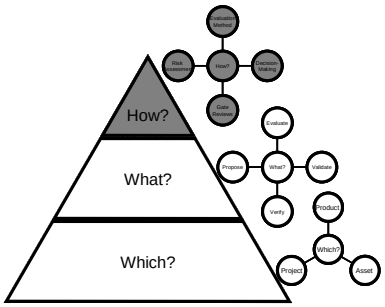
6. Social Criteria in Project Management



Verifying the proposed social sustainability framework (see Chapter 4) indicated that the framework is comprehensive enough to be used as a basis to address any social aspects that might arise in the asset life cycle's construction, operation and decommissioning phases. However, the validation of the framework (see Chapter 5) indicated that the social criteria are addressed differently in the various asset life cycle phases. The validation also indicated that project management experts do not deem all criteria relevant for project management. This chapter discusses HOW the proposed framework's social criteria should be addressed in project management. The chapter's layout is shown in Figure 6-1.

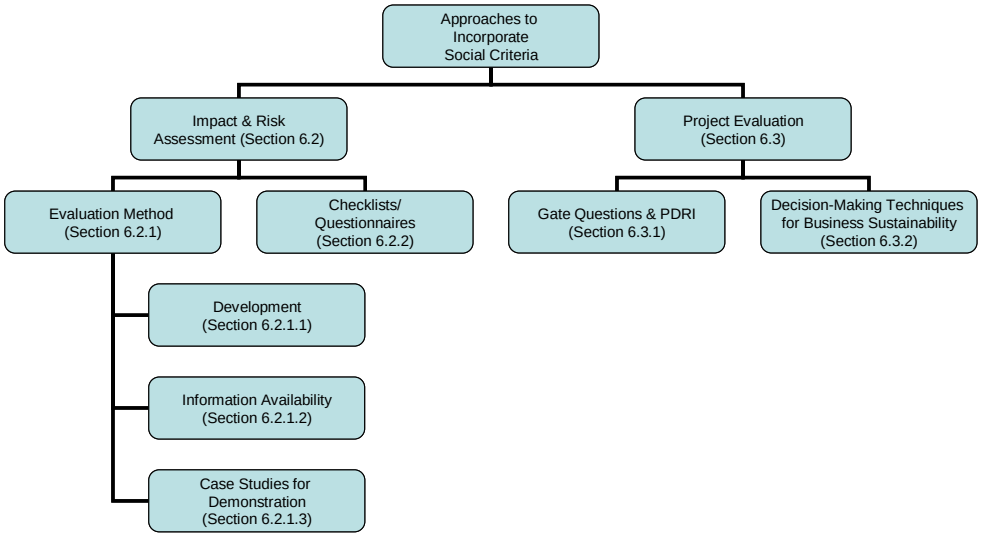


Figure 6-1: Chapter Layout

6.1 Introduction

A core principle of sustainable project life cycle management is that the economic, environmental and social consequences of the asset and product life cycles should be considered in the project life cycle. Although project managers do not deem all social criteria relevant for project management, it is, however, proposed that all social criteria should be addressed in the project management methodology, as all criteria are relevant at some stage in the asset life cycle and a core principle introduced for sustainable project life cycle management is addressing social impacts of the asset life cycle in the project life cycle. Although this conclusion might seem to contradict the Delphi case study's results (see Chapter 5), it does not. Most projects require co-operation across a number of functional departments in the organisation [116], and the social criteria addressed by each of these functional

departments would thus imply that the project will also address the criteria due to the functional department's involvement. The same applies to business strategy, since projects as the tools to implement strategy would definitely adhere to the business strategy. Using Chapter 1's generic project management methodology (Figure 1-4) as basis, it is possible to identify the following two additional levels to the strategic level on which social criteria can be incorporated into project management:

- activities and deliverable level - this includes social aspects in activities executed in specific phases and deliverables required at the end of the specific phase; and
- evaluation level - this includes social aspects in gate readiness reviews as well as in the gate decision-making process.

However, a prerequisite for answering the "HOW" question remains to identify ways of addressing social aspects on these various levels. Proposed approaches for each level is summarised in Table 6-1.

Table 6-1: Approaches to Incorporate Social Criteria in Project Management Methodologies

Level	Approach	Description of Approach
Strategic	Project governance framework	A framework describing the way in which the project must be executed and providing indicators to assess the project afterwards
Activities and deliverables	Risk assessment/risk management	Questionnaires to identify possible risks with guidelines of what to do if it is encountered
Activities and deliverables	Impact prediction/ assessment	Measuring social impacts in terms of the criteria using questionnaires to identify impacts and/or an evaluation method
Activities and deliverables	Social development plan	In certain projects, a social development plan has to be executed as part of the project
Evaluation	Gate questions	Developing gate questions that can both prompt decision-makers to consider the social criteria as well as ensure that the project addressed the criteria
Evaluation	Project Definition Rating Index (PDRI)[12][268]	Developing a social PDRI to be used in gate readiness reviews
Evaluation	Decision-making techniques	Techniques to ensure that all three dimensions of sustainable development are considered in decision-making

[12] "*PDRI is a weighted checklist of project scope definition elements that facilitates assessment of a project during pre-project planning*"[268].

Table 6-2 summarises the approach/es to be followed for each criterion. More detail on the approaches for each specific criterion is attached in Appendix L. Functional departments in the project life cycle should address the following criteria in Table 6-2:

- Employment Opportunities;
- Employment Remuneration;
- Disciplinary and Security Practices;
- Employee Contracts;
- Equity & Diversity;
- Labour Sources;
- Health and Safety Practices; and
- Research and Development.

In certain cases where functional departments do not exist yet or are not involved at all, the project team should follow the approaches listed for the operation phase (see Appendix J) to guide them in executing new placements, and other related or relevant activities.

To incorporate the social criteria in project management methodologies by following the defined approaches mentioned, the following is required:

- checklists/questionnaires to identify possible social risks and/or impacts;
- evaluation methods to measure predicted social impacts;
- structure of a project governance framework with indicators to be used for post-implementation reviews;
- guidelines for social development plans; and
- project evaluation method refinements or development of new techniques.

However, the topic of project governance models or frameworks for project management is a research topic on its own [269]. Financial institutions normally provide guidelines for social development plans [see Appendix A]. Only the following two main approaches to incorporate the social criteria in project management methodologies will therefore be investigated:

- social impact and social risk assessment - checklist, questionnaires and evaluation method; and
- project evaluation methods.

Table 6-2: Approaches that should be Followed to Incorporate Specific Criteria in Project Management Framework

	Approach Followed in Project Management Methodology			
	Measure Predicted Social Impact	**Project Governance Framework and Indicators to Assess during Post Implementation Review (PIR)**	**Risk Assessment (Questionnaires and Guidelines)**	**Address in Social Development Plan if Applicable to project**
Employment Opportunities	X[a]	X	X[b]	
Employment Remuneration		X		
Disciplinary and Security practices		X		
Employee Contracts		X		
Equity and Diversity		X		
Labour Sources	X[a]	X	X[b]	
Health and Safety practices		X		
Health and Safety incidents	X		X	
Research Development	X			
Career Development		X	X	
Health	X[c]			X
Education	X[c]			X
Housing	X[c]			X
Service Infrastructure	X[c]		X	X
Mobility Infrastructure	X[c]		X	X
Regulatory and Public services/ Institutional services		X		X

Table 6-2: Approaches that should be Followed to Incorporate Specific Criteria in Project Management Framework (continues)

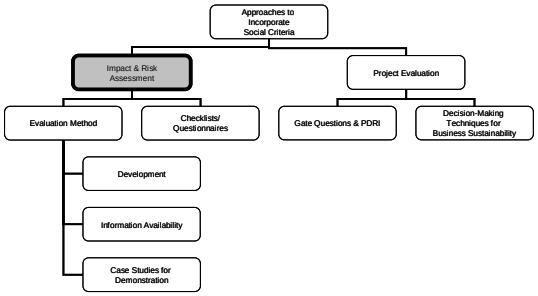
		Approach Followed in Project Management Methodology		
	Measure Predicted Social Impact	**Corporate Governance Framework and Indicators to Assess during PIR**	**Risk Assessment (Questionnaires and Guidelines)**	**Address in Social Development Plan if Applicable to Project**
Sensory Stimuli	X[c]		X	
Security	X[c]			
Cultural Properties	X		X	X
Economic Welfare	X[a,c]			X
Social Pathologies	X[c]			X
Social Cohesion	X[c]		X	X
Economic Welfare	X			
Trading Opportunities	X			X
Monitoring	Not applicable to projects			X
Legislation			X	
Enforcement		X	X	X
Information Provisioning		X	X	
Stakeholder Influence		X	X	

[a] – Link between impacts, double counting can occur

[b] – Link between criteria, can be addressed in same set of guidelines

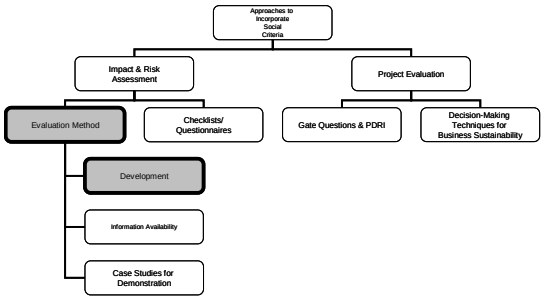
[c] – Influx of people, a contributing factor to impact

6.2 Social Impact and Social Risk Assessment



Social Impact Assessment (SIA) and Social Risk Assessment (SRA) are closely connected, since SIA provides insight into social risks and possible mitigation options, while SRA is regarded as a complement to SIA [270]. The two approaches will be integrated with questionnaires and checklists. However, to determine when to predict impacts and when to rely on a risk approach, the evaluation method proposed for social sustainable project life cycle management has to be developed and tested first.

6.2.1 Evaluation Method for Predicted Social Impact



6.2.1.1 Development of Method

The evaluation method is based on a Life Cycle Impact Assessment (LCIA) methodology. An LCIA model/methodology referred to as the Resource Impact Indicator (RII) method has been developed specifically for the South African environment [271] and is taken as a basis. The RII method calculates environmental impact indicators on four natural resource groups, following the precautionary principle and using the following equation:

$$RII_G = \sum_C \sum_X Q_X \cdot C_C \cdot N_C \cdot S_C \qquad \textbf{6-1}$$

Where:

RII_G = RII calculated for a main resource group, i.e. air, water, land and mined abiotic resources (as discussed in section 3.3.2) by summarising all impact pathways of the life cycle inventory constituents on a resource group

Q_X = Quantity of LCI constituent X, i.e. the impact in units

C_C = Characterisation factor for an impact category C (of constituent X) within the pathway

N_C = Normalisation factor for the impact category based on the ambient footprint, i.e. the inverse of the target state of the impact category

And: $S_C = \frac{C_S}{T_S}$ = Significance (or relative importance) of the impact category based on the distance-to-target method, i.e. current ambient state (C_S) divided by the target ambient state (T_S) [271]

The RII model is applied on a midpoint category, i.e. sub-impact category level, and requires weighting mechanisms to calculate a single score for the environmental dimension (shown in Figure 6-2).

