, environmental, and institutional. The CSD applied the model that indicators should define the driving force, state and response to each relevant issue for the four dimensions. This model gave a set of 134 indicators which was reduced to 65 indicators organized into 38 sub-themes by applying a second model, namely that indicators should relate directly to national policies [5].

3.3 Project-specific indicators

As summarised in Appendix A, the PSM core set of 45 project indicators is obtained by applying a further model, namely that each indicator must a) contribute significantly to *Millennium Development Goals* [6]; and b) be redefined in the project context in order to make it relevant to project activities.

One outcome is that indicators for the institutional dimension do not appear in the PSM core set since none of the CSD indicators for this dimension are relevant to most projects. It should be noted, however, that the list of PSM core indicators in Appendix A includes the original UN CSD indicators. Users can refer to Appendix A for additional indicators.

Another outcome is that the UN CSD indicator *Percent of population living below the poverty line* is redefined as the PSM core project indicator *Proportion of local workers or firms employed on the project*. In this example, the project owner and the engineer can affect the percent of the population living below the poverty line by employing local workers and firms.

In the PSM process, the list of core project indicators can be modified and expanded in a series of steps, applying local indicators for sustainable development and stakeholder input. The process does not, however, allow an indicator to be deleted or materially modified if it seen as being germane to project sustainability.

4 PSM implementation

The Project Sustainability Management (PSM) process for defining and implementing project goals and indicators for sustainable development can be referred to quality management for projects involving the classic PLAN - DO - CHECK - ACT cycle, illustrated in Figure 3.

The project owner and consulting engineer work together at the early design phase of the project to plan and develop a set of project-specific goals for sustainable development. As shown in the inset below, this first step takes place in three stages and involves establishing, adjusting and testing project goals and indicators.

Once agreement is reached on a set of project indicators, the engineer and the project owner develop and apply an implementation plan to satisfy the remaining steps in the quality management cycle. The inset on page 12 describes how the implementation of project sustainability will have a major influence on all of the main elements of a quality management system for projects. It summaries, for each of the quality management processes, the impacts, issues and concerns that must be taken into account when defining and implementing indicators.

The following sections describe in detail how indicators are developed in the three stages and then applied by drawing up an implementation plan.

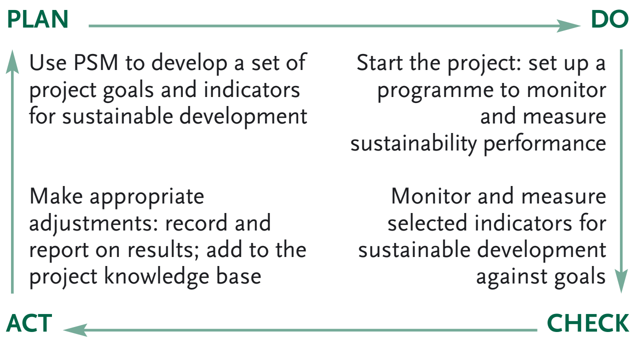


Fig. 3: Incorporating PSM into project quality management

Project Sustainability Management process

Stage	Activity
1	**Establish project-specific goals and indicators for sustainable development** Establish the project scope and setting assumptions Determine the owner's vision, goals and objectives Identify and engage key stakeholders
2	**Adjust goals and project indicators to local conditions** Incorporate applicable safeguard policy considerations Identify and incorporate *Local Agenda 21* or other local indicator development activities
3	**Test and refine project goals and indicators** Test project indicator functionality Refine goals based on systems integration considerations Refine indicators to align with applicable regulations, and protocols
4	**Use project indicators during project implementation, operation and decommissioning** Indicators are used for project management, feedback and adjustment, and for project evaluation

Impacts on quality management

Quality element	Description	Sustainability impacts, issues & concerns
Strategic processes		
Customer focus	Meet project owner requirements Strive to exceed expectations Achieve client satisfaction	Performance of sustainable processes, technologies is not fully predictable Need to carefully manage client expectations
Leadership	Establish unity of purpose & direction Fully involve people in the organisation	Need to establish an environment for innovation inside the organisation & with project stakeholders
Process approach	Manage activities & related resources as a process Identify & document	Traceability & documentation are important for stakeholders for trust & transparency
Continuous improvement	Collect & analyze information gained during a project for use in a continual improvement process	Critical component for improving sustainability practices & technologies
Factual approach to decision-making	Conduct project evaluations & closure reports Use information on future projects	Critical component for improving sustainability practices & technologies
Mutually beneficial supplier relationships	Work with suppliers Benefit from supplier knowledge	Crucial knowledge about sustainability aspects of materials, energy & product performance
Resource management		
Resource planning and control	Identify resource needs Ensure sufficient resources are available	The use of recycled & non-conventional materials & employing new processes & technologies from non-traditional sources adds risk
Personnel	Create an environment where personnel can contribute Encourage effective communication Manage relationships with customers & stakeholders	Need to establish an environment for innovation inside the organisation & with project stakeholders Effective communication with stakeholders is important for building trust Requires new skill sets involving sustainability
Product realization		
Project management plan	Establish a project management plan & a quality plan to fulfill contract requirements. Plans to monitor progress	Need to clarify expected results Processes & technologies employed are new & unconventional
Change management	Identification, evaluation, authorization, documentation, implementation, control of change activities	Implementing new, processes & technologies for sustainable development is a learning process: expect change; set up a programme to learn from unexpected results
Closure	Close out project processes Review & document project performance	Detailed reports about the implementation of sustainability processes & technologies are an important component of learning
Scope	Document project requirements, scope, activities, duration, schedule	Scope can extend throughout the project life-cycle: development, planning, design, construction, operation, de-construction
Cost	Cost estimates should consider all information, trends, past experience Establish cost control system	Cost estimates for new processes & technologies for sustainable development are generally not available or highly variable
Communication	Establish appropriate communication processes Understand audiences Identify & manage information needs	Communication with multiple stakeholders Need to build trust & transparency Create an environment for innovation
Risk technologies	Risk identification, assessment, treatment	Working with new processes & control Performance information is not well documented, or may be unknown Developing performance information may be a project objective
Measurement, analysis & improvement		
Measurement & analysis	Effective data measurement, collection & validation	Essential for judging & validating sustainability performance of processes & technologies
Continual improvement	Collect relevant information on performance Validate & verify Highlight experience that can be used elsewhere	Essential step in learning & transferring knowledge about the levels of sustainable performance achieved & the lessons learnt

4.1 Establish project-specific goals and indicators for sustainable development

During the early planning and design phase of the project, the project owner and the engineer work together to incorporate goals for sustainable development into the project scope, and to align the goals to the owner's overall vision for the project. Key stakeholders are identified and engaged and the owner and the engineer review what others have achieved in terms of goals for sustainable development, and the new processes, systems and technologies that have emerged.

Establish the project scope and setting assumptions

This stage aims to obtain a detailed understanding of the nature of the project, its scope, setting, intended use, etc, and of its potential economic, environmental and social impacts. The work carried out assumes that the project owner has conducted a project risk analysis and has determined that there are no known or anticipated conditions or circumstances that could stop the project.

The project manager uses the PSM core set of goals and indicators for sustainable development as a checklist to make sure that the project is sufficiently well defined in order to assess all aspects of project sustainability. Some aspects concern physical features of the project, for example the constructed works, including

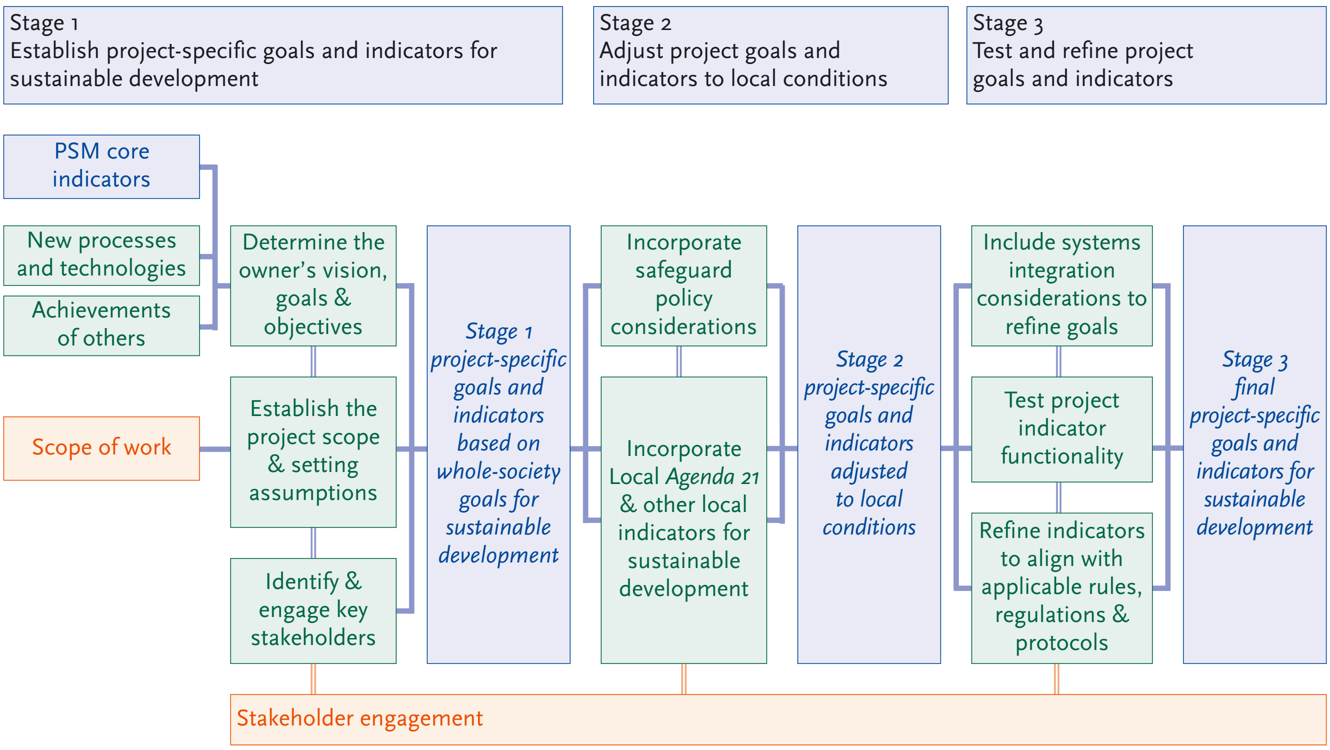


Fig. 3: The Project Sustainability Management process: goal and indicator determination

the expected usable life, operation, maintenance requirements, and disposition at the end of the constructed works' life. Others refer to materials and energy flows. Still others refer to the behaviour of users. A partial list of these information requirements is given in the inset below.

