CHAPTER 5

Case study

5.1 INTRODUCTION

The application of the EEGECOST environmental accounting model was tested in a case study conducted at the cigarette manufacturing facility of British American Tobacco Manufacturers; situated in Heidelberg, South Africa.

5.2 BACKGROUND TO CASE STUDY

5.2.1 Company profile

British American Tobacco Manufacturers (BATM) Heidelberg is a wholly owned subsidiary of British American Tobacco South Africa (BATSA). BATSA currently has an approximate 93% share of the domestic market with the Heidelberg factory manufacturing approximately 20 billion cigarettes per annum (British American Tobacco, 2002). The personnel complement at the Heidelberg site is approximately 750 persons consisting of process and machine operators, technical support artisans and technicians, administrative staff and the factory management team (British American Tobacco, 2003).

5.2.2 Product description

Notwithstanding variants introduced to provide a differentiated product range for a discerning consumer market, a typical filter cigarette is made up of components as illustrated in Figure 5.1 (Brown and Williamson, 2003).

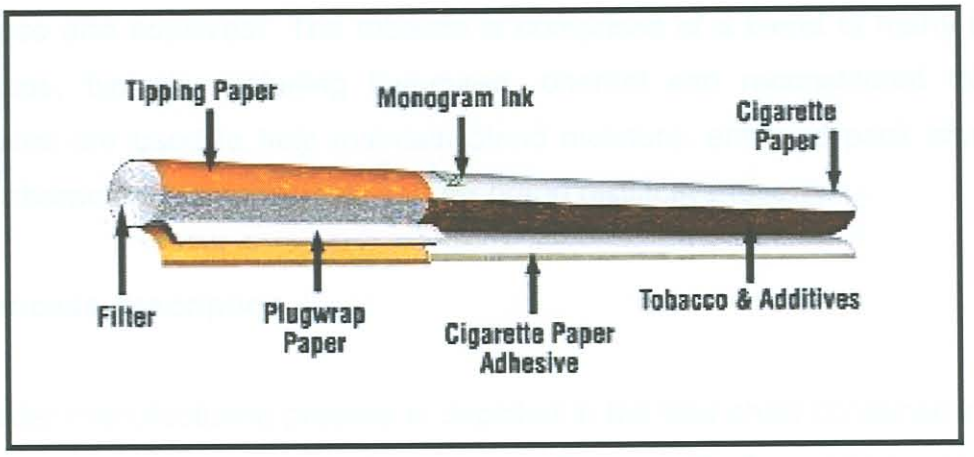

Figure 5.1 A typical filter cigarette.

A brief explanation of these components is given below:

- *Tipping paper*: The outer paper that wraps around the filter rod and is used to attach the filter rod to the tobacco section. Suppliers apply colourants and coatings (for example, lip release agents) via gravure printing to the paper. Various backgrounds, lines and logos may be incorporated into the tipping design.
- *Monogram ink*: A small amount of ink may be applied to the cigarette paper via a letterpress operation to provide a distinctive brand mark to the product.
- *Cigarette paper*: The tobacco section of the cigarette is enclosed with a strong lightweight paper made from flax or other cellulose fiber. Cigarette paper usually contains fillers and other additives to provide whiteness, improve ash appearance and assure burn uniformity.
- *Cigarette paper adhesive*: Also known as seam adhesive, this is used to secure the cigarette paper around the tobacco section.
- *Plug wrap paper and filter rod*: The filter rod is the major component of the filter section of a cigarette. Most conventional filter rods are comprised of four components – filter tow, plasticiser, plug wrap paper and adhesive. Filter tow is a band of cellulose acetate fibers that are bundled together into a cylindrical shape to form a filter after application of a plasticiser. The plasticiser helps provide acceptable filter firmness by bonding the fibers to each other. The plug wrap holds the shape of the filter rod while the plasticiser hardens the filter. The plug wrap is attached to the rod by a thin line of adhesive.

- *Tobacco and additives*: The tobacco is comprised of a blend of many different tobaccos, typically including flue-cured, oriental and reconstituted tobaccos. Additives are used to help maintain blend moisture, enhance pack aroma and taste character, and provide flavour for brand distinctiveness.

5.2.3 Process description

The broader manufacturing process is depicted in the flow chart contained in Figure 5.2. The core cigarette production process begins with the primary processing, cutting and blending of pre-threshed tobacco leaf and stem. Thereafter the cigarettes are manufactured and packed on high speed manufacturing and packing machines and transferred to the bonded dispatch stores in cases of 8 000 and 10 000 cigarettes.