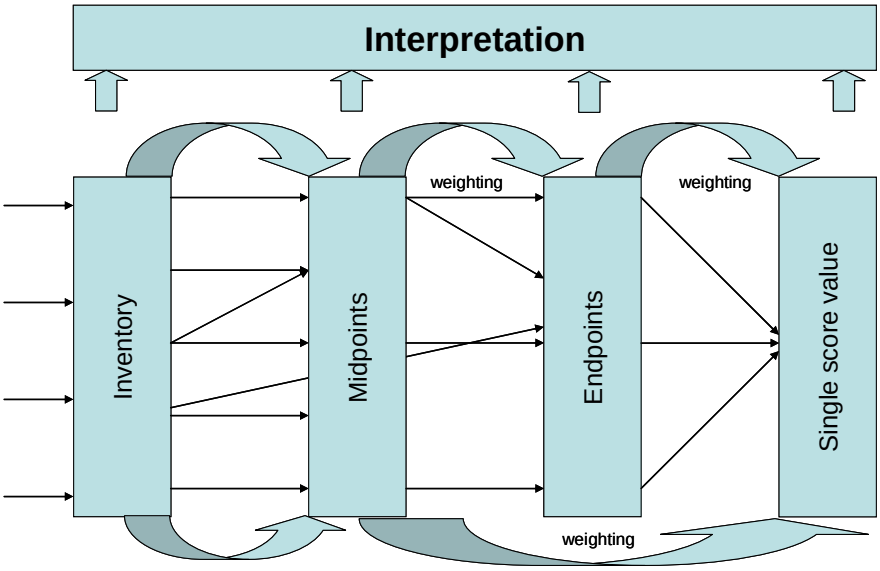


Figure 6-2: Midpoints and Endpoints in a Single Scoring Mechanism [Bare, et all in 271]

The RII method has been adopted to calculate Social Impact Indicators (SII). The following equation determines SII values by using the available project and social footprint information:

$$SII_G = \sum_C \sum_X Q_X \cdot C_C \cdot N_C \cdot S_C \qquad \textbf{6-2}$$

Where:

SII_G = SII calculated for a main area of protection (Level 4 of framework see Figure 3-6) by summarising all impact pathways of the life cycle inventory constituents for the areas of protection

Q_X = Quantity of LCI constituent X, i.e. the impact in units

C_C = Characterisation factor for an impact category C (of constituent X) within the pathway if necessary

N_C = Normalisation factor for the impact category based on the social footprint, i.e. the inverse of the target state of the impact category

And: $S_C = \frac{C_S}{T_S}$ = Significance or relative importance of the impact category based on the distance-to-target method, i.e. current state of social footprint (C_S) divided by the target state for social footprint (T_S).

To use the SII method, it is necessary to develop, define or determine the following:

- social interventions - actions affecting the social impact category that should form part of a compiled social LCI of the evaluated project/asset/product system;
- social impact category/areas of concern that can be used in the same manner as the four main resource groups in the RII. This would typically be a category representing a social issue of

concern into which LCI results can be assigned. Areas of concern will also be used as endpoints; and

- social midpoint categories or sub-impact categories, representing variables between the social interventions and social impact category endpoints, through an overview of the causal relationships between the social intervention, midpoints and endpoints [272].

6.2.1.1.1 Social Interventions

The case studies in Chapter 4 provided information regarding possible social interventions caused or influenced by businesses. These social interventions should therefore be taken into consideration. These interventions are listed in Table 6-3.

Table 6-3: Possible Social Interventions

Possible Social Interventions
• Employment opportunities - permanent or temporary, full-time or part-time, i.e. nature of jobs • Wages • Employee benefits • Indirect employment opportunities • Health and safety incidents • Health and safety practices • Migratory influx • National taxes • Local taxes • Water usage • Energy usage • Waste generation • Transporting people • Transporting goods • Structure of plant • Location of plant • Noise generated • Emissions released with strong odours • Nature of purchases, i.e. value and location of vendors • Nature of sales, i.e. value and location of clients • Investment in socio-environmental services • Investment in stakeholder participation initiatives • Investment in research and development facilities • Investment in training

Table 6-3: Possible Social Interventions (continues)

• Investment in health facilities
• Investment in education
• Investment in housing
• Investment in water services
• Investment in energy services
• Investment in waste services
• Investment in regulatory and public services
• Investment in transport network
• Stakeholder complaints

6.2.1.1.2 Social Impact Categories

The proposed social sustainability framework is used to define social impact categories. The four main social criteria, i.e. Level 4 of the framework, namely Internal Human Resources, External Population, Macro Social Performance and Stakeholder Participation, are defined as Areas of Concern (AoC) for which SIIs have to be calculated. The criteria on Levels 5 and 6 of the framework are used to assist in drawing causal relationships.

6.2.1.1.3 Midpoint Categories and Causal Relationships

Midpoint categories are sub-indicator categories used to establish a causal relationship between the social interventions and Level 6 criteria. Initially, all Level 6 criteria are used. A detailed overview of the causal relationships is shown in Appendix M. Table 6-4 shows the midpoint categories that have been defined in the relationship diagram as well as the best unit of equivalence. The causal relationship diagram was constructed by mapping interventions against areas of protection. As indicated in Appendix M, two midpoint categories, namely permanent positions and local population, are a level below the others.

The approaches proposed in Table 6-2 indicates that the following two midpoint categories are obsolete, since it does not provide input to a criterion that needs to be measured:

- knowledge level; and
- access to regulatory and public services.

Figure 6-3 shows the mapping between the relevant midpoint categories and the Areas of Protection.

Table 6-4: Midpoint Categories and Units of Equivalence

Midpoint Category	Units of Equivalence
Permanent positions	Number of employment opportunities equivalent to managerial positions e.g. number of black disabled female manager equivalents
Possible health and safety incidents	Fatality or disability injury rate
Knowledge level	Number of a skills level
R&D capacity	Expenditure on R&D capacity
Comfort level	Risk of discomfort
Aesthetics	Level of perceived acceptability
Local employment	Fraction of employable community hours
Local population	Level of short-term demographic changes
Access to health facilities	People per qualified doctor
Access to education	Literate adults
Availability of acceptable houses	Zoned residential area per capita
Availability of water services	Water of drinking quality per capita
Availability of energy services	kWh of electricity per capita
Availability of waste services	Capita per G:h landfill site
Pressure on public transport services	Seat kilometres per capita
Pressure on transport network	Ton kilometres per capita
Access to regulatory and public services	Expenditure on regulatory and public services per capita
External value of purchases	Fraction of purchased locally-manufactures goods
Migration of clients	Level of client portfolio
Improvement of socio-environmental services	Expenditure on socio-environmental services per capita
Change in relationships	Level of stakeholder trust

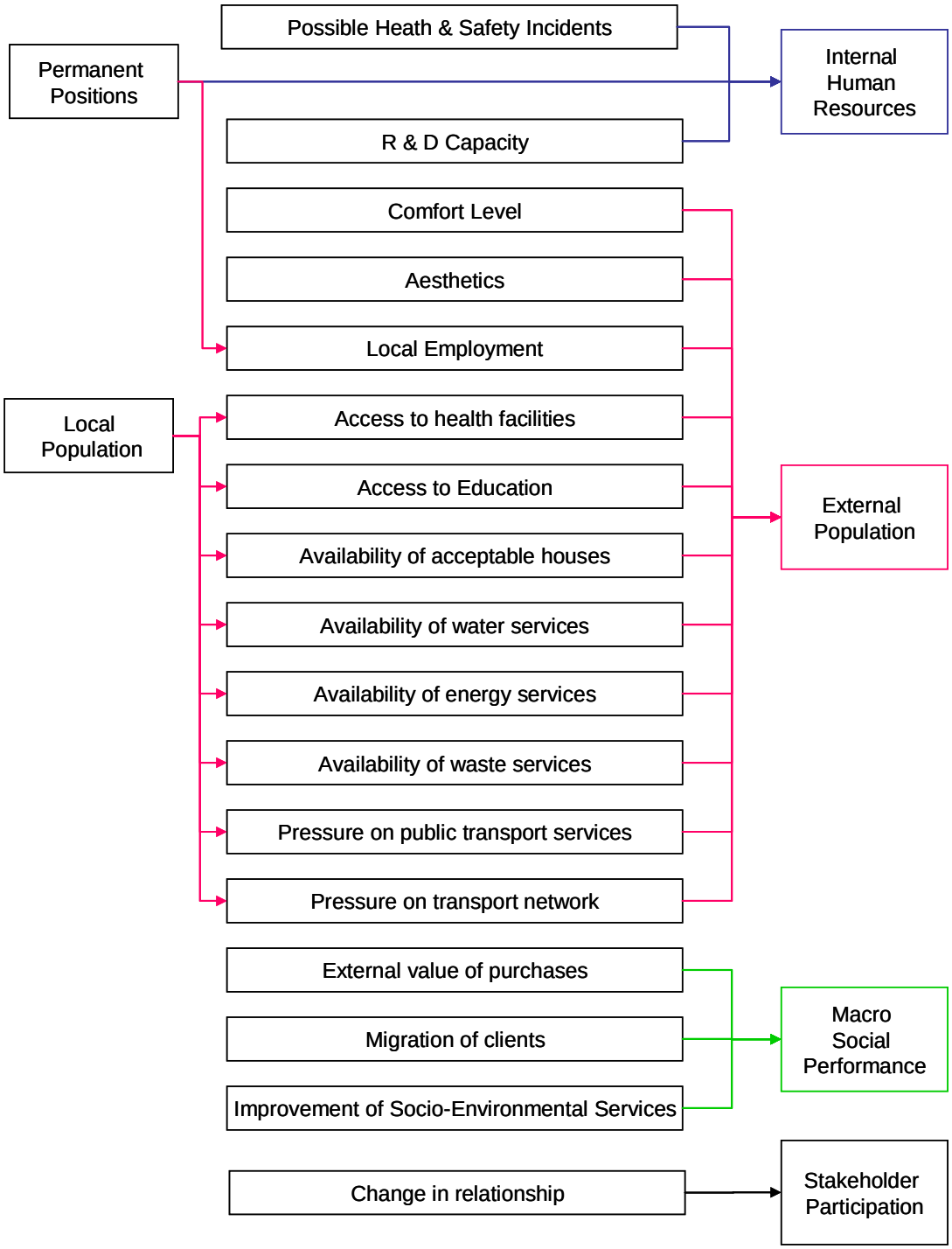


Figure 6-3: Midpoint Categories Mapped Against Areas of Protection

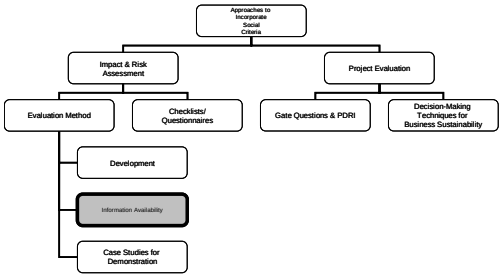
Two measurement methods are proposed to express the defined midpoint categories in equivalence units (see Table 6-5):

- quantitative evaluation approaches, including, but not limited to, costs and direct measurements in society; and
- qualitative evaluation approaches, which require appropriate subjective scales and associated guidelines, and have been proposed for the industrial ecology and streamlined LCA disciplines [133, 136].

Table 6-5: Midpoint Categories and Evaluation Methods

Quantitative Evaluation Method	Qualitative Evaluation Method
• Permanent positions • Possible health and safety incidents • Knowledge level • R&D capacity • Comfort level • Local employment • Access to health facilities • Access to education • Availability of acceptable houses • Availability of water services • Availability of energy services • Availability of waste services • Pressure on public transport services • Pressure on transport network • Access to regulatory and public services • External value of purchases • Improvement of socio-environmental services	• Aesthetics • Local population • Migration of clients • Change in relationships

The proposed evaluation methods for the midpoint categories are shown and demonstrated in the following sections.



6.2.1.2 Information Availability

To refine each midpoint category's evaluation method and to decide at which point in the project to start using the evaluation method, the following aspects should be addressed:

- information availability at the point of assessment within the project life cycle; and
- the availability of background social footprint information in the society where an operational initiative will occur.

These aspects can only be addressed when it is known both what information is needed from the project, i.e. the contributing interventions to the midpoint category, as well as with what social footprint information it should be characterised and normalised. Table 6-6 and Table 6-7 summarise the proposed project and social footprint information required.