Information requirements

Detailed project scope
System boundaries, both physical and temporal (life-cycle)
Affected environments, habitats or other environmentally sensitive areas
Groups affected, both positively and negatively, by e.g., employment, involuntary displacement or resettlement, etc.
Affected cultural heritage sites
Life expectancy of the constructed works
Requirements for servicing, maintenance and refurbishment
Demolition, deconstruction, recovery, recycling, disposal
Energy consumption and related impacts such as greenhouse gas emissions
Materials usage
Energy changes and evolution of energy chains
Expected use of the facility
Access to transport

Determine the owner's vision, goals and objectives

What does the project owner want to accomplish in terms of sustainable development? The engineer should work with the project owner to determine the economic, environmental and social goals for the project. The owner may have specific sustainability goals in mind, such as saving water, providing a variety of mobility options, or employing alternative energy resources.

In this stage, the project owner's vision, goals and objectives for project sustainability are compared against the PSM core set of project indicators to make sure that the elements of sustainable development the owner intends to pursue can be matched to the indicators. It is important to recognize that project planning and design decisions made at this stage will have impacts (see inset below) during the project life-cycle, that is, through construction, operation, and deconstruction and disposal.

Since progress toward sustainable development will be accomplished by individual projects, the project owner may wish to stretch the project's goals beyond what has been accomplished, creating new benchmarks for performance in one or more dimensions of sustainable development. To these ends, the owner may want to make improvements on current sustainable performance, that is, apply some new process, system or

Impacts of planning and design decisions at various phases of the project life-cycle on sustainable development

Project life-cycle phase				
Development	Planning, siting, design	Construction	Operation	Deconstruction, disposal
Decision				
Location Function Partnerships Financing Cost	Recycled materials use Openness of design Natural lighting use Access to transport	Recycling Disposition of construction waste	Energy efficiency Indoor air quality Materials use	Building reuse Ability to recycle building materials
Impact				
Access Quality User-occupant efficiency User-occupant comfort Community contribution	Materials intensity Energy efficiency User-occupant efficiency User-occupant comfort	Recycled materials use Construction environmental footprint	Occupant efficiency Occupant productivity	Resale value Redevelopment potential

Adapted from [7]

technology which achieves higher performance than has been achieved previously.

If the project owner is seeking to advance current levels of sustainable performance, the consulting engineer and the owner should work together to:

- Benchmark the performance of other projects
  Locate other relevant projects and learn what others have achieved; identify the indicators and methods of measurement used to track performance.
- Evaluate proposed processes, systems & technologies
  Perform an evaluation of the selected new approach based on the principles of sustainable development.
- Incorporate the appropriate performance indicators
  Add or modify the current set of project indicators for sustainable development to accommodate the benchmarking indicators for the proposed technology application. Additional indicators may be needed to capture important performance information regarding the application of a new technology or technique.

In working together early in the design phase, it may be useful for the engineer and the project owner to apply the concepts of eco-efficiency to the design of the project (see inset below). It is also valuable to undertake an interdisciplinary planning process involving the key stakeholders (called a “design

Eco-efficiency checklist

The seven principles of eco-efficiency are a useful starting point for embarking on the journey towards sustainable development. They offer new perspectives and ways of rethinking how products are made or services are delivered. The table lists ideas for innovation based on the principles.

Reduce the material intensity of goods and services

Can the consumption of water be reduced?
Would the use of higher quality materials create less waste at the later stages of the project?
Can waste be reused on site or transported elsewhere for reuse?
Can products or services be combined to reduce overall materials intensity?
Can packaging be reduced or eliminated?

Increase the service intensity of products

Can one work with project owners to improve the service intensity of their business model, i.e., find ways to sell more services associated with the product instead of selling the product itself?
Can one add more knowledge content to the services being sold?
Can one leverage knowledge of the owner’s business to reduce the owner’s costs or reduce waste?
Can one expand the scope of services to meet increased stakeholder needs?

Enhance material recyclability

Can waste be remanufactured, reused or recycled?
Can one specify products with high-recycled content?
Can one design the facility or infrastructure giving consideration to reuse, flexibility or recycling?
Can one consider ease of deconstruction and materials recovery in the design and operation of the facility or infrastructure?

Reduce the energy intensity of goods and services

Can one find ways to employ renewable energy?
Would the use of different materials reduce energy usage?
Can one use waste heat from one process to supply another?
Can building energy use be monitored and controlled?
Can transport needs be reduced or systems made more efficient?

Reduce toxics dispersion

Can toxic substances be totally eliminated from a process?
Can waste and emissions be reduced during the project construction phase?
Are there ways to better handle harmful materials during the construction phase?
Can one specify products with a low toxic or harmful substance content?

Maximize the sustainable use of renewable resources

Can one specify products made with resources certified as sustainable?
Can one design facilities and infrastructure making maximum use of passive heating and cooling?
Can one employ renewable energy sources in the design?

Extend product durability

Can one incorporate durability considerations in designs?
Can one design the facility and infrastructure for ease of maintenance?
Can one design in a high degree of flexibility?

Adapted from [8]

charrette", see inset below). New ideas generated from this effort may require new or modified goals and indicators to track performance.

Identify and engage key stakeholders

In the past, companies recognized a limited number of groups – shareholders, employees, regulatory agencies, the financial community, and a few others – as legitimate stakeholders. Today, the situation has changed considerably. Enabled by information technology and telecommunications, many non-governmental organisations and activist groups are emerging with new powers of communication and information acquisition. If they see fit, these organisations can use the power of the media and the Internet to communicate what they perceive as misbehaviour. In effect, these groups set the de facto standards for governmental and non-governmental behaviour. They can have a strong impact on an organisation's reputation, and a corresponding impact on its financial performance.

It is the same situation with projects. The organisational performance of the project owner is judged in part by the projects the owner commissions, constructs and operates, and can thus be the subject of inquiry for stakeholder groups. It is therefore important that the owner and the engineer identify early on the key stakeholders for a project, understand their issues and information needs, and establish a set of project indicators which meets the needs. Situations where the interests of local stakeholders run contrary to the perceived interests of society as a whole are a recognized source of conflict. Some useful tools for stakeholder engagement are provided in Appendix E.

4.2 Adjust project goals and indicators to local conditions

Goals and indicators established in the first stage are modified to reflect local conditions and concerns, particularly those of low and middle income countries.

Incorporate applicable safeguard policy considerations

If the project is located in a low or middle income country defined by The World Bank *Development Indicators Database* [10] as incorporated in *The Equator Principles* (see Appendix C), then additional indicators should be developed to reflect the special concerns and policy safeguards applicable to developing countries. These concerns include natural habitats, pest management, forestry, dam safety, indigenous peoples, involuntary resettlement, cultural property, child and forced labour, and international waterways [11].

In addition to safeguard policies, additional consideration should be given to local resources and the capacity to understand and apply policies pertaining to sustainable development. Without this understanding,

Design charrettes

A design charrette is an intense and rigorous planning and design process conducted over a relatively short period of time. It involves a group of professionals from the project disciplines working together in a collaborative process to create a workable design.

Openness and stakeholder involvement are essential ingredients. Cross-disciplinary teams working with stakeholders produce design solutions that are the product of many views and much experience. The compressed time schedule inspires creativity and discourages debate that is not relevant. A well-run design charrette can bring about significant change as the participants come to a new understanding of the problems and issues involved in the project.

National Charrette Institute

The US National Charrette Institute [9] recommends a four- to seven-day session in order to accommodate several stakeholder testing and feedback sessions.

After initial research and preparation, the process starts with a public workshop designed to educate all participants and elicit the stakeholder's vision of the project. The charrette team ("charrette" comes from the French word meaning "cart") then develops several alternative designs and presents them in a second public meeting. Input is used to refine the alternative designs into a single design and implementation plan. Additional planning and stakeholder meetings are conducted after the charrette is completed in order to continue to refine the plan.

certain categories of issues may dominate discussions with stakeholders, perhaps to the exclusion of all others, no matter what their importance to sustainable development happens to be.

In working in low and middle income countries, consulting engineers should be careful to understand the context in which PSM is applied, making sure that local priorities are being addressed, but within the context of the core project indicators for sustainable development.

For example, in some countries, many if not most project owners and engineers have not been equally exposed to all aspects of sustainable development. Currently, social and socio-economic issues are receiving considerable attention while environmental issues are not.

Incorporate local indicator activities

The locality in which the project will be delivered may have developed its own set of whole-society indicators in accordance with Chapter 40 of *Agenda 21* (see [12] for a survey of Local *Agenda 21* processes). If this is the case, the consulting engineer should locate the indicator set and use it to develop project-specific indicators. The engineer compares the local indicators for sustainable development to the PSM core indicators, adding any local indicators that are not present in the core set, or modifing the set to obtain better agreement with the local indicators.

Even if no Local *Agenda 21* processes are underway, the engineer should still check with local government officials and organisations representing stakeholders to identify other activities related to local indicators for sustainable development

The outcome of this stage is a set of indicators for sustainable development based on the PSM core set of indicators, but modified to make them relevant to local problems and conditions. The indicators must have a substantial level of endorsement from local government officials and/or key stakeholder groups.

4.3 Test and refine project goals and indicators

The project owner and the engineer will have established a set of project goals for sustainable development and a corresponding set of project indicators, reflecting the owner's vision of the project and modified to reflect local conditions and sustainable development goals. In the third stage of the PSM process, the owner and the engineer will make three additional refinements to these goals and indicators.

Test project indicator functionality

Once the indicator set is complete, the project owner and the engineer should review the set and test each indicator to see if the PSM process has produced a sensible and workable set. The Pastille Consortium [13] three-part analysis (see inset below) stimulates different

The Pastille analysis

- Characterise the indicator profile
  At what level are the project indicators in use: strategic, programme, project?
  Within which tools are the indicators operating?
  What is the indicator typology?
  What is the purpose of the indicator system?
  Who are the stakeholders relevant to the project's indicator system?
  What is the role of the project indicators?
  Are stakeholders supportive, neutral or obstructive?
  How can stakeholders become more supportive of the project's indicators?
- Define the arena of action
  Define the extent of the arena for action, to better understand the factors, both positive and negative, that affect the use of the indicators. Issues include:
  - stakeholder identification, engagement, communication, trust and cooperation;
  - ease of data collection;
  - indicator linkage to targets and thresholds;
  - how indicators are used to make decisions.
- Illustrate the arena of action
  Interpret and present the results of the analysis by plotting results on a radar chart as a way of comparing each dimension of the evaluation.

The analysis may reveal problems with the set of project specific indicators. The consulting engineer and the project owner should conduct a final review of the indicator set and make any necessary modifications.

ways of thinking and a better understanding of the context in which the indicators will operate, and ultimately identify indicator strengths and weaknesses.

System integration considerations to refine goals

In the design and delivery of a project that advances the state-of-practice across all dimensions of sustainable development, the consulting engineer will draw upon several processes, systems and technologies. It is important for the engineer to consider how these individual elements will work together to achieve the desired outcome. The elements are cross-checked to make sure that the interferences are minimized. It may be necessary to change the goals for sustainable development established earlier to accommodate these integration considerations.

Refine indicators to align with applicable rules, regulations and protocols

For some projects, client organisations, associations, local authorities and other institutions may require the application of existing project indicator sets that relate to sustainable development. Furthermore, for reasons of overall image and reputation management, competitiveness, or as part of the overall enterprise strategy of the organisation, the project owner may want to apply a specific reporting or appraisal protocol (the inset below gives examples).

Reporting and appraisal protocols

The set of PSM indicators may be adjusted to align with reporting and appraisal protocols.

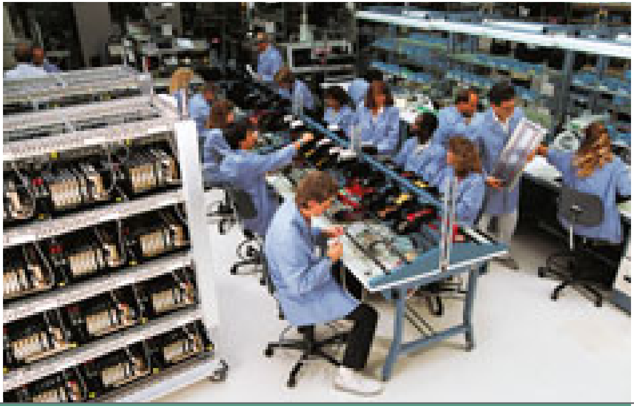
- Global Reporting Initiative
  Some clients have made it a policy to report their sustainable development performance in conformance with the Global Reporting Initiative guidelines [14].
- LEED certification
  The project owner may want to achieve a certain certification level for one or more of the buildings or facilities in the project. The project indicators may therefore need to be modified or suplemented to match, say, the LEED system (in the US, new facilities for the Department of Defence must meet a certain level of LEED certification [15]).
- SPeAR
  The project owner may want to modify the project indicators to match the SPeAR appraisal model [16].

4.4 Use project indicators during project implementation, operation and decommissioning

The plan to implement project-specific indicators consists of methods and schedules for measuring and assessing numeric quantities for indicators, and reporting the results to a defined constituency. The reporting schedules should match other reports related to sustainable development that the project owner produces.

In addition to producing reports, additional effort should be made to review results periodically so that the project owner and the engineer can detect unforeseen problems with either the indicators themselves or the values being generated. Unexpected results, or values greatly out of line with pre-set thresholds, should be noted and reported to the project owner.

Throughout the course of the project, indicators, methodologies and measuring schedules are reviewed regularly and the results assessed. Sustainable development issues and the corresponding indicator frameworks are in a constant state of change because of new information, issues and values. The review process should be incorporated into the project owner's management processes. As an example, the lifetime of a project, that is from project concept through design and construction to decommissioning, might be measured in tens of years. It is a virtual certainty that the concepts of sustainable development and what constitutes appropriate and sustainability technology will have evolved considerably during the period.



5 the path forward

Project Sustainability Management can make a substantial contribution to progress towards sustainable development. Over time, PSM will provide valuable support to consulting engineers when designing and delivering projects that improve conditions of sustainability.

However, these guidelines are by no means the final word on the subject. PSM is by its very nature and construction an evolving system that will change as society improves its understanding of the issues of sustainable development. FIDIC intends to follow this evolution closely, making changes to PSM as knowledge and experience improves.

FIDIC initiatives

Communication and collaboration with stakeholders

FIDIC will work with interested and affected stakeholder groups, and continue to refine its core indicators as well as the PSM process. Specifically, FIDIC seeks to improve the processes for engaging key stakeholders, creating and measuring indicators, developing sustainable development goals, adapting sustainable development goals and indicators to developing world conditions, and testing indicator functionality.

FIDIC is especially interested in the work of national and international organisations engaged in developing sustainable development indicators, including the United Nations Commission for Sustainable Development, The World Bank, the World Business Council for Sustainable Development, the International Standardization Organisation, International Council for Local Environmental Initiatives, and the Global Reporting Initiative.

Expansion of the knowledge base

FIDIC will work to expand the knowledge base for sustainable practices. One of the values of PSM is that it provides a foundation for expanding society's knowledge about sustainable development including:

- how to measure and assess progress;
- the performance of sustainable processes, systems and technologies;
- lessons learned during implementation;
- experience in sustainable system integration;
- existing or proposed codes, regulations, policies and protocols which affect progress towards sustainable development.

Such a database will be an invaluable tool for the consulting engineering industry.

Education and dissemination

FIDIC will develop and disseminate, in conjunction with these guidelines, a set of tools and training materials to be used in seminars for member firms. These seminars aim to educate consulting engineers on how to apply the PSM process to their projects.

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A FIDIC Project Sustainability Management core project indicators

FIDIC PSM core project indicators are derived from the UN CSD indicators which refer to *Agenda 21* issues. The numbers in brackets give the *Agenda 21* chapters for the social (SO), environmental (EN) and economic (EC) dimensions. The table also gives the theme and the indicator description for each UN CSD indicator. The FIDIC PSM core project indicators are labelled "SO-01", etc. or are indicated as "n/a" if they are not applied.

Dimension	Theme	Sub-theme	Indicator description	Relevance to projects	Core project indicator	Code
SO	Equity	Poverty (3)	Percent of population living below the poverty line	Contribution to employment; hiring local firms, workers	Proportion of local workers, firms employed on the project, as compared to other workers, firms	SO-01
SO	Equity	Poverty (3)	Gini index of income inequality	Owner & engineer have little or no control	n/a	
SO	Equity	Poverty (3)	Unemployment rate	Contribution to employment; hiring local firms, workers	See SO-1	
SO	Equity	Gender equality (24)	Ratio of average female wage to male wage	Establish hiring & wage policies on the project during planning & design; implement upon construction	Existence of hiring and wage policies related to minorities and women employees	SO-02
					Proportion of minorities, women hires	SO-03
					Wage comparison of minorities, women compared to standards	SO-04
SO	Health (6)	Nutritional status	Nutritional status of children	Owner & engineer have little or no control	n/a	
SO	Health (6)	Mortality	Mortality rate under 5 years old	Owner & engineer have little or no control	n/a	
SO	Health (6)	Mortality	Life expectancy at birth	Owner & engineer have little or no control	n/a	
SO	Health (6)	Sanitation	Percent of population with adequate sewage disposal facilities	Contribution to improvement of sewage disposal incorporated into the project	Proportion of population with access to adequate sewage treatment	SO-05
SO	Health (6)	Drinking water	Population with access to safe drinking water	Contribution to access to safe drinking water incorporated into the project	Proportion of population with access to safe drinking water	SO-06
SO	Health (6)	Healthcare delivery	Percent of population with access to primary health care facilities	Contribution to healthcare facilities as part of the project scope	Proportion of population with access to primary health care facilities	SO-07
SO	Health (6)	Healthcare Delivery	Immunization against infectious childhood diseases	Owner & engineer have little or no control	n/a	
SO	Health (6)	Healthcare delivery	Contraceptive prevalence rate	Owner & engineer have little or no control	n/a	
SO	Health(6)	Occupational health & safety	Systems, procedures for managing and maintaining job safety, health	Safety during construction	Record of safety performance during construction	SO-8
SO	Human rights	Child labour	Use of child labour on project	Use of child labour during construction	Record of use of labour during project construction	SO-9