Table 6-6: Information Required for Social Footprint

Midpoint Category	Assessment Method	Units of Equivalence	Social Footprint Information Needed
Permanent positions	Quantitative	Number of employment opportunities equivalent to employment type	Employment by type, i.e. position and full-time/part-time, for municipality
Possible health and safety incidents	Quantitative	Fatality or disability injury rate	Industry fatal accident or disability injury rate
R&D capacity	Quantitative	Expenditure on R&D capacity	Municipality budget on R&D or industry budget
Comfort level	Quantitative	Kilo tons of pollutants emitted per annum	Emissions and noise level of municipality as well as acceptable levels by standards, e.g. SABS standards
Aesthetics	Qualitative	Level of perceived acceptability	Perceived level of aesthetic acceptability by community
Local employment	Quantitative	Fraction of employable community hours	Employment by type for community or municipality
Local population	Quantitative	Level of short-term demographic changes	Demographic profile of community or municipal area
Access to health facilities	Quantitative	People per qualified doctor	National ratio of people per qualified doctor or international ratio

Table 6-6: Information Required for Social Footprint (continues)

Access to education	Quantitative	Literate adults[13]	Literate adults in municipality area or region
Availability of acceptable houses	Quantitative	Zoned residential area per capita	Size of municipality area
Availability of water services	Quantitative	Water of drinking quality per capita	Water of drinking quality used by municipality
Availability of energy services	Quantitative	kWh of electricity per capita	Electricity usage by municipality
Availability of waste services	Quantitative	Capita per G:h landfill site	Landfill sites (type and size) used by municipality.
Pressure on public transport services	Quantitative	Seat kilometres per capita	Public Transport seats available in municipal area.
Pressure on transport network	Quantitative	Ton kilometres per capita	Ton kilometres per capita (in region or nationally).
External value of purchases	Quantitative	Fraction of purchased locally-manufactures goods	Gross Domestic Product (GDP) per region and/or per industry.
Migration of clients	Qualitative	Level of client portfolio	
Improvement of socio-environmental services	Quantitative	Expenditure on SE services per capita	Expenditure on Environmental Services by the region.
Change in relationships	Qualitative	Level of stakeholder trust	Perceived stakeholder trust based on community questionnaires or surveys.

[13] Literate adults are defined as the percentage of people aged 15 and above who can, with understanding, both read and write a short, dimple statement on their everyday life.

Table 6-7: Project and Additional Information Required

Midpoint Category	Assessment Method	Intervention	Intervention Information	Information Classification	Additional Information Required
Permanent positions	Quantitative	Nature of jobs	Number and type of employment opportunities created or destroyed	Quantitative	Characterisation or conversion factors for different types of employment
Possible health and safety incidents	Quantitative	Health and safety incidents	Risk of health and safety incidents with prediction of number based on similar previous undertakings	Quantitative	Guidelines and checklists
R&D capacity	Quantitative	Investment in R&D	Investment by project in R&D as part of project budget	Quantitative	Conversion factor of money into capability
Comfort level	Risk/ Quantitative	Smell	Predicted emissions that can smell or risk of emissions	Quantitative	Characterisation factors for interventions
		Noise	Predicted noise levels or risk of noise	Quantitative	
Aesthetics	Qualitative	Local population	Predicted change in local population	Qualitative	Scoring guidelines and characterisation factors
		Structure and location	Risk of structure and location having a negative impact on aesthetics of community	Qualitative	Guidelines or checklists and characterisation factors
Local employment	Quantitative	Permanent positions	Number of permanent job type equivalents	Quantitative	Characterisation factors and conversion factors for indirect employment
		Indirect employment opportunities	Calculation: permanent positions multiplied by conversion factor	Quantitative	

Table 6-7: Project and Additional Information Required (continues)

Local population	Quantitative	Migratory influx	Predicted change in local population	Quantitative	Impact prediction scoring guidelines
Access to health facilities	Quantitative	Employee benefits	Monetary value of employment benefits or description thereof	Quantitative/ Qualitative	Characterisation factor and/or scoring guidelines
		Investment in health facilities	Monetary value	Quantitative	Characterisation factor
		Health and safety Incidents	Risk of health and safety incidents with prediction of number based on similar previous undertakings	Quantitative	Guidelines and checklists
		Local taxes	Monetary value	Quantitative	Characterisation factor
		National taxes	Monetary value	Quantitative	Characterisation factor
		Local population	Predicted change in local population	Qualitative	Scoring guidelines and characterisation factors
Access to education	Quantitative	National taxes	Monetary value	Quantitative	Characterisation factor
		Local taxes	Monetary value	Quantitative	Characterisation factor
		Investment in education	Monetary value	Quantitative	Characterisation factor
		Local population	Predicted change in local population	Qualitative	Scoring guidelines and characterisation factors

Table 6-7: Project and Additional Information Required (continues)

Availability of acceptable housing	Quantitative	Employee benefits	Monetary value of employment benefits or description thereof	Quantitative/ Qualitative	Characterisation factor and/or scoring guidelines
		Local population	Predicted change in local population	Qualitative	Scoring guidelines and characterisation factors
		Investment in housing	Monetary value	Quantitative	Characterisation factor
		National taxes	Monetary value	Quantitative	Characterisation factor
		Local taxes	Monetary value	Quantitative	Characterisation factor
Availability of water services	Quantitative	Investment in water services	Monetary value	Quantitative	Characterisation factor
		Water usage	Predicted water usage	Quantitative	Characterisation factor
		Local population	Predicted change in local population	Qualitative	Scoring guidelines and characterisation factors
		Local taxes	Monetary value	Quantitative	Characterisation factor
Availability of energy services	Quantitative	Local taxes	Monetary value	Quantitative	Characterisation factor
		Local population	Predicted change in local population	Qualitative	Scoring guidelines and characterisation factors
		Energy usage	Predicted energy usage	Quantitative	Characterisation value
		Investment in energy services	Monetary value	Quantitative	Characterisation factor
Availability of waste services	Quantitative	Local population	Predicted change in local population	Qualitative	Scoring guidelines and characterisation factors
		Local taxes	Monetary value	Quantitative	Characterisation factor
		Waste generated	Predicted waste that will be generated	Quantitative	Characterisation factor
		Investment in waste services	Monetary value	Quantitative	Characterisation factor

Table 6-7: Project and Additional Information Required (continues)

Pressure on public transport services	Quantitative	Local population	Predicted change in local population	Qualitative	Scoring guidelines and characterisation factors
		Local taxes	Monetary value	Quantitative	Characterisation factor
		National taxes	Monetary value	Quantitative	Characterisation factor
		Transport of people	Predicted number of additional people that will use public transport	Quantitative	Characterisation factor
Pressure on transport network	Quantitative	Local population	Predicted change in local population	Qualitative	Scoring guidelines and characterisation factors
		National taxes	Monetary value	Quantitative	Characterisation factor
		Local taxes	Monetary value	Quantitative	Characterisation factor
		Transport of people	Predicted number of additional people that will use public transport	Quantitative	Characterisation factor
		Transport of goods	Predicted number of additional tons of goods that will be transported	Quantitative	Characterisation factor
		Investment in transport network	Monetary value	Quantitative	Characterisation factor
External value of purchases	Quantitative	Nature of purchases	Monetary value	Quantitative	
Migration of sales	Qualitative	Nature of sales	Monetary value with qualitative description	Quantitative/ Qualitative	Scoring guidelines

Table 6-7: Project and Additional Information Required (continues)

Improvement of socio-environmental services	Quantitative	Investment in socio-environmental services	Monetary value	Quantitative	Characterisation factor
Change in relationships	Qualitative	Investment in energy services	Monetary value	Quantitative	Characterisation factor and scoring guidelines
		Investment in waste services	Monetary value	Quantitative	
		Investment in water services	Monetary value	Quantitative	
		Investment in regulatory and public services	Monetary value	Quantitative	
		Investment in housing	Monetary value	Quantitative	
		Investment in education	Monetary value	Quantitative	
		Investment in health facilities	Monetary value	Quantitative	
		Investment in transport network	Monetary value	Quantitative	
		Investment in socio-environmental services	Monetary value	Quantitative	
		Investment in stakeholder participation initiatives	Monetary value	Quantitative	

6.2.1.2.1 Project Information

The Delphi technique [267] was used to determine the availability of the social information necessary to use the evaluation method. The same group of project management experts that participated in the first Delphi technique (see section 5.3), took part in this study. These experts were handled anonymously. Two iterations of questionnaires and feedback reports were executed.

The first round of questionnaires was completed during personal interviews with each respondent to ensure a clear understanding of the required information (as shown in Table 6-7). The questionnaires contained a list of social information needed and asked the open-ended question "Before which decision point (gate) in the project life cycle is the information available or can it be predicted?" using the project life cycle showed in Figure 1-4. The results were analysed and presented in the second questionnaire as an answer statement to the question. Respondents had to indicate whether they agree or disagree. Where respondents disagreed, they had to indicate when in the project life cycle they believe the information would be available. The second questionnaire resulted in consensus and was followed by the final feedback report. Examples of the questionnaires are shown in Appendix N. The results of the Delphi questionnaires are summarised in Table 6-8.

Table 6-8: Summary of Results from Delphi Technique on Project Information Available

Social Information Needed	Intervention[14]	Phase in which Information is Available	Type: Prediction/ Certainty
Number and type of jobs created	Nature of jobs	Feasibility phase	Prediction of types and numbers
Health and safety risks (possible incidents)	Health and safety incidents	Feasibility phase	Prediction of risk involved
Number of specific skilled personnel required	Nature of jobs knowledge level	Feasibility phase and development phase	Prediction of types and numbers
Expenditure on R&D	Investment in R&D	Pre-feasibility, if applicable	Prediction of necessity and possible cost
Environmental risks e.g. smells	Smell Noise Other nuisance issues	Feasibility phase	Initially it is only possible to predict risk - detail risk figures follow later
Nuisance risks to public	Structure location	Feasibility phase	Prediction of risks

[14] Interventions associated with the information have not been listed in the Delphi questionnaire.

Table 6-8: Summary of Results from Delphi Technique on Project Information Available (continues)

Social Information Needed	Intervention [14]	Phase in which Information is Available	Type: Prediction/ Certainty
Percentage of jobs that can be filled by local people	Permanent positions	Feasibility phase	Prediction of types and numbers
Possible inflow of people	Migratory influx	Pre-feasibility phase and feasibility phase	Prediction of risk
Project will invest in housing	Investment in housing	Feasibility phase	Prediction of possibility
Water usage of project	Water usage	Feasibility phase	Prediction of numbers
Energy usage for project	Electricity usage	Feasibility phase	Prediction of numbers
Waste generated by project	Waste generated	Feasibility phase	Prediction of numbers
Pressure on public transport services	Transport of people	Feasibility phase	Prediction of possible impact - low, medium or high
Pressure on transport network by additional people transfers, e.g. company buses	Transport of goods	Feasibility phase	Prediction of possible impact - low, medium or high. Later more information
Percentage of goods required for project that can be purchased locally	Nature of purchases	Development phase (sometimes feasibility phase)	Prediction of types and numbers
Possibility of clients migrating to project location	Nature of sales	Pre-feasibility phase	Possibilities will be known or predictable
Knowledge about whether the project should invest in macro social environmental aspects, e.g. monitoring	Investment in socio-environmental services	Development phase	Predictions

Table 6-8: Summary of Results from Delphi Technique on Project Information Available (continues)

Social Information Needed	Intervention [14]	Phase in which Information is Available	Type: Prediction/ Certainty
Information regarding stakeholders	Investment in stakeholder participation initiatives	Feasibility phase and development phase	Predictions

The Delphi case study indicates that most information can be predicted during the feasibility phase, i.e. before Gate 3: Business Case Gate, and will be known with more certainty as the project progresses. However, not all of the information is currently collected. All of the information will also not be collected for all sizes and types of projects. This case study also confirmed the results of the Delphi technique case study in Chapter 5, which concluded that a distinction between greenfield and brownfield projects might be necessary in the process industry.

6.2.1.2.2 Social Footprint Information

South Africa does currently not have a centralised statistics database from which statistics can be extracted. Different organisations are collecting statistics around the country in various details. Statistics South Africa launched a project in 2005, which attempted to centralise a database to provide information on the kind of statistics available from different bodies across the country [273]. The database is, however, not available yet. The following organisations have been approached to gather social footprint information:

- Statistics South Africa [274];
- Department of Transport [275];
- Council for Scientific and Industrial Research (CSIR) [276];
- Department of Health [277];
- Department of Labour [278];
- NOSA International [279]; and
- Municipal Demarcation Board South Africa [280] and individual municipalities.

The statistical information available from these sources are summarised in detail Appendix O and briefly in Table 6-9. The searches for statistics indicated that statistics on municipal level are mostly collected in the five-yearly census [273] and are restricted predominantly to household statistics. Statistics South Africa's Labour force survey does provide industry statistics. The statistical information available from municipalities depends on the area's size, the council's environmental initiatives and whether a strategic environment assessment has been conducted in the area..

Table 6-9: Summary of Social Footprint Information Available for Midpoint Categories

Midpoint Category	Information Available	Level	Frequency of Updates
Permanent positions	Employment percentage (by gender)	Municipality or industry	Five-yearly or bi-annually
	Employed, unemployed and not economically active	Municipality	Five-yearly
Possible health and safety incidents	NOSA does not make industry average information available [281]. However, the complaint commissioner publishes information with a five year lead time, namely number of accidents per extent of disablement according to industry, magisterial district, province or national and average days lost due to accidents [282]		
R&D capacity	No statistical information on R&D expenditure on a provincial or municipal level is available. The national budget's allocation to the Department of Science and Technology can be used as a baseline but is not a true representation of government R&D expenditure, since other departments also undertake R&D projects		
Comfort level	Air pollution levels	Some municipality	Depends on source
Aesthetics	Statistics are not available but the company can gather information through community surveys		
Local employment	As for permanent positions		
	Gross salaries and wages	Industry	Annually
Local population	Population breakdowns	Provincial and national	Annually and bi-annually
	Migration streams	Provincial	Annually
	Immigrant and emigrant figures	National	Annually
	Population breakdown	Municipality	Five-yearly
	Citizenship statistics	National	Five-yearly
Access to health facilities	Life expectancy at birth	National	Annually
	Medical Aid coverage by population group	National	Annually
Access to education	Adult literacy rate	National	Five-yearly
	Highest education levels	Provincial	Annually
	Education institutions attended	Municipality	Five-yearly
Availability of acceptable houses	Dwelling types, household size and number of rooms	Municipality	Five-yearly
Availability of water services	Water used by municipality	Municipality	On request

Table 6-9: Summary of Social Footprint Information Available for Midpoint Categories (continues)

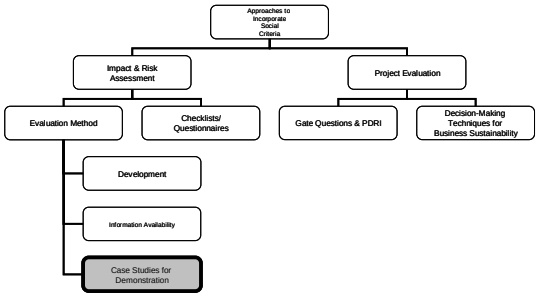
Midpoint Category	Information Available	Level	Frequency of Updates
Availability of energy services	Energy used by municipality	Municipality	On request
Availability of waste services	Household refuse statistics	Municipality	Five-yearly
	Available landfill site	National	Five-yearly
Pressure on public transport services	Municipal, provincial and national statistics are not available. However, some individual municipalities are starting to collect data, especially those cities participating in CEROI[15], since "Access to public transport" is one of their indicators [283]		
Pressure on transport network	Volumes of good transported in the transport network	National	Every three to five years
External value of purchases	GDP	Provincial/Industry	Quarterly/Annually
	Purchases	Industry	Annually
	Turnover	Industry	Annually
Migration of clients			
Improvement of socio-environmental services	Expenditure on environmental protection	Provincial	Annually
Change in relationships	Statistics are not available, but the company can gather information through community surveys		

6.2.1.2.3 Conclusion

The social footprint information required is not available in the sought format for the SII calculation procedure. This implies that certain units of equivalence will have to be changed according to the available information. However, the relevant information will most probably differ from project to project, depending on the region in which the project is executed as well as the type of project. To define new units of equivalence for the relevant midpoint categories, the evaluation method is applied to three different case studies, each representing an asset life cycle phase.

[15] CEROI is the City Environmental Reports on the Internet initiative supported by UNEP. Four South African cities are currently involved.

6.2.1.3 Case Studies to Test Information Availability and Demonstrate Evaluation Method



The SII evaluation method will be demonstrated below using equation 6-2.

$$SII_G = \sum_C \sum_X Q_X \cdot C_C \cdot N_C \cdot S_C \qquad \textbf{6-2}$$

Where:

SII_G = SII calculated for a main area of protection (Level 4 of framework see Figure 3-6) through summarising all impact pathways of the life cycle inventory constituents for the areas of protection

Q_X = Quantity of LCI constituent X, i.e. the impact in units

C_C = Characterisation factor for an impact category C (of constituent X) within the pathway, if necessary

N_C = Normalisation factor for the impact category based on the social footprint, i.e. the inverse of the target state of the impact category

And: $S_C = \frac{C_S}{T_S}$ = Significance or relative importance of the impact category based on the distance-to-target method, i.e. current state of social footprint (C_S) divided by the target state for social footprint (T_S)

6.2.1.3.1 Construction

The construction project involving the open cast mine discussed in Chapter 4 (see section 4.1.2) will be used for demonstration purposes. The project is handled hypothetically as a stand alone project and the impacts of the associated underground mine closure are not taken into account. The project information retrieved from the environmental management programme [230], specialist report [284] and publications of StatsSA are summarised in Table 6-10 and Table 6-11.

Table 6-10: Summary of Project Information Available for the Construction Project

New Mine: Project Information		
	Construction	**Operation**
Employment opportunities created	450 people [230:138]	300 employment opportunities over a 20 year life span [230:121]
Employment opportunities destroyed	20 employment opportunities on farms [230:267]	
Indirect employment opportunities	Multiplier effect of 2.8: 1260	Multiplier effect of 2.8: 840
Contribution to GDP (added or lost)	R52 million per annum (in 1999/2000) [284:32]	
Reduction in property values	9-19% (year 1-10) [230:258]	2-6% (after year 10 till mine closure) [230:258]
Increases in ambient noise levels (dBa) on average	<2 [230: 195]	< 2 [230: 238-239]
Dust (mg/day/m2)	Between <50 – 250 [230:187]	<100 [230:231]

Table 6-11: Summary of Social Footprint Information Available for the Construction Project

Social Footprint Information			
Labour Force: Potentially Economically Active in Region[284: 55]			
Total	**Employed**	**Unemployed**	**Not Economically Active**
736,721	308,826	149,335	278,560
100%	41.9%	20.3%	37.8%
Estimated Ambient Noise Level (dBA) [230: 97]			
Time of Day	**Typical Weekday**		**Typical Weekend**
Morning	50,9		49,2
Midday	46,9		48,0
Evening	41,4		46,9
Night	34,7		42,3
Over 24 hours	44,6		46,8
Sasolburg GGP (1991) Due to Kind of Activity [284: 59]			
Mining and quarrying		R259,677,000.00 per annum	
Dust Pattern [230]			
March - July		Low	
August - December		Higher	
January - February		Lower	
Dust Figures [230]			
September	Moderate		251-500 mg/day/m2
October (2 sites)	Heavy		501-1200 mg/day/m2
November (1 site)	Heavy		501-1200 mg/day/m2

The calculated Social Impact Indicators for the project, using equation 6-2, is shown in Table 6-12. The project will have an overall positive social impact, although job creation could not outweigh the negative impact on the comfort level on the neighbourhoods in a close vicinity to the plant. The overall positive impact is mainly due to the large contribution the project will make to the Gross Geographic Product (GGP) of a relative small area, which relies strongly on mining.

Table 6-12: Social Impact Indicators for a Construction Project

Area of Protection	Intervention	Mid-point Category	Normalisation Value (T_S^{-1})	Significance Value (C_S/T_S)	Midpoint Indicator Value	SII Value
Internal Human Resources	Employment Creation	Permanent Positions	2.18264 x 10^{-06}	0.455791741	2.98E x 10^{-04}	**2.98E x10^{-04}**
External Population	Permanent Positions	Local Employment	1.11359 x 10^{-09}	0.674055627	1.68 x 10^{-03}	**-7.48 x10^{-02}**
	Noise & Dust generated	Comfort Level[16]	2.19 x 10^{-02} 1.09 x 10^{-03}	1 1	-4.38 x 10^{-02} -1.09 x 10^{-01}	
Macro Social Performance	Nature of Sales	External value of purchases[17]	3.85 x10^{-03}	1	2.0 x 10^{-01}	**2.0 x 10^{-01}**
Stakeholder Participation						
Final Social Impact Value						**1.26 x10^{-01}**

[16] Since no characterisation factors for noise to dust or dust to noise is available, the midpoint category was calculated as a weighted average with equal weights to each constituent.

[17] The units of equivalence have been changed to contribution to GDP due to the information available

6.2.1.3.2 Operation

The chemical manufacturing facility in the Mpumalanga province discussed as a case study in Chapter 4 (see section 4.2.1.2) is used to demonstrate the SII for the operational phase. The facility was chosen since a strategic environmental assessment for the area as well as the company's sustainable development report is available [285, 263]. Information obtained from these sources together with stated assumptions are summarised in Table 6-13.

Table 6-13: Summary of Information Available for Operation Phase

Intervention	Plant Information[18]	Social Footprint Information
Employees	± 7000	Target: To have everyone employed, excluding people who prefer to be not economically active. Govan Mbeki Municipality [19]: Employed: 60681 Unemployed: 40189 Total Labour Force: 100870
Indirect employment creation	±21000 (applying the rule of used in SIA (see Chapter 4))	Employable community work hours - assuming all full-time employees - 40 hours - 49 weeks (3 weeks leave)
Total injuries	541	13 019[20]
Disabling injury rate (no/200,000 hours)	0.59	
Health and safety incidents (spillages)	70	
Atmospheric emissions:		
SO_2	197 kilo ton	
NO_x	138.8 kilo ton	
VOC	394 kilo ton	
H_2S	90 kilo ton (Permit: 101)	
CO_2	44 109.2 kilo ton	

[18] All plant information has been obtained from the sustainable development report, where the average of data available has been used unless otherwise stated.

[19] Census 2001 information.

[20] Total number of accidents in the Mpumalanga province in 1999 according to the Compensation Fund Statistics Report [282].