Dimension	Theme	Sub-theme	Indicator description	Relevance to projects	Core project indicator	Code
SO	Education (36)	Education level	Secondary or primary school completion ratio	Contribution to K-12 education by building facilities and incorporating auxiliary programmes into the project	K-12 facilities built, if part of project scope Ancillary programmes to improve K-12 education	
SO	Education (36)	Literacy	Adult literacy rate	Contribution to adult literacy by building facilities, incorporating auxiliary programmes into the project	Facilities built related to improving adult literacy as part of project scope Ancillary programmes to improve adult literacy	
SO	Housing (7)	Living conditions	Floor area per person	Contribution to improved housing (project scope specific)	Proportion of persons living with adequate floor area per person	SO-10
SO	Security	Crime (36, 24)	Number of recorded crimes per 100,000 population	Efforts to reduce crime related to the project, all phases	Specific development and design decision made to reduce crime rate Implementation activities	
SO	Population (5)	Population change	Population growth rate	Owner & engineer have little or no control	n/a	
SO	Population (5)	Population change	Population of urban formal and informal settlements	Contribution to improving conditions in informal settlements	Change in number and proportion of populations in formal and informal settlements affected by the project	SO-11
SO	Culture	Cultural heritage	Protection of cultural heritage	Impacts on local culture and historic buildings	Assessment of impacts on local culture and historic buildings	SO-12
SO	Culture	Involuntary resettlement	Protection from involuntary resettlement	Effects of project on displacement of local populations	Degree to which the project displaces the local population	SO-13
SO	Integrity	Bribery and corruption	Reporting of bribery and corruption	Reduction of bribery and corruption associated with projects	Efforts to monitor and report bribery and corruption	SO-14
EN	Atmosphere (9)	Climate change	Emissions of greenhouse gases	Quantity of GHGs emitted; part of considerations in all project phases.	Quantities of GHGs emitted in all phases of the project	EN-01
EN	Atmosphere (9)	Ozone layer depletion	Consumption of ozone depleting substances	Quantity of ozone depleting substances used; part of considerations in all project phases	Quantities of ozone-depleting substances used in all phases of the project	EN-02
EN	Atmosphere (9)	Air quality	Ambient concentration of air pollutants in urban areas	Effects of project on air pollution in urban areas	Quantities of key air pollutants emitted in all phases of the project	EN-03
EN	Atmosphere (9)	Indoor air quality	Ambient concentration of air pollutants inside the facilities	Effects of project on indoor air pollution	Quantities of indoor air pollutants	EN-04
EN	Land (10)	Agriculture (14)	Arable and permanent crop land area	Effects of project on arable and permanent crop land area	Proportion of arable and permanent crop land affected by the project	EN-05

Dimension	Theme	Sub-theme	Indicator description	Relevance to projects	Core project indicator	Code
EN	Land (10)	Agriculture (14)	Use of fertilizers	Effects of project on use of fertilizers	Quantity of fertilizers used compared to norms	EN-06
EN	Land (10)	Agriculture (14)	Use of agricultural pesticides	Effects of project on use of agricultural pesticides	Quantity of pesticides used compared to norms	EN-07
EN	Land (10)	Forests (11)	Forest area as a percent of land area	Effects of project on forest area	Extent to which forests are used or affected in the development, design & delivery of the project	EN-08
EN	Land (10)	Forests (11)	Wood harvesting intensity	Effects of project on wood harvesting	Extent to which wood is used in all project phases	EN-09
EN	Land (10)	Desertification (12)	Land affected by desertification	Effects of project on land affected by desertification	Extent to which land covered by project is affected by desertification. Measurements of desertification and improvements contributed by project	EN-10
EN	Land (10)	Urbanization (7)	Area of urban formal and informal settlements	Effects of project on the area of urban formal and informal settlements	Measurements of area of formal and informal settlements affected by the project	
EN	Oceans, seas & coasts (17)	Coastal zone	Algae concentration in coastal waters	Effects of project on algae concentration in coastal waters	Measurements of changes in algae concentrations	EN-11
EN	Oceans, seas & coasts (17)	Coastal zone	Percent of total population living in coastal areas	Effects of project on the population living in coastal areas	Changes in populations living in coastal areas	EN-12
EN	Oceans, seas & coasts (17)	Fisheries	Annual catch by major species	Owner & engineer have little or no control	n/a	
EN	Fresh water (18)	Water quantity	Annual withdrawal of ground & surface water as a percent of total available water	Use of water in relation to total available water	Measurements of water usage on project during all phases	EN-13
EN	Fresh water (18)	Water quality	BOD in water bodies	Effects of project on BOD in water bodies	Measurements of BOD on water bodies affected by project during all phases	EN-14
EN	Fresh water (18)	Water quality	Concentration of faecal coliform in freshwater	Effects of project on concentration of faecal coliform in freshwater	Measurements of faecal coliform in freshwater bodies affected by project during all phases	EN-15
EN	Biodiversity (15)	Ecosystem	Area of selected key ecosystems	What area of key ecosystems is affected by project?	Proportion of area affected by the project that contains key ecosystems	EN-16
EN	Biodiversity (15)	Ecosystem	Protected area as a percentage of total area	How much of the area affected by the project is protected?	See EN-16	
EN	Biodiversity (15)	Species	Abundance of selected key species	Effect of project on abundance of selected key species	Measurements of the affect of project on the abundance of key species	EN-17

Dimension	Theme	Sub-theme	Indicator description	Relevance to projects	Core project indicator	Code
EC	Economic structure (2)	Economic performance	GDP per capita	Effect of the project on the improvement of GDP (could be the local domestic product)	Extent to which the project provides economic benefit to the local economy	EC-01
EC	Economic structure (2)	Economic performance	Investment share in GDP	Owner & engineer have little or no control	n/a	
EC	Economic structure (2)	Trade	Balance of trade in goods & services	Use of local labour & materials	See SO-01	
EC	Economic structure (2)	Financial status (33)	Debt to GNP ratio	Owner & engineer have little or no control	n/a	
EC	Economic structure (2)	Financial status (33)	Total ODA given or received as a percentage of GNP	Owner & engineer have little or no control	n/a	
EC	Consumption & production patterns (4)	Material consumption	Intensity of material use	How has the project been designed & delivered to reduce use of materials Recycling during demolition, disposal?	Extent of use of materials compared to norms & other practices	EC-02
EC	Consumption & production patterns (4)	Energy use	Annual energy consumption per capita	How has the project been designed & delivered to reduce the energy consumption?	Extent of energy consumption compared to norms & other practices	EC-03
EC	Consumption & production patterns (4)	Energy use	Share of consumption of renewable energy resources	How has the project been designed & delivered to use renewable energy resources?	Extent of the use of renewable energy resources compared to norms & other practices	EC-04
EC	Consumption & production patterns (4)	Waste generation & management (19-22)	Intensity of energy use	How has the project been designed & delivered to reduce the intensity of energy use?	See EC-03	
EC	Consumption & production patterns (4)	Waste generation & management (19-22)	Generation of industrial & municipal solid waste	How has the project been designed & delivered to reduce industrial & municipal solid waste generation & disposal?	Quantities of industrial & municipal wastes generated compared to norms & other practices	EC-05
					Disposition of industrial & municipal wastes compared to norms & other practices	EC-06
EC	Consumption & production patterns (4)	Waste generation & management (19-22)	Generation of hazardous waste	How has the project been designed & delivered to reduce hazardous waste generation & disposal ?	Quantities of hazardous wastes generated compared to norms & other practices	EC-07
					Disposition of hazardous wastes compared to norms & other practices	EC-08
EC	Consumption & production patterns (4)	Waste generation & management (19-22)	Generation of radioactive waste	How has the project been designed & delivered to reduce radioactive waste generation & disposal?	Quantities of radioactive wastes generated compared to norms & other practices	EC-09
					Disposition of radioactive wastes compared to norms & other practices	EC-10

Dimension	Theme	Sub-theme	Indicator description	Relevance to projects	Core project indicator	Code
EC	Consumption & production patterns (4)	Waste generation & management (19-22)	Waste recycling & reuse	How has the project been designed & delivered to maximize waste recycling & reuse?	Extent to which waste recycling & reuse is employed in all phases of the project compared to norms & other practices	EC-11
EC	Consumption & production patterns (4)	Transport	Distance traveled per capita by mode of transport	How has the project been designed & delivered to reduce the use of inefficient transport?	Measurements of transportation modes & distances travelled by people & materials in all project phases compared to norms & other practices	EC-12
EC	Consumption & production patterns (4)	Durability (service life)	Durability of the constructed works	How has the project been designed & delivered to maximize the length of service of the facility?	Extent to which durable materials are specified Design for extended service life	EC-13
EC	Consumption & production patterns (4)	Care, ease of maintenance & repair	Level of care and maintenance required	How has the project been designed & delivered for ease of service & maintainability of the facility?	Extent to which the facility requires care & maintenance, compared to norms	EC-14
EC	Institutional framework (38, 39)	Strategic implementation of SD (8)	National sustainable development strategy	Owner & engineer have little or no control	n/a	
EC	Institutional framework (38, 39)	International cooperation	Implementation of ratified global agreements	Owner & engineer have little or no control	n/a	
EC	Institutional capacity (37)	Information access (40)	Number of Internet subscribers per 1000 inhabitants	Contribution to an increase in Internet use	Increase in the number of Internet users as a result of the project	
EC	Institutional capacity (37)	Communication infrastructure (40)	Main telephone lines per 1000 inhabitants	Contribution to an increase in telephone lines	Increase in the number of telephone lines as a result of the project	
EC	Institutional capacity (37)	Science & technology (35)	Expenditure on research & development as a percentage of GDP	Owner & engineer have little or no control	n/a	
EC	Institutional capacity (37)	Disaster preparedness & response	Economic & human loss owing to natural disasters	Contribution to protection of economic & human loss due to natural disasters	n/a	

Indicators are taken from the UN Division of Sustainable Development *Indicators of sustainable development: Frameworks and methodologies*, DESA/DSD/2001/3. Adjustment for the relevance to projects draws upon the International Standardization Organisation *Buildings and constructed assets – Sustainability in building construction*, ISO/AWI 21931, and *Buildings and constructed assets – Sustainability – sustainability indicators*, ISO/AWI 21932, and the Global Reporting Initiative *Sustainability Reporting Guidelines*, 2002.