Table 6-13: Summary of Information Available for Operation Phase (continues)

Atmospheric Emissions (Concentration Information from SEA)		
NO_x	1 Hour Maximum NO_2 concentration average of 5 receptor points: 539. 4µg/m^3	Acceptable target (WHO guideline): 200µg/m^3 (1-hour NO_x average) [285:80] Current State: 1 hour maximum NO_2 concentration based on maximum predicted concentration: 801µg/m^3 [286: Appendix A page 1]
SO_2	24-hour maximum SO_2 Concentration based on average of five receptor points: 127.4µg/m^3 [285:237]	Acceptable target (WHO guideline): 125µg/m^3 [285:80] Current State: 24 Hour Maximum SO_2 Concentration based on maximum predicted concentration: 152µg/m^3 [286: Appendix A page 1]
Water usage - river water	89 963 m^3	Target: (1:200 year firm yield) 150 million m^3 per annum Current (predicted 1998/2000 average) 183.6 million m^3 per annum [285: 160-161]
Financial turnover	R7,835.00 million	R49 707 million[21]
Transportation incidents	12	
Complaints	36	

Table 6-14 shows the calculated SIIs for the project, using equation 6-2. It is shown that the operation of the plant has an overall negative social impact. The positive contribution to GDP and employment cannot outweigh the negative impacts on comfort level, people (in the form of health and safety accidents) and the water usage. The biggest social impact is the impact on comfort level due to atmospheric emissions, i.e. secondary environmental impacts.

[21] According to GDP statistics of StatsSA - Publication Number: P0441 - GDP; Average of 1995 to 2000.

Table 6-14: Social Impact Indicators for the Operational Phase

Area of Protection	Intervention	Mid-point Category	Normalisation Value (T_S^{-1})	Significance Value (C_S/T_S)	Midpoint Indicator Value	SII Value
Internal Human Resources	Employment Creation	Permanent Positions	9.91375×10^{-06}	0.601576286	0.04174714	1.92×10^{-04}
	Health & Safety Accidents	Possible Health & Safety Incidents[22]	7.68×10^{-05}	1	-0.041554651	
External Population	Permanent Positions	Local Employment	5.05753×10^{-09}	0.601516653	0.125237887	-1.84821
	Atmospheric Emissions (SO_2)	Comfort Level[23]	0.008	1.216	-1.2393472	
	Water Usage	Availability of water services	0.006666667	1.2240	-0.73409808	
Macro Social Performance	Nature of Sales	External value of purchases[24]	2.01179×10^{-05}	1	0.157623675	0.158
Stakeholder Participation						
Final Social Impact Value						**-1.690018**

[22] The units of equivalence have been changed to annual accidents due to the information available.

[23] Comfort level is measured quantitatively in concentration SO_2.

[24] The units of equivalence have been changed to contribution to GDP due to the information available.

6.2.1.3.3 Decommissioning

Decommissioning the acrylic fibre plant in the Ethekwini municipal district of South Africa's KwaZulu Natal province discussed as a case study in Chapter 4 (see section 4.3.2) is used for demonstration purposes. The specific project was chosen, since project and social footprint information is available, due to the following reasons:

- the plant's social and environmental data during its operational phase is available in the company's sustainable development report [263];
- a Strategic Environmental Assessment has been completed for the Durban South basin area where the plant was located [287]; and
- Ethekwini Municipality have other sustainable development indicator data available on their internet website [288].

The project information retrieved from the sustainable development report is summarised in Appendix P. Some information is provided as per kilogram of product produced. The report states that the factory had an annual production capacity of 36,000 tons. An efficiency of 80% is assumed to calculate project impact figures from the provided information. In the same way, a fixed annual turnover and number of employees are assumed, based on the figures provided in the sustainable development report. Social footprint information are also summarised in Appendix P. Table 6-15 provides a summary of information available to apply the evaluation method.

Table 6-15: Summary of Information Available for the Decommissioning Phase

Intervention	Project Information	Social Footprint Information
Nature of jobs	250 employment opportunities lost (5% relocated = 12)	Ethekwini unemployment: 28% Durban South basin unemployment: 52% Ethekwini employment: 37% Target: To have everyone employed, excluding people who prefer to be not economically active
Indirect employment destruction	±750 (applying the rule of used in SIA (See Chapter 4))	Employable community work hours - assuming all full-time employees - 40 hours - 49 weeks (3 weeks leave)
Work-hours lost due to injuries	475.25 hours	

Table 6-15: Summary of Information Available for the Decommissioning Phase (continues)

Disabling injuries	6.5	Although social footprint information is available, the definition of disabling injuries is not given and therefore information is not comparable
Disabling injury rate (no/200 000 hours)	2.375	
Health and safety incidents (spillages)	0.75 per annum	
Atmospheric Emissions:		*Ethekwini Emissions*
SO_2	0.488 kilo ton per annum	54.50 kilo ton per annum
NO_x	0.111 kilo ton per annum	54.50 kilo ton per annum
VOC	0.005 kilo ton per annum	No information available
Water usage	1 429 200 kilo litre per annum	Ethekwini - with water loss: 168 090 ML - without water loss:280149 ML
Energy usage	48.384 GWh per annum	Ethekwini: 9098 GWh per annum
Solid waste:	$5.25x10^3$ m^3 per annum	
General/Domestic	$2.575x10^3$ m^3 per annum 1545 tons per annum[25] [289]	Durban South basin: 45 000 ton per annum
Non-Hazardous Industrial	$2.675x10^3$ m^3 per annum	
Nature of sales	Annual turnover of R500 million	GDP of KwaZulu Natal: R113,047.00 million
Stakeholder complaints	0.5 per annum	

SIIs calculated for the project, using equation 6-2, are shown in Table 6-16. The decommissioning project has an overall positive social impact since the positive impact on resources and comfort level outweighs the negative impact on the economy due to employment termination. The secondary impacts of employment termination, for example social pathologies, have not been accounted for. The score is thus showing an impaired social picture.

[25] The South African Department of Water Affairs and Forestry's minimum requirements for waste density was used for the conversion (See Appendix P) [289].

Table 6-16: Social Impact Indicators for a Decommissioning Project

Area of Protection	Intervention	Mid-point Category	Normalisation Value (T_S^{-1})	Significance Value (C_S/T_S)	Midpoint Indicator Value	SII Value
Internal Human Resources	Nature of Jobs	Permanent Positions	7.27825×10^{-07}	0.569838066	-1.09×10^{-04}	-1.09×10^{-04}
External Population	Permanent Positions	Local Employment	3.71339×10^{-10}	0.569838066	-4.20×10^{-04}	5.47×10^{-02}
	Energy Usage	Availability of Energy Services	0.000109909	1	5.32×10^{-03}	
	Water Usage	Availability of Water Services	3.56952×10^{-09}	1	5.10×10^{-03}	
	Waste generated	Availability of waste services[26]	2.22222×10^{-05}	1	3.43×10^{-02}	
	Atmospheric Emissions (SO_2 & NO_X)	Comfort Level[27]	0.018350644	1	1.04×10^{-02}	
Macro Social Performance	Nature of Sales	External value of purchases[28]	7.98335×10^{-06}	1	-3.99×10^{-03}	-3.99×10^{-03}
Stakeholder Participation						
Final Social Impact Value						**5.06×10^{-02}**

[26] Based on information available, the units of equivalence have been changed to domestic waste generated in tons.

[27] Comfort level is measured quantitatively in kilo tons SO_2 per annum using CML characterisation factors.

[28] The units of equivalence have been changed to contribution to GDP due to the information available.

6.2.1.4 Conclusion

The case studies indicated that:

- all midpoint category indicators cannot be calculated either due to a lack of project information or due to a lack of social footprint information;
- the limitation of available social footprint information resulted in only some midpoint category indicators being calculated, i.e. permanent positions, water usage, energy usage, nature of sales and comfort level, which leads to an impaired social picture. In addition, the midpoint category indicators for water usage, energy usage and comfort level are much higher than permanent positions, thus resulting in a net negative social impact not representing the true social picture;
- the units of equivalence cannot be fixed, since it depends on the available information. This will complicate indicator comparison between various projects; and
- to determine whether social impacts are positive or negative is not straightforward. Although conventional methods that regard resource usage as a negative impact were followed, it can be argued that company resource use may result in infrastructure to be built, which benefits the community.

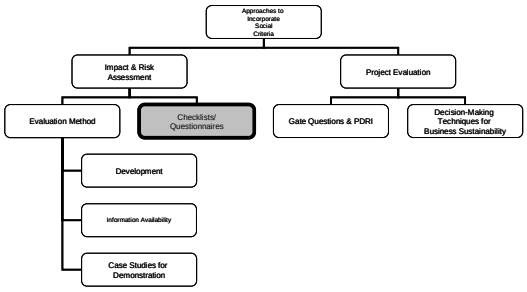
The case studies together with the whole evaluation method were presented to a focus group. The Focus Group Technique[29] [290] was chosen to determine project management personnel's perspectives, opinions and concerns with regards to the evaluation method. The technique was thus applied as a confirmatory tool [291] with the aim of determining the appropriateness and usefulness of the evaluation method. The focus group consisted of senior business personnel involved in project management in the process industry. A mini group approach (only 4 to 6 members in the group) was chosen due to the fact that more in-depth knowledge can be gained from a smaller group [292]. The following is concluded from the focus group:

- the idea of assigning quantitative values to social impacts and concerns appealed to the participants;
- however, the participants did not feel comfortable with the LCIA methodology used as a basis for the evaluation method. This can be due to the unfamiliarity of LCIA in the project management field;
- participants were concerned about the social footprint data needed for the evaluation; and
- incorporating the information into decision-making was also questioned, based on current decision-making techniques, which prefer monetary values.

[29] The Focus Group Technique is a social science research technique, which provides emic data (data that arise in a natural or indigenous form and are minimally imposed by the researcher or the research settings). The technique consists of a small group of people (maximum 10 people) who enters a 90 to 120 minute discussion led by a trained facilitator or moderator. The group can be recruited based on common demographics, attitudes or skill levels. There are various applications for the technique, especially in the marketing field.

It can be concluded that the evaluation method should not immediately be applied or used in project management due to resistance to the method and a lack of social project and footprint information. It is an international problem that current available statistics are incapable of providing an integrated view of various dimensions of sustainable development [293], including the social dimension. The lack of social information parallels the situation regarding environmental information in the middle 1980s when researchers identified a lack of quality information as a problem and various calls for environmental data banks emerged [294, 295]. Since the state of development for indicators or measurements for social business sustainability parallels that of environmental performance approximately 20 years ago [158], and the attention the dimension received from business had been marginal until the late 1990s [93, 89, 157] it is not surprising that the evaluation method proposed can be overwhelming to project managers. It is therefore proposed that social sustainability should be incorporated into project management methodologies in phases, starting with questionnaires and checklists following more traditional risk approaches. In future, the proposed evaluation method can be implemented when information is more readily available.

6.2.2 Checklists and Questionnaires



Reservations was expressed towards a checklist or questionnaire approach in that it may be used instead of following a proper social impact assessment scoping process [166]. However, the checklists and questionnaires aimed to ensure a pro-active approach with regards to addressing social criteria during the project life cycle and thus to increase awareness of possible social consequences that the project can have.

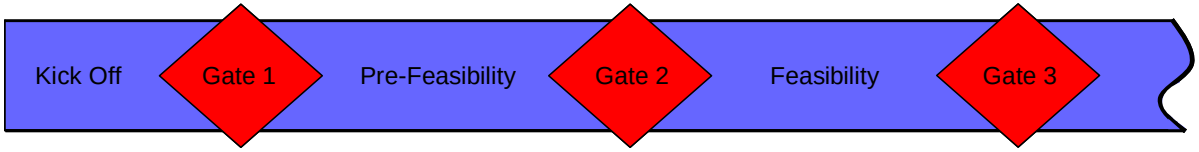
An extensive literature search indicated that not many social impact assessment checklists or questionnaires are available within the public domain. Therefore, specific checklists and/or questionnaires have been developed for the individual project life cycle phases using the research conducted for the evaluation method as basis. The nature of information requested changes as the project progresses and more detail information is available of the associated asset and product life cycle. The magnitude and significance of impacts are described using the systematic manner proposed by the South African Department of Environmental Affairs and Tourism (DEAT), namely:

- extent or spatial scale of impact;
- intensity and severity of impact;
- duration of impact;
- mitigatory potential;
- acceptability;
- degree of certainty;
- status of the impact; and
- legal requirements [296].

The checklists and questionnaires do not replace the social impact assessment study, which is normally completed as a part of the EIA in the development phase, but can provide input to the study. The checklists and questionnaires for individual phases are attached in Appendix Q. A summary of the main activities and deliverables prompted by the questionnaires and checklists are shown in Figure 6-4 and Figure 6-5.

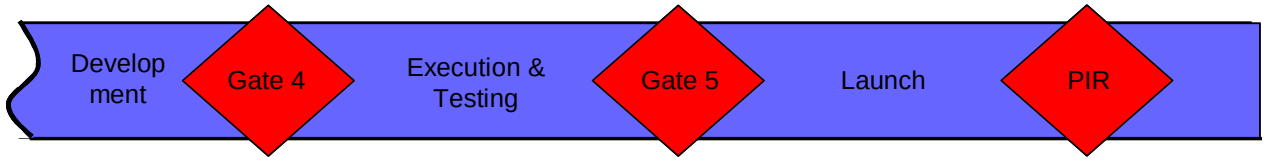
The two Delphi technique applications (section 5.3and section 6.2.1.2.1) concluded that greenfield and brownfield projects required different approaches. In spite of this, the questionnaires and/or checklists are generic and contain detailed social questions and activities, which might not always be relevant to brownfield projects. It is the project manager's prerogative to ignore some of the social aspects. In a greenfield project, the need might arise to address social issues earlier, which would imply that checklists and questionnaires of future phases are used earlier. A webbased computer package has been designed to assist with the implementation of the checklists in the project life cycle. The package

distinguishes between brownfield and greenfield projects by providing references to additional information sources for Greenfield projects. (See Appendix R).



Communicate all relevant strategies to design team. Clarify the role of R&D in the project. Identify individuals for project team in accordance with competencies and career paths. Identify all stakeholders. Complete questionnaire and identify possible areas of concern.	Design/Develop Stakeholder Engagement Plan. Identify possible opposing legislation or legislative needs of project. Identify capacity development requirements to ensure employees that can operate technologies. Complete questionnaire and identify possible areas of concern.	Complete Impact Descriptions according to the DEAT Method as far as possible Communicate or Study Equity and Labour Source Strategies of Company Identify possible resistance groups Identify possible opposing legislation or legislative needs of project. Compile Scope for SIA Complete questionnaire to identify gaps in business that needs to be addressed or problems that threatens feasibility.	**Activities**
List of Stakeholders List of possible areas of concern. Informed Design team. Project Team	Stakeholder Engagement Plan List of possible external impacts of concern List of relevant legislation Capacity Development Requirements List of possible stakeholders of concern	Scope for SIA List of possible resistance to project Impact Descriptions and a list of areas with incomplete data or knowledge of impacts List of gaps in business that needs to be addressed Action plans to ensure feasibility in terms of service resources	**Deliverables**

Figure 6-4: Summary of Proposed Activities and Deliverables Prompted by Questionnaires and Checklists for Phase 1 to 3



SIA performed Complete questionnaire Formalize Health & Safety Practices Develop Environmental Enforcement Plan	Appointment of employees in accordance with equity and labour strategy. Adoption of security and disciplinary practices. Execution of Environmental Enforcement Plan Development of measures to measure actual impacts Identification & Mitigation of additional social problems.	Adopting strategies and business practices for future functioning as an independent unit. Initiation of actions to build a long-terms stakeholder relationships with stakeholder.	**Activities**
Completed SIA List of critical social concerns Predicted social impacts List of possible problems that threatens strategy adherence of the project. Environmental Enforcement Plan	Employee Force in accordance with equity and labour source strategies Impact Measures	A functioning asset in accordance with project objectives	**Deliverables**

Figure 6-5: Summary of Proposed Activities and Deliverables Prompted by Questionnaires and Checklists for Phase 4 to 6

6.2.3 Conclusion

Questionnaires and checklists promoting social impact and risk identification should be incorporated in project management methodologies as the first phase of addressing social business sustainability. In a subsequent phase, the proposed evaluation method can be implemented in the project management methodologies. However, this can only occur once the paradigm shift of internalising external social impacts has taken place and the database of social information has been broadened, which would solve most problems associated with the method. Figure 6-6 shows at which stages in the life cycle the various proposed tools could be used.

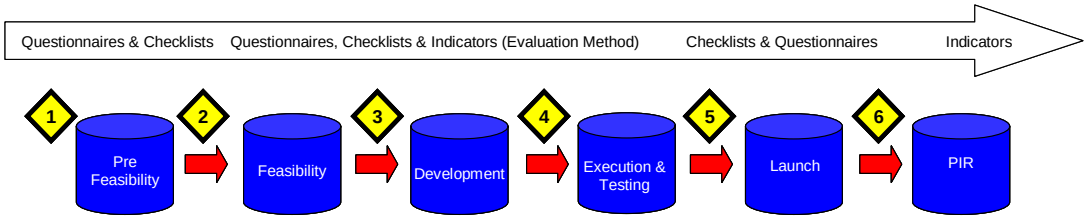
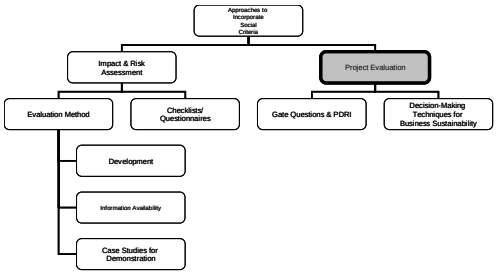


Figure 6-6: The Use of Proposed Methods over the Life Cycle

6.3 Project Evaluation Methods



In the project life cycle management methodology introduced in Chapter 1, six decision points or gates have been identified over the project life cycle [see Figure 1-4]. The project's sponsors and other stakeholders evaluate the project at these decision points or gates. The primary objectives of these project appraisals are:

- estimating project outcomes before committing significant funds;
- comparing estimated outcomes with other investment alternatives;
- comparing forecasted return on investment with the cost of financing; and
- the risk assessment regarding project failure [131].

According to Kerzner (98: 559), companies identified four possible decisions that can be taken at each decision point, namely:

- proceed to the next phase based on an approved funding level;
- proceed to the next phase **but** with a new or modified set of objectives;
- postpone decision to proceed based on a need for additional information; and
- terminate the project.

These gate reviews are normally preceded by a preliminary assessment by the project team to determine whether the project has completed the expected deliverables for the specific phase and is ready to enter the gate. These preliminary assessments are referred to as gate readiness reviews.

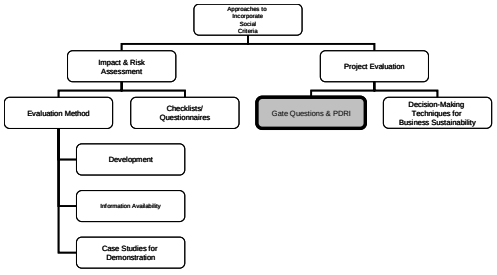
Industry project appraisal practices used through the life cycle currently concentrates only on assessing the project's financial and technical feasibility [106, 297]. The main decision-making techniques used are:

- cash flow estimates;
- rate of return or "earning power" estimates; and
- risk and sensitivity analysis [131].

To incorporate social business sustainability on the evaluation level within the project management methodology, the following two aspects should be addressed:

- gate readiness reviews; and
- decision-making techniques used at the gate reviews.

6.3.1 Gate Readiness Reviews



A gate readiness review aims to determine whether the project can progress to the next phase. It acts as an internal review to ensure that projects enter the gates at the right time. Gate readiness reviews are guided by the gate questions in the project management methodology, which provides insight into the aspects that the decision-makers, i.e. sponsor and stakeholders, would be looking at/for during the gate review.

In 1994, the Construction Industry Institute developed the PDRI, an effective, simple and easy-to-use scope definition tool that quantifies pre-project planning efforts, specifically scope definition, and correlate it to the predictability of achieving project objectives [268]. The index was developed specifically for industrial projects and was based on industry best practice. It can be used at any time before a project enters the execution phase [298], thus during front-end loading, i.e. Phases 1 to 4. The index works on a handicap principle, i.e. the lower the score, the more complete the scope definition. Many companies have adapted the PDRI and use it as a guideline during a gate readiness review. For example, the PDRI must equal 500 or less before the project can enter gate 2.

To incorporate social sustainability aspects in gate readiness reviews, the following two aspects are studied:

- gate questions; and
- PDRI.

6.3.1.1 Gate Questions

Gate questions provide decision-makers with guidelines of what deliverables the project should have completed at the end of a specific phase. Deliverables can be information required by decision-makers to decide whether to continue with the project. The questions found in literature could be divided into three categories:

- project management - administrative details, resource allocation, etc.;
- technical management - technical feasibility, operational capabilities, permits, etc; or
- business management - fit of project to business strategy, business plan, business risks, etc. [103].

These gate questions are shown in Appendix R. These questions assess activities and deliverables that have been listed in the project management methodology. The proposed activities and deliverables of Figure 6-4 and Figure 6-5 have been used as a basis to develop a set of proposed gate questions to be added to the current project management methodologies to address social business sustainability. These questions are shown in Figure 6-7.

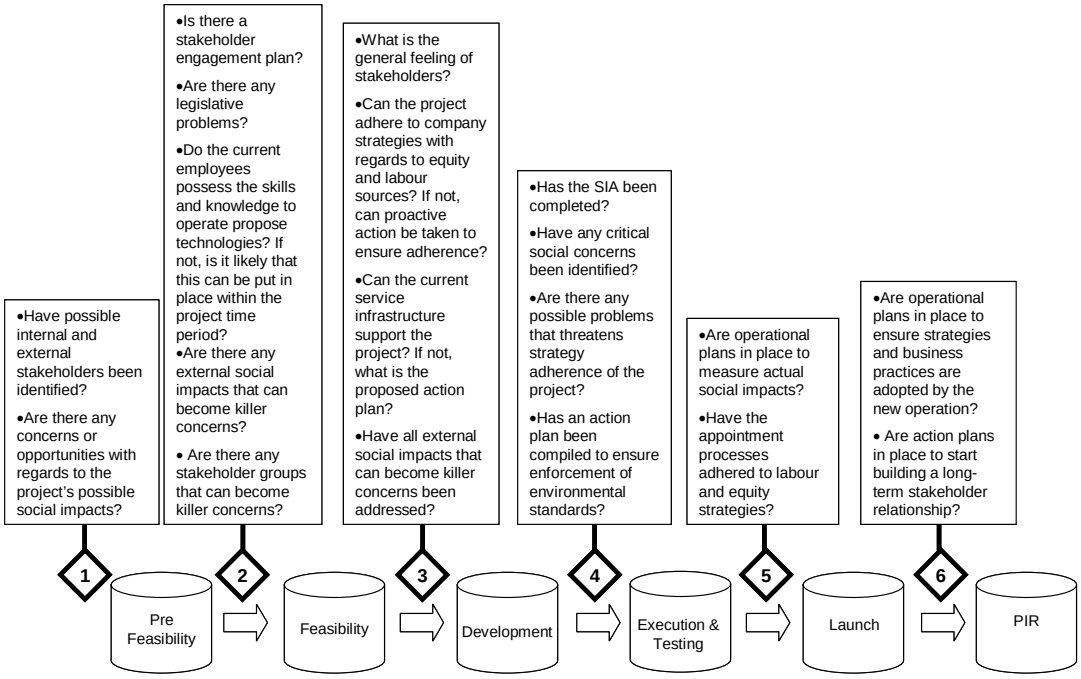


Figure 6-7: Proposed Gate Questions to Address Social Business Sustainability

6.3.1.2 Project Definition Rating Index

The PDRI for industrial projects does not only analyse scope definition, but can also predict factors able to impact on project risk [299]. The PDRI consists of 70 elements, which are divided into three main sections and 15 categories (see Table 6-17). There is currently one element (B8) specifically dedicated to social issues. However, some of the other elements relate to the proposed social sustainability framework, for example I2, O6, N3 and L3.