B Indicators for sustainable development

B1 Characteristics

An indicator is characterised by:

- a definition, general description and underlying definitions and concepts
- unit of measurement
- method of measurement, including the status of the methodology against recognized standards
- relevance
- relationship and links to other indicators
- data used to compile the indicator, including data availability and sources
- value system and judgments by which indicator quantities are compared against norms or benchmarks
- conventions, agreements, references and recognized standards related to the indicator, plus additional readings and knowledge sources
- limitations of the data, including ease of measurement, comparability, reliability, availability, accuracy, completeness and seasonal variations.

B2 Aggregation

Indicators are aggregated into multi-dimensional sets in ways that offer insights into the current situation, the real or potential impacts and the range of plausible responses. These sets can be further combined to create a single index depicting a net aggregate condition.

B3 Criteria

Indicators must satisfy several well-established criteria:

- Policy relevant
  Can the indicator be associated with one or several issues around which key policies are formulated? Is the target group able to influence the outcome? Sustainability indicators are intended to improve the outcome of decision-making on levels ranging from the individual to the entire biosphere. Unless the indicator can be linked to critical decisions and policies, it is unlikely to motivate action.
- Simple
  Can the information be presented in an easily understandable, appealing way to the target audience? Even complex issues and calculations should eventually yield clearly presentable information that is understandable to all.
- Valid
  Is the indicator a true reflection of the facts? Was the data collected using scientifically defensible measurement techniques? Is the indicator verifiable and reproducible? Methodological rigour is needed to make the data credible for both experts and lay people.
- Based on time-series data
  Is time-series data available, reflecting the trend of the indicator over time? If based on only one or two data points, it is not possible to visualise the future direction of change.
- Based on available and affordable standardized data
  Is good quality data available at a reasonable cost or is it feasible to initiate a monitoring process that will make it available in the future? Information tends to use many resources: time, effort and money.
- Able to aggregate information
  Is the indicator about a very narrow or a broad sustainability issue? The list of potential sustainability indicators is endless. For practical reasons, indicators that aggregate information on broader issues are preferred. For example, forest canopy temperature is a useful indicator of forest health and is preferred to many other potential measures of species, growth, etc. that yield the same conclusion.
- Sensitive and responsive
  Can the indicator detect a small change in the system? It needs to be determined beforehand if small or large changes are relevant for monitoring.
- Reliable
  Will one arrive at the same result if one makes two or more measurements of the same indicator under the same circumstances? Would two different analyses arrive at the same conclusions?

B4 Purpose

Indicators address different audiences for several purposes. They allow users to:

- understand sustainability issues
- support decisions
- solve conflicts
- involve stakeholders.

A given indicator is unlikely to be appropriate for all purposes. For example, an indicator used in scientific analyses is an unlikely candidate for communicating with the public.

An audience, with its matched performance indicators, will generally focus on specific purposes:

Audience	Indicator purpose
Stakeholders	Measure progress towards achieving objectives and targets Promote accountability to stakeholders
Staff	Compare performance to identify opportunities for improvement
Clients; business partners	Highlight industry capacity
Professional service firms	Comparisons and benchmarks
National industry sector	Demonstrate progress towards industry targets and development objectives
International agencies	Industry capacity
General public	Generate trust and a shared long-term vision for development

Indicators are therefore used for:

- Design and project evaluation
- Monitoring industry and national sector commitments to socially and environmentally responsive voluntary initiatives, law, regulations and directives
- Monitoring progress to sustainable development goals
- Screening project proposals
- Selection procedures.

B5 Project-level indicators

Infrastructure projects are generally separated into several phases, and indicators have a role to play at each stage. For instance, they:

- identify where projects may be needed
- clarify project purpose and guide design
- determine how existing projects are meeting expectations
- support project monitoring and supervision
- help gauge a project's development impact.

The roles of indicators at the different phases of a project are:

Project phase	Indicator role
Development	Demonstrate to investors and funding agencies that the project has a sufficient likelihood of delivering the specified results and performance.
Planning Siting Design	Show stakeholders the proposed net contribution to sustainable development made by the materials, technologies, processes & other components incorporated in the design. Indicators established at the design stage will be used to measure the actual performance of the project during operation. Provide the ability to measure and verify the project's contribution to sustainable development.
Construction	Show stakeholders that sustainable development principles were followed during construction. Such practices affect: waste, noise, on-site recycling and take-back policies for excess materials.
Operation	Measure and verify the sustainability performance of the project as designed. Facilitate renovation and reuse of the facility.
Deconstruction Decommissioning	Show that the efforts made in the planning, siting & design phase facilitate the deconstruction, demolition & disposal of the facility as well as the recycling of materials from the facility at its end of life.

B6 Data sources

There are several well-established sources of information and data for assigning numeric quantities to project indicators:

Project-cycle phase	Information source
Strategy formulation	Programme effectiveness review
Program development	Feedback to policy makers
Project identification	Feedback to project planners
Project preparation	Design monitoring system and design
	Feedback to project designers
	Evaluation framework
Appraisal	Evaluation lessons
Selection, negotiation and approval	
Inception or start-up	Baseline survey
Project implementation and monitoring	Input, activity and output monitoring
	Activity monitoring briefs
	Benefit monitoring
Mid-term evaluation	Mid-term survey
Project completion	Project completion report
Post-evaluation	Impact survey
	Impact evaluation
	Lessons database
Follow-up and feed-back	Evaluation lessons for new projects

B7 Accuracy

The degree of rigour used in the selection of indicators, and the accuracy required for the data compiled to support each indicator, will vary greatly depending on how the indicators are to be applied. For example, indicators used to educate and inform are likely to be less accurate than those used by policy makers for planning purposes.

C The Equator Principles

The Equator Principles have been adopted by 32 financial institutions, including the International Finance Corporation (IFC): see www.equator-principles.com.

They are "an industry approach for financial institutions in determining, assessing and managing environmental and social risk in project financing."

C1 Preamble

Project financing plays an important role in financing development throughout the world. In providing financing, particularly in emerging markets, project financiers often encounter environmental and social policy issues. We recognize that our role as financiers affords us significant opportunities to promote responsible environmental stewardship and socially responsible development.

In adopting these principles, we seek to ensure that the projects we finance are developed in a manner that is socially responsible and reflect sound environmental management practices.

We believe that adoption of and adherence to these principles offers significant benefits to ourselves, our customers and other stakeholders. These principles will foster our ability to document and manage our risk exposures to environmental and social matters associated with the projects we finance, thereby allowing us to engage proactively with our stakeholders on environmental and social policy issues. Adherence to these principles will allow us to work with our customers in their management of environmental and social policy issues relating to their investments in the emerging markets.

These principles are intended to serve as a common baseline and framework for the implementation of our individual, internal environmental and social procedures and standards for our project financing activities across all industry sectors globally.

In adopting these principles, we undertake to review carefully all proposals for which our customers request project financing. We will not provide loans directly to projects where the borrower will not or is unable to comply with our environmental and social policies and processes.

C2 Statement of Principles

We will only provide loans directly to projects in the following circumstances:

1 We have categorised the risk of a project in accordance with internal guidelines based upon the environmental and social screening criteria of the IFC as described in the attachment to these Principles (Exhibit I).

2 For all Category A and Category B projects, the borrower has completed an Environmental Assessment (EA), the preparation of which is consistent with the outcome of our categorisation process and addresses to our satisfaction key environmental and social issues identified during the categorisation process.

3 In the context of the business of the project, as applicable, the EA report has addressed:
- a assessment of the baseline environmental and social conditions
- b requirements under host country laws and regulations, applicable international treaties and agreements
- c sustainable development and use of renewable natural resources
- d protection of human health, cultural properties, and biodiversity, including endangered species and sensitive ecosystems
- e use of dangerous substances
- f major hazards
- g occupational health and safety
- h fire prevention and life safety
- i socioeconomic impacts
- j land acquisition and land use
- k involuntary resettlement
- l impacts on indigenous peoples and communities

m cumulative impacts of existing projects, the proposed project, and anticipated future projects
n participation of affected parties in the design, review and implementation of the project
o consideration of feasible environmentally and socially preferable alternatives
p efficient production, delivery and use of energy
q pollution prevention and waste minimization, pollution controls (liquid effluents and air emissions) and solid and chemical waste management

Note: In each case, the EA will have addressed compliance with applicable host country laws, regulations and permits required by the project. Also, reference will have been made to the minimum standards applicable under the World Bank and IFC *Pollution Prevention and Abatement Guidelines* (Exhibit III) and, for projects located in low and middle income countries as defined by the World Bank *Development Indicators Database*, the EA will have further taken into account the then applicable IFC Safeguard Policies (Exhibit II). In each case, the EA will have addressed, to our satisfaction, the project's overall compliance with (or justified deviations from) the respective above-referenced Guidelines and Safeguard Policies.

4 For all Category A projects, and as considered appropriate for Category B projects, the borrower or third party expert has prepared an Environmental Management Plan (EMP) which draws on the conclusions of the EA. The EMP has addressed mitigation, action plans, monitoring, management of risk and schedules.

5 For all Category A projects and, as considered appropriate for Category B projects, we are satisfied that the borrower or third party expert has consulted, in a structured and culturally appropriate way, with project affected groups, including indigenous peoples and local NGOs. The EA, or a summary thereof, has been made available to the public for a reasonable minimum period in local language and in a culturally appropriate manner. The EA and the EMP will take account of such consultations, and for Category A Projects, will be subject to independent expert review.

6 The borrower has covenanted to:
a comply with the EMP in the construction and operation of the project
b provide regular reports, prepared by in-house staff or third party experts, on compliance with the EMP and
c where applicable, decommission the facilities in accordance with an agreed Decommissioning Plan.

7 As necessary, lenders have appointed an independent environmental expert to provide additional monitoring and reporting services.

8 In circumstances where a borrower is not in compliance with its environmental and social covenants, such that any debt financing would be in default, we will engage the borrower in its efforts to seek solutions to bring it back into compliance with its covenants.

9 These principles apply to projects with a total capital cost of US$50 million or more.

The adopting institutions view these principles as a framework for developing individual, internal practices and policies. As with all internal policies, these principles do not create any rights in, or liability to, any person, public or private. Banks are adopting and implementing these principles voluntarily and independently, without reliance on or recourse to IFC or the World Bank.

Exhibit I
Environmental and social screening process

Environmental screening of each proposed project shall be undertaken to determine the appropriate extent and type of EA. Proposed projects will be classified into one of three categories, depending on the type, location, sensitivity, and scale of the project and the nature and magnitude of its potential environmental and social impacts.

Category A
A proposed project is classified as Category A if it is likely to have significant adverse environmental impacts that are sensitive, diverse, or unprecedented. A potential impact is considered "sensitive" if it may be irreversible (e.g., lead to loss of a major natural habitat) or affect vulnerable groups or ethnic minorities, involve involuntary displacement or resettlement, or affect significant cultural heritage sites. These impacts may affect an area broader than the sites or facilities subject to physical works. EA for a Category A

project examines the project's potential negative and positive environmental impacts, compares them with those of feasible alternatives (including, the "without project" situation), and recommends any measures needed to prevent, minimize, mitigate, or compensate for adverse impacts and improve environmental performance. A full environmental assessment is required which is normally an Environmental Impact Assessment (EIA).

Category B

A proposed project is classified as Category B if its potential adverse environmental impacts on human populations or environmentally important areas – including wetlands, forests, grasslands, and other natural habitats – are less adverse than those of Category A projects. These impacts are site-specific; few if any of them are irreversible; and in most cases mitigatory measures can be designed more readily than for Category A projects. The scope of EA for a Category B project may vary from project to project, but it is narrower than that of Category A EA. Like Category A EA, it examines the project's potential negative and positive environmental impacts and recommends any measures needed to prevent, minimize, mitigate, or compensate for adverse impacts and improve environmental performance.

Category C

A proposed project is classified as Category C if it is likely to have minimal or no adverse environmental impacts. Beyond screening, no further EA action is required for a Category C project.

Exhibit II
Safeguard policies

As of 4 June 2003, the following is a list of IFC Safeguard Policies:

Environmental Assessment OP4.01 (October 1998)
Natural Habitats OP4.04 (November 1998)
Pest Management OP4.09 (November 1998)
Forestry OP4.36 (November 1998)
Safety of Dams OP4.37 (September 1996)
Indigenous Peoples OD4.20 (September 1991)
Involuntary Resettlement OP4.30 (June 1990)
Cultural Property OPN11.03 (September 1986)
Child & Forced Labour Policy Statement (March 1998)
International Waterways OP7.50 (November 1998)

Note: The principal requirements relate to the role of IFC as a multilateral agency and notification requirements between riparian states which are generally outside the remit of private sector operators or funders. It is referenced for the sake of completeness. The substantive elements of good practice with respect to environmental and social aspects therein are fully covered by OP4.01.

Exhibit III
World Bank and IFC pollution prevention and abatement guidelines

As of 4 June 2003, IFC is using two sets of guidelines for its projects.

1 IFC is using all the environmental guidelines contained in the World Bank *Pollution Prevention and Abatement Handbook* (PPAH). This Handbook went into official use on July 1, 1998.

2 IFC is also using a series of environmental, health and safety guidelines that were written by IFC staff in 1991-1993 and for which there are no parallel guidelines in the *Pollution Prevention and Abatement Handbook*. Ultimately new guidelines, incorporating the concepts of cleaner production and environmental management systems, will be written to replace this series of IFC guidelines. When completed, these new guidelines will also be included in the World Bank *Pollution Prevention and Abatement Handbook*.

Where no sector specific guideline exists for a particular project, then the World Bank *General Environmental Guidelines* and the IFC *General Health and Safety Guideline* will be applied, with modifications as necessary to suit the project.

Note: The following are World Bank Guidelines not contained in the PPAH and currently in use:

Mining and Milling – Underground
Mining and Milling – Open Pit

The table on page 32 lists both the World Bank Guidelines and the IFC Guidelines.

World Bank Guidelines (PPAH)		IFC Guidelines	
1	Aluminium Manufacturing	1	Airports
2	Base Metal and Iron Ore Mining	2	Ceramic Tile Manufacturing
3	Breweries	3	Construction Materials Plants
4	Cement Manufacturing	4	Electric Power Transmission and Distribution
5	Chlor-Alkali Plants	5	Fish Processing
6	Coal Mining and Production	6	Food and Beverage Processing
7	Coke Manufacturing	7	Forestry Operations: Logging
8	Copper Smelting	8	Gas Terminal Systems
9	Dairy Industry	9	General Health and Safety
10	Dye Manufacturing	10	Health Care
11	Electronics Manufacturing	11	Geothermal Projects
12	Electroplating Industry	12	Hazardous Materials Management
13	Foundries	13	Hospitals
14	Fruit and Vegetable Processing	14	Office Buildings
15	General Environmental Guidelines	15	Offshore Oil & Gas
16	Glass Manufacturing	16	Polychlorinated Biphenyls (PCBs)
17	Industrial Estates	17	Pesticide Handling and Application
18	Iron and Steel Manufacturing	18	Plantations
19	Lead and Zinc Smelting	19	Port and Harbour Facilities
20	Meat Processing and Rendering	20	Rail Transit Systems
21	Mini Steel Mills	21	Roads and Highways
22	Mixed Fertilizer Plants	22	Telecommunications
23	Monitoring	23	Tourism and Hospitality Development
24	Nickel Smelting and Refining	24	Wildland Management
25	Nitrogenous Fertilizer Plants	25	Wind Energy Conversion Systems
26	Oil and Gas Development (Onshore)	26	Wood Products Industries
27	Pesticides Formulation	27	Waste Management Facilities
28	Pesticides Manufacturing	28	Wastewater Reuse
29	Petrochemicals Manufacturing		
30	Petroleum Refining		
31	Pharmaceutical Manufacturing		
32	Phosphate Fertilizer Plants		
33	Printing Industry		
34	Pulp and Paper Mills		
35	Sugar Manufacturing		
36	Tanning and Leather Finishing		
37	Textiles Industry		
38	Thermal Power Guidelines for New Plants		
39	Thermal Power Rehabilitation of Existing Plants		
40	Vegetable Oil Processing		
41	Wood Preserving Industry		

D Millennium Development Goals

A framework of 8 goals, 18 targets and 48 indicators to measure progress towards the Millennium Development Goals was adopted by experts from the United Nations, the International Monetary Fund, OECD and The World Bank [see *Road map towards the Implementation of the United Nations Millennium Declaration*, United Nations, A/56/326]. Detailed definitions of some indicators are given in footnotes available at millenniumindicators.un.org/unsd/mi/mi_goals.asp

Goal	Target	Indicator
Eradicate extreme poverty and hunger	Halve, between 1990 and 2015, the proportion of people whose income is less than one US dollar a day	Proportion of population below US$1 Purchasing Power Parity (PPP) per day Poverty gap ratio: incidence x depth of poverty
	Halve, between 1990 and 2015, the proportion of people who suffer from hunger	Share of poorest quintile in national consumption Prevalence of underweight children under five years of age Proportion of population below minimum level of dietary energy consumption
Achieve universal primary education	Ensure that, by 2015, children everywhere, boys and girls alike, will be able to complete a full course of primary schooling	Net enrolment ratio in primary education Proportion of pupils starting grade 1 who reach grade 5 Literacy rate of 15-24-year-olds
Promote gender equality and empower women	Eliminate gender disparity in primary and secondary education, preferably by 2005, and to all levels of education no later than 2015	Ratio of girls to boys in primary, secondary and tertiary education Ratio of literate women to men of 15- to 24-year-olds Share of women in wage employment in the non-agriculture sector Proportion of seats held by women in national parliament
Reduce child mortality	Reduce by two thirds, between 1990 and 2015, the under-five mortality rate	Under-five mortality rate Infant mortality rate Proportion of 1-year-old children immunized against measles
Improve maternal health	Reduce by three quarters, between 1990 and 2015, the maternal mortality ratio	Maternal mortality ratio Proportion of births attended by skilled health personnel HIV prevalence among 15-to-24-year-old pregnant women
Combat HIV/AIDS, malaria and other diseases	Have halted by 2015 and begun to reverse the spread of HIV/AIDS	Condom use rate of the contraceptive prevalence rate Condom use at last high-risk sex Percentage of population aged 15-24 with comprehensive correct knowledge of HIV/AIDS Ratio of school attendance of orphans to school attendance of non-orphans aged 10-14
	Have halted by 2015 and begun to reverse the incidence of malaria and other major diseases	Prevalence and death rates associated with malaria Proportion of population in malaria risk areas using effective malaria prevention and treatment measures Prevalence and death rates associated with tuberculosis Proportion of tuberculosis cases detected and cured under DOTS (internationally recommended TB control strategy)
Ensure environmental sustainability	Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources	Proportion of land area covered by forest Ratio of area protected to maintain biological diversity to surface area Energy use (kg oil equivalent) per US$1 GDP (PPP) Carbon dioxide emissions (per capita) and consumption of ozone-depleting CFCs (ODP tons) Proportion of population using solid fuels