Many companies adopted the PDRI, e.g. a per track score [300]. The US Department of Energy developed a PDRI for environmental management projects by using the CII (waarvoor staan dit?) PDRI for building projects as a basis [301].

It is thus proposed that the PDRI should be used to address social business sustainability in project management methodology. This can be done by either one of two routes. The first is to use the existing PDRI elements and to group those addressing social aspects together to form a social rating. The other route is to develop a separate PDRI focussing solely on social aspects in a project scope definition.

However, separate research is required for both of these routes, which might even be company specific. Nevertheless, research into the feasibility or practicality of these proposed approaches cannot be executed before projects start to address social sustainability. These projects could then be used for baseline information. Incorporating social business sustainability through questionnaires and/or checklists is a prerequisite to explore the PDRI options.

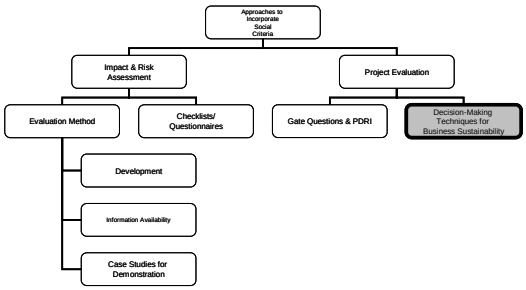
Table 6-17: PDRI Sections, Categories and Elements [299]

Section 1: Basis of Project Decision	Section 2: Front End Definition	Section 3: Execution Approach
Category A: Manufacturing Objectives	**Category F: Site Information**	**Category L: Procurement Strategy**
A1: Reliability Philosophy	F1: Site Location	L1: Identify Long Lead/ Critical Equipment &and
A2: Maintenance Philosophy	F2: Survey and Soil Tests	Materials
A3: Operating Philosophy	F3: Environmental Assessment	L2: Procurement Procedures and Plans
Category B: Business Objectives	F4: Permit Requirements	L3: Procurement Responsibility Matrix
B1: Products	F5: Utility Sources with Supply Conditions	**Category M: Deliverables**
B2: Market Strategy	F6: Fire Protection and Safety Considerations	M1: CADD/Model Requirements
B3: Project Strategy	**Category G: Process/Mechanical**	M2: Deliverables Defined
B4: Affordability/Feasibility	G1: Process Flow Sheets	M3: Distribution Matrix
B5: Capacities	G2: Heat nd Material Balances	**Category N: Project Control**
B6: Future Expansion Considerations	G3: Piping and Instrumentation Diagrams	N1: Project Control Requirements
B7: Expected Project Life Cycle	G4: Process Safety Management	N2: Project Accounting Requirements
B8: Social Issues	G5: Utility Flow Diagrams	N3: Risk Analysis
Category C: Basic Data Research and Development	G6: Specifications	**Category P: Project Execution Plan**
C1: Technology	G7: Piping System Requirements	P1: Owner Approval Requirements
C2: Processes	G8: Plot Plan	P2: Engineering/ Construction Plan and Approach
Category D: Project Scope	G9: Mechanical Equipment List	P3: Shut Down/ Turn-Around Requirements
D1: Project Objectives Statement	G10: Line List	P4: Pre-Commissioning Turnover Sequence
D2: Project Design Criteria	G11: Tie-in List	Requirements
D3: Site Characteristics Available vs Required	G12: Piping Speciality Items List	P5: Start-up Requirements
D4: Dismantling and Demolition Requirements	G13: Instrument Index	P6: Training Requirements

Table 6-17: PDRI Sections, Categories and Elements [299] (continues)

Category D: Project Scope (Continues)	**Category H: Equipment Scope**	
D5: Lead/Discipline Scope of Work	H1: Equipment Status	
D6: Project Schedule	H2: Equipment Location Drawings	
Category E: Value Engineering	H3: Equipment Utility Requirements	
E1: Process Simplification	**Category I: Civil, Structural and Architectural**	
E2: Design and Material Alternatives Considered/Rejected	I1: Civil/Structural Requirements	
E3: Design for Constructability Analysis	I2: Architectural Requirements	
	Category J: Infrastructure	
	J1: Water Treatment Requirements	
	J2: Loading/Unloading/Storage Facilities Requirements	
	J3: Transportation Requirements	
	Category K: Instrument and Electrical	
	K1: Control Philosophy	
	K2: Logic Diagrams	
	K3: Electrical Area Classifications	
	K4: Substation Requirements/Power Sources Identified	
	K5: Electrical Single Line Diagrams	
	K6: Instrument and Electrical Specifications	

6.3.2 Decision-Making Techniques for Business Sustainability



Social business sustainability can only be incorporated in decision-making if the long-term social consequences of any course of action are considered in the decision-making process. The idea that the above is the true meaning of social responsibility is not a new [302], yet internal appraisals in industry typically focus on financial and technical aspects only [106]. The decision environments faced by project managers are complex with numerous problems and interrelationships, yet few project managers have had training in decision analysis [303]. Another complexity is that sustainable development emphases evaluation above valuation, thus traditional decision-making techniques based on reducing all information into economic terms cannot be applied, since all social and environmental consequences are not reducible to economic metrics [150]. The real complexity of choice can only be placed before decision-makers if evaluation methods are used [150]. The best decision-making techniques for sustainable project life cycle management are thus evaluation methods instead of valuation methods.

Over the last decade, sustainable development evaluation methods have been researched extensively. The following section describes two evaluation methods deemed best to be used in project life cycle management decision-making, namely:

- Multi Criteria Decision Analysis (MCDA); and
- Balanced Scorecards.

6.3.2.1 Multi Criteria Decision Analysis

MCDA is regarded as the best decision-making technique to use if negative and positive impacts or consequences cannot be expressed in monetary terms [304]. MCDA is a quantitative approach to evaluate decision problems involving multiple and sometimes conflicting variables or criteria. The approach aims to highlight the conflicts and reach compromise by following a transparent process [305]. The technique's transparency, together with the flexibility thereof, is regarded as the main advantages of MCDA [306]. MCDA techniques include Analytic Hierarchy Process (AHP), goal progamming, pre-emptive optimisation, weighted sums, fuzzy set theory, ELECTRE (Outranking) and data envelopment analysis [305, 307]. The AHP has been applied to both project management [303] as well as sustainable development initiatives [308, 309] and is therefore explored further.

6.3.2.1.1 Analytic Hierarchy Process (AHP)

Thomas Saaty developed the AHP [303]. The technique's uniqueness lies in the objective hierarchy used for decision-making purposes and the way it converts pair-wise comparisons into weights or scores by using matrix algebra and solving eigenvector problems. The process thus enables decision-makers to construct their decision objectives or criteria into a hierarchy. Weights or relative importance are subsequently assigned to each level of the hierarchy by comparing only two objectives at a time, using the nine point scale developed specifically for the process (see Table 6-18). Saaty also developed a method to test the consistency of these pair-wise comparisons. After establishing weights for all decision criteria, the various alternatives can be compared using the same pair-wise method. A final score for each alternative is calculated by a weighted sum method [307].

Table 6-18: AHP Nine-Point Evaluation Scale [307]

Numerical Value	Verbal Terms
1	Equally important
3	Moderately more important
5	Strongly more important
7	Very strongly/demonstrably more important
9	Extremely/absolutely more important
2,4,6,8	Intermediate values

Saaty [310] summarised the process in the following seven steps:

1. define the problem and determine the goal;
2. construct the hierarchy from the top through the intermediate levels to the lowest level. The lowest level is normally alternatives;
3. construct a set of pair-wise comparison matrices (size n x n) referred to as A;
4. there are n (n – 1) judgments required to develop the set of matrices in step 3;
5. hierarchical synthesis is now used to solve the eigenvector problem to get the priority vector (weight/score). The principal eigenvalue is denoted by the symbol $\lambda_{max.}$ The following equation shows its relation to the pair-wise comparison.

$$A \bullet \omega = \lambda_{max} \omega \sum_{i=1}^{n} \omega_i = 1 \qquad \textbf{6-3}$$

6. consistency is determined by using the eigenvalue, λ_{max}, to calculate the consistency index, CI as follows:

$$CI = \frac{\lambda_{max} - n}{n}$$ where n is the matrix size.

The consistency is right if the consistency ratio CR < 10%. The consistency ratio is calculated as follows:

$$CR = \frac{CI}{RI}$$ where RI is the random index value based on the matrix size.

7. steps 3 to 6 are performed for all levels.

Direct weighting has been proposed as an alternative to the pair-wise comparison method of the original AHP method. The idea is that AHP logic is followed, but instead of doing pair-wise comparison, decision-makers assign direct weights to criteria or alternatives together with their level of uncertainty when assigning these weights. The advantages of this approach are:

- the straight forwardness of the approach;
- no computer or software package is needed; and
- trade-off between attributes becomes more visible [308].

6.3.2.1.2 AHP Demonstration

The information of the acrylic fibre plant used for a case study in section 4.3.2 and section 0 is used for demonstration purposes. The hypothetical case study considers that the plant will be built in future. The decision hierarchy based on the proposed social sustainability framework is shown in Figure 6-8.

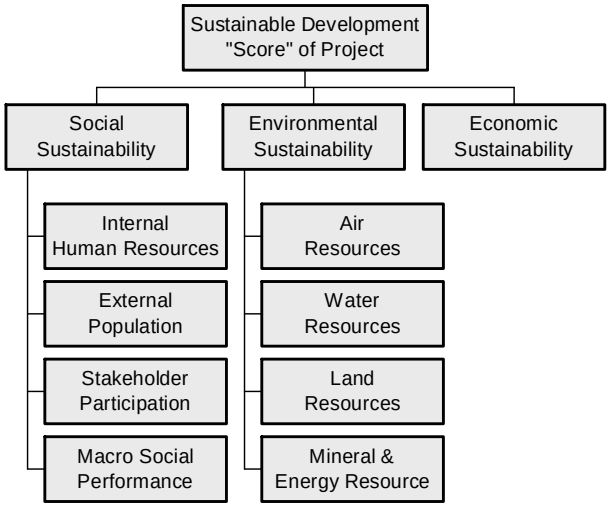


Figure 6-8: Decision Criteria Hierarchy

Weight for the Criteria

Weights for the environmental sub-criteria have been obtained from a previous study conducted in South Africa [271]. These are:

- air resources 0.12
- water resources 0.47
- land resources 0.20
- mineral and energy resources 0.21

Weights for the three main sustainable development criteria and the social sub-criteria have been acquired from the analysis of a questionnaire. Hundred and five professionals attending post graduate courses on life cycle engineering and management completed the questionnaire (attached in Appendix

S). The direct weighting approach was used for social sub-criteria and the pair-wise comparison method for the main criteria. The following weights have been obtained:

- Environmental 0.33
- Economic 0.40 } 1
- Social 0.27
  - Internal Human Resources 0.37
  - External Population 0.23 } 1
  - Macro Social Performance 0.18
  - Stakeholder Participation 0.22

Project Scores for the Criteria

The values for the SIIs in Table 6-16 are used as scores for the social sub-criteria. The environmental scores is calculated based on the RII method referred to in section 6.2.1.1. Standard RII values have been calculated for selected process parameters [311]. These RII values have been used together with the available information (see Appendix P) to calculate RIIs for the four environmental categories. These calculations are shown in Table 6-19.

Table 6-19: Calculation of Resource Impact Indicators

Process Parameter (Annual Quantities)		**Water**	**Air**	**Land**	**Mined**
Waste	1 545 000 kg	7.29×10^{-02}	2.33×10^{-06}	4.22×10^{-02}	0
Electricity used	174182400 MJ	7.88×10^{5}	1.79×10^{4}	1.68×10^{2}	8.81×10^{1}
Coal used	46368000 kg	0	0	0	1.67×10^{2}
Steam used	354960000 kg	2.60×10^{4}	2.51×10^{2}	4.41	1.52×10^{2}
Water used	1429200000 kg	7.00×10^{4}	0	0	0
Resource Impact Indicator		$8.84 \times 10^{+05}$	$1.81 \times 10^{+04}$	$1.72 \times 10^{+02}$	$4.07 \times 10^{+02}$

Scores for the economic criteria is calculated based on only one midpoint category, namely annual turnover. The same approach used for the environmental and social dimensions is followed. The following values are assumed:

- Project Annual Turnover R500 million
- Current Annual Turnover of entire company R13 545 million
- Target Annual Turnover (20% increase assumed) R16,254 million

The Economic Impact Indicator (EII) is thus 2.56×10^{-02}

The values and weighted sum method is shown in Table 6-20 to convert all scores into a final project sustainability score.

Table 6-20: Example of Analytic Hierarchy Process

Criteria	Weight	RII/SII/EII	Calculated Score
Economic	**0.4**		**2.56×10^{-02}**
Environmental	**0.33**		**$-4.18 \times 10^{+05}$**
• Air resources	0.12	$-1.81 \times 10^{+04}$	
• Water resources	0.47	$-8.84 \times 10^{+05}$	
• Land resources	0.20	$-1.73 \times 10^{+02}$	
• Mineral and energy resources	0.21	$-4.07 \times 10^{+02}$	
Social	**0.27**		**-1.18×10^{-02}**
• Internal Human Resources	0.37	1.09×10^{-04}	
• External Population	0.23	-5.47×10^{-02}	
• Macro Social Performance	0.18	3.99×10^{-03}	
• Stakeholder Participation	0.22	0	
Sustainability Score of Project			**$-1.38 \times 10^{+05}$**

The AHP method can be applied to choose between projects, thus choosing the project with the best overall positive impact. In line with the PDRI model threshold, values for projects at specific gates can be developed.

6.3.2.2 Balanced Scorecard (BSC)

6.3.2.2.1 History of the BSC

Kaplan and Norton first proposed the concept of the BSC in 1992 as *"a set of measures that gives top managers a fast but comprehensive view of the business"* [312]. The concept is based on viewing the business from four perspectives by answering four basic questions linked to each perspective. The questions are:

- how do customers see us? (customer perspective);
- what must we excel at? (internal perspective);
- can we continue to improve and create value? (innovation and learning perspective); and
- how do we look to shareholders? (financial perspective).

The scorecard is centred on the company's vision and strategy and provides goals and measures for each perspective, using non-financial indicators as measures in supplying financial measures [313].

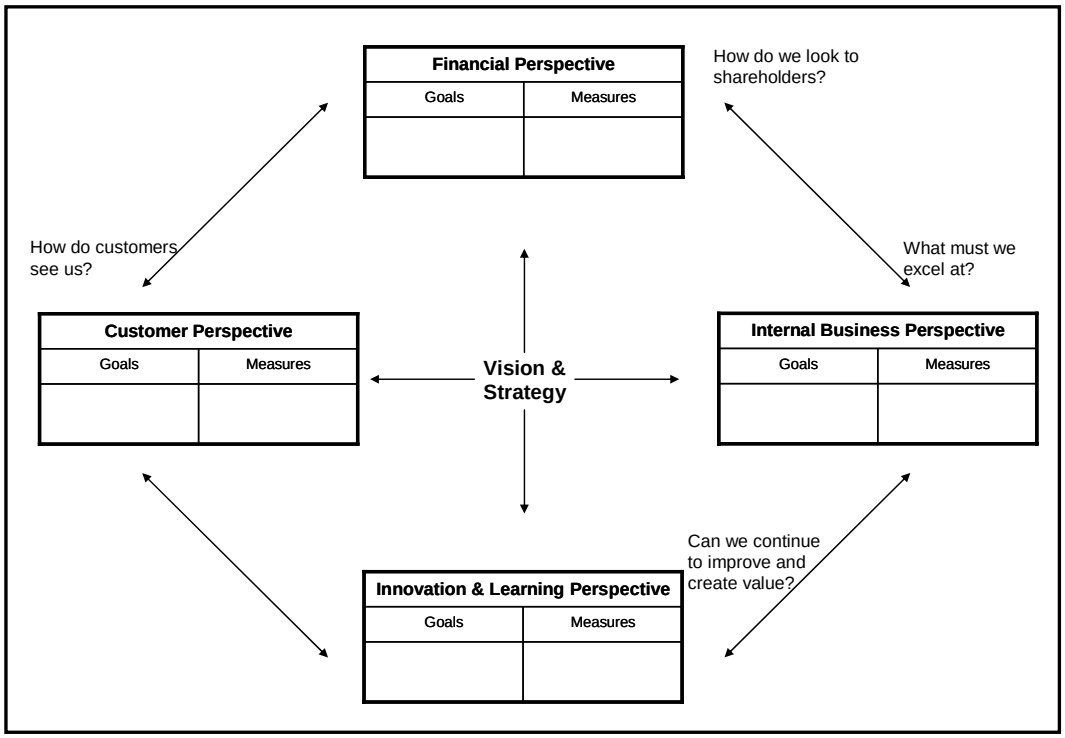


Figure 6-9: The BSC [312, 313].

6.3.2.2.2 Sustainability BCS

In the last ten years, numerous proposals have been made to add the environmental and social dimensions to the BSC to enable measurement of business sustainability. Some of these proposals are summarised in Table 6-21. However, using sustainable BSCs are not that common.

Table 6-21: Approaches to Adopt BSC to Include Social and Environmental Dimensions of Sustainable Development

Author	Idea to Adapt BSC	Reference
Kaplan & Norton	Instead of adding a fifth perspective dealing with stakeholders other than customers and shareholders, stakeholder objectives should be included only when they are vital to the success of the shared service unit's strategy.	[314]
Kaplan & Norton	Social and environmental indicators emerged in the internal process perspective.	[315]
Johnson	Add employees to the learning and growth perspective and external stakeholders to the customer perspective.	[316]
Epstein & Wisner	Add a fifth dimension dealing explicitly with environmental and social aspects or inserting environmental and social indicators in each dimension.	[316]
Figge, et al.	Proposes an approach based on whether companies internalise environmental and social consequences. If internalised, the best approach proposed would be to integrate environmental and social indicators in each perspective. If not internalised, an additional fifth dimension is proposed. The approaches proposed are predominantly economic-oriented. A third approach is to derive an environmental and social scorecard, which is integrated into the existing BSC, following one of the two first proposals.	[317]
Bieker, et al.	Four proposals for a sustainability balanced scorecard are discussed, namely services, partial, transversal and additive.	[318]

6.3.2.2.3 Sustainability BSC in Projects

A BSC approach based on a stoplight mechanism had been proposed for project management [319] (see Figure 6-10). The stoplight mechanisms visually express the project's status by using one of three colours, each with a specific meaning. These are:

- green - project performance agrees with project plans and stakeholder expectations;
- yellow - deficiencies in project performance have been noted, are being monitored and corrective action will be implemented in the near future; and
- red - serious deficiencies have been noted and the project is in a crisis.

The scorecard promotes better management of the project since it presents the true impact of a project and can be used throughout the project life cycle for health checks [319]. However, as with the original BSC, the proposed scorecard does not address the environmental and social dimensions. Proposals have been made to add a fifth dimension to the scorecard to address environmental aspects [103].

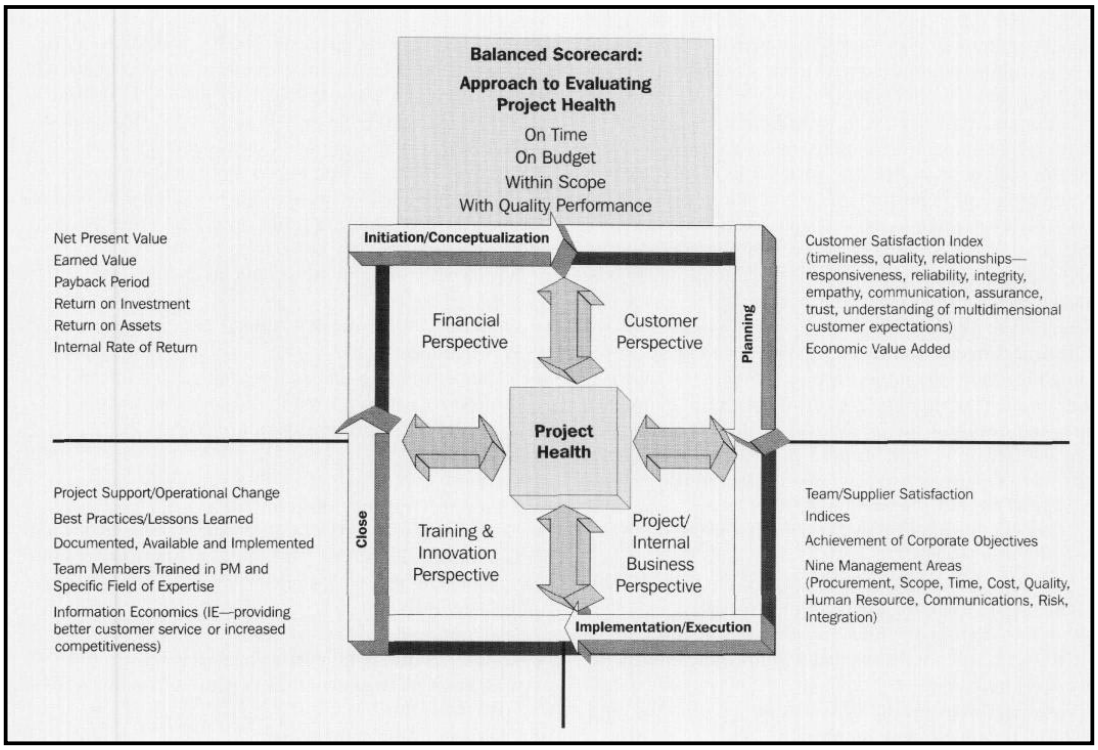


Figure 6-10: Balanced Scorecard for Projects [319]

It is proposed that companies using a BSC for projects follow the most suitable approach from their viewpoint proposed for the original BSC to adopt their project scorecard to address social and environmental sustainability. The checklists, questionnaires and indicators discussed can serve as a baseline of what to address or measure from a social perspective.

6.4 Conclusions

The chapter concludes that social business sustainability should be incorporated into project management methodologies by using a phased approach. The first phase should entail applying the proposed questionnaires and checklists (section 6.2.2) in the various life cycle phases and including the proposed gate questions in the model. The results of this phase can be used to refine the units of equivalence of the proposed midpoint categories (section 6.2.1.1.3) as well as for an input or testing material for the PDRI (section 6.3.1.2). The second phase should incorporate more social aspects in the gate readiness, thus the application of a social PDRI or the adaptation of the existing PDRI. The final phase should modify the existing decision-making methods to ensure alignment with sustainable development. This might include applying new techniques, such as MCDA, to the decision-making process or relying more on the use of project BCS. The proposed evaluation method can be applied in the feasibility or development life cycle phases, either during the second or third phase of the incorporation of social sustainability aspects. The time would depend on the availability of information, internally and externally and familiarity with the LCIA approach.