Goal	Target	Indicator
	Halve by 2015 the proportion of people without sustainable access to safe drinking water and sanitation By 2020, to have achieved a significant improvement in the lives of at least 100 million slum dwellers	Proportion of population with sustainable access to an improved water source, urban and rural Proportion of urban population with access to improved sanitation, urban and rural Proportion of households with access to secure tenure
Develop a global partnership for development	Develop further an open, rule-based, predictable, non-discriminatory trading and financial system. Includes a commitment to good governance, development and poverty reduction – both nationally and internationally Address the special needs of the Least Developed Countries Includes: tariff and quota-free access for Least Developed Countries' exports; enhanced programme of debt relief for HIPCs and cancellation of official bilateral debt; and more generous ODA for countries committed to poverty reduction Address the special needs of landlocked countries and Small Island Developing States (through the *Programme of Action for the Sustainable Development of Small Island Developing States* and the outcome of the 23rd Special Session of the UN General Assembly) Deal comprehensively with the debt problems of developing countries through national and international measures in order to make debt sustainable in the long term (some of the indicators listed are monitored separately for the Least Developed Countries, Africa, Land-Locked Developing Countries and Small Island Developing States)	*Official development assistance (ODA)* Net ODA, total and to LDCs, as percentage of OECD/Development Assistance Committee donors' gross national income (GNI) Proportion of total bilateral, sector-allocable ODA of OECD/DAC donors to basic social services (basic education, primary health care, nutrition, safe water and sanitation) Proportion OECD/DAC donors bilateral ODA that is untied ODA received in landlocked countries as proportion of their GNIs ODA received in small island developing States as proportion of their GNIs *Market access* Proportion of total developed country imports (by value and excluding arms) from developing countries and from LDCs, admitted free of duties Average tariffs imposed by developed countries on agricultural products and textiles and clothing from developing countries Agricultural support estimate for OECD countries as percentage of their GDP Proportion of ODA provided to help build trade capacity *Debt sustainability* Total number of countries that have reached their Heavily Indebted Poor Countries Initiative (HIPC) decision points and number that have reached their HIPC completion points (cumulative) Debt relief committed under HIPC initiative, US$ Debt service as a percentage of exports of goods and services
	In cooperation with developing countries, develop and implement strategies for decent and productive work for youth.	Unemployment rate of 15- to 24-year-olds, each sex and total
	In cooperation with pharmaceutical companies, provide access to affordable essential drugs in developing countries.	Proportion of population with access to affordable essential drugs on a sustainable basis
	In cooperation with the private sector, make available the benefits of new technologies, especially information and communications.	Telephone lines and cellular subscribers per 100 population Personal computers in use per 100 population and Internet users per 100 population

E Tools for stakeholder engagement

E1 Stages

There are six stages in building positive stakeholder relationships:

1 Create a foundation
Address strategic relationship building in the organisation's strategic plans, and incorporate it into the organisation's vision, mission and values.
2 Organisational alignment
Align the organisation to establish collaborative relationships with stakeholder groups to the extent practical.
3 Strategy development
Assess existing relationships; enter into dialogue with key stakeholders; establish best practices; develop strategies and action plans.
4 Trust building
Work with stakeholder groups to understand issues, to identify and resolve areas of conflict, and to access and share information.
5 Evaluation
Design and conduct a stakeholder audit.
6 Repeat
Continue to repeat the earlier steps and refine approaches.

E2 Stakeholder engagement process

Project indicators for sustainable development must be developed through a consensus process involving the key stakeholders. Given the intrinsic diversity of knowledge and views of the stakeholders, a process for indicator development is necessary in order to keep such a process on track.

There are several methodological frameworks for developing indicators for sustainable development that provide a workable solution. Representative is a set of principles and a seven-step process for indicator development that is named after its acronym PICABUE [G. Mitchell, A. May & A. McDonald, *Int. J.Sust. Dev. – World Ecology* 2, 104-123, 2001].

1 Principles
Bring stakeholders to consensus about principles and definitions of sustainable development that are in use and the objectives of the indicators programme.
2 Identify
Identify and select issues of concern.
3 Construct
Construct/select indicators which encompass issues of concern (issues indicators).
4 Add
Add issues indicators (3 above) to those relating to sustainable development principles: test each quality-of-life indicator to ensure that it is relevant to the sustainability principles. For example, not just the rate of use of a resource, but the rate of use relative to investment in a substitute or regeneration, e.g.: tree planting; investment in renewable energy.
5 Boundary
Where appropriate, modify step 4 to address boundary issues (definition of spatial and temporal units of measurement and issues at the edges of the area). Methodologies and data are not available to make a full calculation of the wider effects of cities, so the engineer has to concentrate on those which can be pinned down, e.g.: percentage of water derived from outside the demand areas; percentage of waste disposed of beyond the area where it is generated.
6 Uncertainty
Starting with the indicators from step 4, develop uncertainty augmented indicators: lack of knowledge of critical limits; lack of data; unpredictability of certain processes. The precautionary principle is required where there is uncertainty.
7 Evaluate
Evaluate and review final sustainability indicators for: relevance and scientific validity; sensitivity to change in space; sensitivity to change over time; consistency; comprehension; appropriateness; measurability; potential for establishing targets.

F Case study

Sustainable school construction in the Poudre School District

William Franzen and Stu Reeve
Poudre School District, Fort Collins, CO, USA

This case study illustrates the first three stages of the FIDIC Project Sustainability Management (PSM) process where project specific goals and indicators for sustainable development are established, adjusted and tested.

F1 Project description

The Poudre School District is located in Fort Collins, CO, USA, at the northern edge of the rapidly growing Colorado Front Range of the Rocky Mountains some 100 km north of Denver. Fort Collins has a population of 130,000, lies at 1,500 m above sea level and enjoys a moderate, four-season climate with 300 days of sunshine and 370 mm of precipitation a year. It offers an excellent quality of life and a well-educated work force. Community involvement, concern for the environment and a genuine interest in preserving the quality environment has resulted in national recognition.

In 2000, voters passed a US$175 million bond issue for building new and upgrading existing schools in the District. Working in partnership with universities, state initiatives, the US Department of Energy, local utilities and others, it has been able to raise support and additional funds to help design and construct sustainable school buildings. The District has completed or has in the works several school projects.

The District believes that its students learn more, perform better and attend more often when they are educated in a sustainable building. Students simply do better when their school is full of daylight and offers fresh air and comfortable temperatures. It also believes that the application of sustainable principles can save money, in both the first cost (design and construction costs), and in operating costs.

A Poudre School District school

F2 PSM goals and indicators

Stage 1: Establish indicators

1a Project scope and setting assumptions

- Increase energy and water conservation and efficiency.
- Increase use of renewable energy resources.
- Reduce or eliminate toxic and hazardous substances in facilities, processes, and their surrounding environment.

Improve indoor air quality and interior and exterior environments leading to increased human productivity and performance and better human health.

Use resources and materials efficiently.

Select materials and products that minimize safety hazard and life-cycle environmental impact (e.g., local materials and lowest “embodied energy” materials)

- Increase the use of material and products with recycled content and environmentally preferred products.

Recycle and salvage construction waste and building materials during construction and demolition.

Generate less harmful products during construction, operation, and decommissioning/demolition.

Implement maintenance and operational practices that reduce or eliminate harmful effects on people and the natural environment.

- Reuse existing infrastructure, locate facilities near public transportation, and consider redevelopment of contaminated properties.
- Consider off-site impacts such as storm water discharge rates and water quality.

1b Owner's vision, goals and objectives

Vision

"[We] stand committed to sustainable design and are confident it will yield positive outcomes for our students and the community."

Goals

- Steward natural resources.
- Provide leadership in developing an ethic of sustainability.
- Apply state-of-the-art technology without being experimental.
- Use exemplary buildings as precedents.
- Be proper stewards of the bond monies assigned for building new or upgrading existing schools.
- Achieve the anticipated cost savings and sustainable performance in the school buildings.
- Enhance student performance and attendance.
- Teach principles of sustainable design.
- Harmonize with the natural landscape.

Provide higher quality lighting.

- Consume less energy; safeguard water; conserve materials and natural resources
- Enhance indoor environmental quality
- Share the risks and rewards with contractors and other benefactors.

Objective

See Table 1: Project objectives

1c Identify key stakeholders

Stakeholders

- Core "Green Team": includes project owner, suppliers and vendors, and representatives of District employees, teachers and local public interest groups.
- Design Advisory Group: community members and utility and government partners.

Stage 2: Goals & indicators adjusted to local conditions

2a Safeguard policies

Not required

2b Local *Agenda 21*:

None, so a workshop organized thus adding indicators for:

- Enhancing student performance and attendance
- Teaching principles of sustainable design
- Providing higher quality lighting

Stage 3: Testing and refining project goals & indicators

3a Systems integration

- Project management encourages collaboration among the team members.
- The project timeline is established for normal design

  development and construction phases, allowing time for the evaluation of new systems and products, and to perform building simulations.
- Instrumentation for monitoring and evaluating building performance is incorporated into the building design.
- Building commissioning is performed.
- Post-occupancy inspection is performed and recommendations are made as appropriate for operational improvement.

3b Indicator functionality

Functional since only four locally-derived indicators were added to the core set.

3c Alignment with applicable rules, regulations and protocols

Not required

Table 1: The Poudre School District's project objectives
Objectives, the measures envisaged and specific targets.

Objectives	Measures	Targets
Sustainable site planning and landscape design		
Bio-diversity	Bio-diversity of landscaping design	Match area's natural conditions
Low input after establishment	Net use of water, mowing, labour, fertilizers, etc.	Achieve a uniformity rate of at least 80% in the application of water
Relates to and is connected to the area's natural systems	Based on judgment	None available
Uses green materials where possible	Extent to which green materials are used	Meet *LEED* standards in the use of green materials
Looks like it belongs in the bio-climatic region	Based on judgment: met if the four measures above are satisfied	None available
Visible from the indoors	Visibility by school users	Natural areas seen in all classrooms and offices, cafeteria, gymns and auditoria
Modulate heating and cooling of buildings	Use of wind buffers and shading in designs	None available
Reinforces the health and welfare of the local community and economy	Reduction of school absenteeism and increased student academic performance	Targets under discussion
Engages the community in its construction and use	Extent of public involvement	Incorporate stakeholders at the design stage
Use of renewable energy sources: solar, wind and geo-thermal	Extent of use of solar, wind or geo-thermal	Substantial percent of energy supplied by renewable sources
High quality and energy efficient equipment		
Daylighting	Extent to which daylighting is used	Extensive use of daylighting
Electric lighting	Use of occupancy sensors, electronic ballasts and T-8/T-5 lamps	Less than 15.5 W/m^2
Energy efficient building shell: technologies and approaches – glazing, air sealing	Building energy efficiency	See below
Energy efficient HVAC systems: technologies/approaches – "micro-loaded" building, thermal ice storage, HVAC reheat system, operable windows, geo-exchange system, variable frequency drive motors, energy management system	Comparisons of energy use with other buildings *EnergyStar* rating of 75 to be eligible to use the *EnergyStar* mark Conventional standard: *ASHRAE 90*	Be in top 25% in building energy efficiency Achieve *EnergyStar* certification
Environmentally preferable building processes		
Environmentally preferable building materials	Sources of materials	Follow *LEED* guidelines, e.g., wood from sustainably managed forests
Water conservation: technologies/approaches – shared raw water irrigation system, water-efficient landscaping	Reduction in water use	Substantially below conventional rates of water use
Recycling and waste management	Extent to which waste generation is reduced and materials are recycled	Recycling programmes in place
Construction waste reduction and recycling	Requirements of contractors to reduce waste and recycle	Substantially below conventional practices
Commissioning	Plan for commissioning early in the project delivery process	Incorporate commissioning function at the design stage
Eco-education	Provisions for educating students and teachers	Incorporate learning tools into the building design

Table 2: The FIDIC PSM project-specific indicators

The PSM core set of project indicators after adjustment to meet the project owners goals and objectives. The designation of the core set (see *PSM Guidelines*, Appendix A) are retained for the indicators designated SO (social), EN (environmental) and EC (economic). Additional indicators are designated AD (additional). Core indicators that do not apply do not appear in the table. Under the description of the goal are given the goals for achieving the "best-in-class" (do what is currently achievable) and "state-of-practice " (apply conventional), as descibed in *PSM Guidelines*, Fig. 1.

Code	PSM core indicator	Goal	State-of-practice	Best in class	Project-specific indicator
AD-01	Enhance student performance and attendance	*Reduced absenteeism, better grades than state average*	Conventional teaching practices	Design the building to connect with natural surrounding, outdoors	Student absentee rate Overall occupant satisfaction with the building & facilities Student test scores
AD-02	Teach principles of sustainable design	*Students knowledgeable of sustainable development principles*	Conventional teaching practices	Education elements incorporated into the design	Use of learning tools and computer kiosks Building design incorporates exposed walls to show how systems work
SO-02	Existence of hiring and wage policies related to minorities and women employees	*Meet existing requirements*	Hiring & wage policies exist & meet regulatory requirements	Hiring & wage policies exist & exceed regulatory requirements Proactive programmes locate women & minority hires Comparable wage structures	Current hiring and wage policies give equal status to women & minorities
SO-03	Proportion of minorities, women hires	*Proportion in accordance with local rules & project owner policies*			Current hiring policies
SO-04	Wage comparison of minorities, women compared to standards		Proportion in accordance with local rules, project owner policies	Exceed project averages Proactive programmes to use local workers & firms	Employment statistics for women & minorities Wage comparisons
SO-05	Proportion of population with access to adequate sewage treatment	*Reduce water usage through conservation measures: waterless toilets, irrigation controls, low water use plants*	Connect to local sewage systems	Connect to local sewage systems; reduce water usage	Sanitary sewer connections Percent reduction in water use compared to conventional
SO-06	Proportion of population with access to safe drinking water	*Connect to local water supply*	Connect to local water supply	Connect to local water supply	Existence of municipal water supply connections
SO-08	Record of safety performance during construction	*No accidents*	At national average	No accidents	Number of accidents
AD-03	Provide higher quality lighting	*Use of daylighting; design to reduce glare*	Conventional lighting	Use of daylighting Design to reduce glare	Daylighting incorporated into the building design
AD-04	Visibility of natural surroundings by school users	*Natural areas seen by all classrooms, offices*	Conventional windows	Natural areas seen by all classrooms & offices	Incorporate into building and landscaping design
SO-11	Change in prop. & no. of populations in formal & informal settlement affected by the project	*No change in the number of formal/informal settlements*	No change in the number of formal/informal settlements	No change in the number of formal/informal settlements	No formal or informal settlements at the proposed project site
SO-12	Assessment of impacts on local culture, historic buildings	*Provide educational resources regarding area history and local culture*	No significant impacts on local culture & historic buildings	Building enhances local culture; preserves and enhances historic buildings	Extent to which educational resources are provided
EN-01	Quantity of GHGs emitted in all project phases	*Reduction of GHG emissions. Specific goals not specified*	No rules or regulations on GHG emissions	Reduction of GHG emissions	Be in top 25% of building energy efficiency Achieve *EnergyStar* rating of 80 or better Achieve 120 KBTU/m^2
EN-03	Quantities of key air pollutants emitted in all project phases	*Reduce pollution emissions substantially below regulated levels*	Meet regulatory requirements on pollution emissions	Low emission vehicles; dust control; low VOC-emitting materials	Use of low VOC-emitting materials Use of LNG-powered vehicles
EN-04	Quantities of indoor air pollutants	*Use high performance systems; provide fresh air ventilation; low VOC-emitting materials*	Use on natural ventilation Percent use operable windows	Low VOC-emitting materials	Use of natural ventilation Percent use of operable windows Use of low VOC materials
EN-09	Extent to which wood is used in all project phases	*Use wood harvested from sustainably-managed forests & extensive use of recycled materials*	Use wood from commercial sources	Use wood harvested from sustainably managed forests	Use of recycled materials for construction

Code	PSM core indicator	Goal: State-of-practice	Goal: Best in class	Project-specific indicator
EN-13	Measurements of water usage on project during all phases	*Reduced water usage per capital* Connect to local water utility & user pays on a rate structure	Reduced water use per capital	40-50% reduction in water use over conventional
EN-16	Proportion of area affected by the project that contains key ecosystems.	*No significant impact on key ecosystems* Meet local and national regulations regarding ecosystem protection	No significant impact on key ecosystems	Match project area's natural conditions
EN-17	Measurements of affect of project on the abundance of key species	*No significant impact on key ecosystems* Meet local and national regulations regarding ecosystem protection	No significant impact on key ecosystems	Match project area's natural conditions
EC-01	Extent to which the project provides economic benefit to the local economy	*Purchase materials locally, hire local people and vendors* Decisions on materials purchases, hiring of people, & use of local suppliers at the discretion of the contractor	Purchase materials locally & engage local people & suppliers	Percent materials & labour purchased locally
EC-02	Extent of use of materials	*Reduced materials usage; use of "green" or recycled materials in construction; construction recycling programmes* Use of materials at the discretion of the contractor	Designs incorporate reduced use of materials	Follow *LEED* standards in use of "green" & recycled materials 75% recycling of construction materials
EC-03	Extent of energy consumption	*Purchase energy from renewable sources; energy conservation measures* Connect to local energy utility: user pays for electricity on a rate structure & buy fuels at commercial rates	Buy energy from renewable sources; use non-polluting fuels; reduce energy usage; use hybrid vehicles	Purchase 100% wind energy Install thermal ice storage Super insulation
EC-04	Extent of the use of renewable energy resources	*Electrical energy from renewable resources* Use energy from renewable sources dictated by cost	Electrical energy from renewable resources	Purchase 100% wind energy Extent to which wind buffers & natural shading are used
EC-05	Quantities of industrial and municipal wastes generated	*Use of recycled materials in construction & programmes for recycling construction waste* Waste generation & reduction measures are dictated by cost of disposal	Waste reduction programmes & extensive use of recycling	Percent waste recycled
EC-06	Disposition of industrial and municipal wastes	*Use of recycled materials in construction, including programmes for recycling construction waste* Waste generation & reduction measures are dictated by cost of disposal	Waste reduction programmes & extensive use of recycling	75% of construction wastes diverted from landfill Percent use of recycled building materials
EC-07 EC-08	Quantities: Disposition: of hazardous waste generated	*No hazardous waste generated* Waste generation & reduction measures dictated by risk & hazardous waste disposal cost	No hazardous waste generated	Percent hazardous waste generated
EC-09 EC-10	Quantities: Disposition: of radioactive wastes generated	*No radioactive waste generated* Waste generation & reduction measures dictated by risk & radioactive waste disposal cost	No radioactive waste generated	Percent radioactive waste generated
EC-11	Extent to which waste recycling & reuse is employed in all phases of the project	*Use of recycled materials in construction & programmes for recycling construction waste* Waste generation & reduction measures dictated by risk & radioactive waste disposal cost	No hazardous waste generated	Percent of recycling construction waste Percent use of recycled building materials
EC-12	Measurements of distances of people & materials & transportation modes in all project phases	*Use local people, suppliers & materials to the extent practical* No measurements done; practices dictated by economics	Programmes to track distances of people & materials transportation modes	Percent use of local labour & materials
EC-13	Extent to which durable materials were specified; design for extended service life	*Use durable materials, products & equipment that have longer than normal lifves* Materials specifications based on economic cost-benefit analyses; design life determined by client	Use of durable materials; specifications require extended service life of materials, equipment & systems	Percent use of durable materials
EC-14	Extent to which the facility requires care & maintenance	*Use durable materials, products & equipment that requires low care & maintenance* Average care and maintenance requirements	Little or no care and maintenance requirements	Percent reduction of care & maintenance requirements, compared to norms

contents

information

For information, consult www.fidic.org/psm

summary

Guidelines for creating business opportunities using a process to generate and implement goals and a set of project-specific indicators for sustainable development that aligns with whole-society goals.

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