Ancillary manufacturing processes include the making of filter rods, metallised paper, and Laube boxes for one of the three packaging variants, which consist of soft-packs, hinged-lid packs and Laube boxes. Utilities supporting the manufacturing process include electricity supply at 11kV, steam from four John Thompson Afripac coal-fired boilers, compressed air at 6 bar, chilled water from the refrigeration plant for air conditioning in all production areas and process water supplied by the local municipal authority (Buissine, 2003).

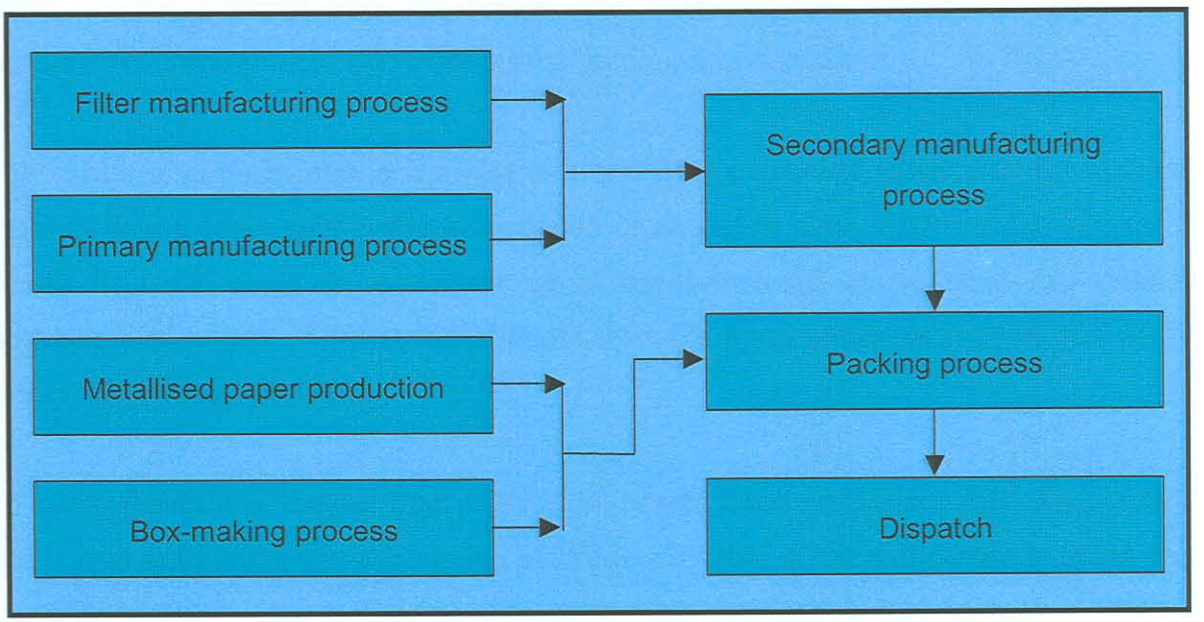

Figure 5.2 The core cigarette production process.

5.2.4 Objective statement and scope of analysis

The objective of the case study is to demonstrate the application of the EEGECOST model in obtaining a more comprehensive picture of environmental cost accounting than that presented by traditional financial accounting methods, for both current and future activities, as well as identifying impacts and prioritising interventions and corrective actions that will result in overall environmental performance improvement. The results of the case study will be used to verify the model.

This will be done by first determining the present production costs based on a production volume of 1 million cigarettes. These costs (Types I and II) are only partially categorised for conventional fiscal accounting purposes and do not incorporate less tangible costs, future costs and costs external to the company (Types III to V costs). Then, after incorporation of Types III to V costs in the EEGECOST model, with costs being properly allocated to cost types, a better representation can be created of the highest cost contributors of the manufacturing process. These costs are based on future costs and risk scenarios. These costs are prioritised to assist decision making regarding interventions and corrective actions.

Then, after prioritisation of the highest cost contributors and implementation of possible interventions and corrective actions, the model will be amended with the newly acquired data incorporated, to prove the effect of accounting for all types of costs, in the present and the future and mitigating the impacts of high cost contributors through sound environmental accounting principles.

The scope of conventional costs (Types I and II) is evaluated to account for at least most of these costs, within the boundaries of available data, whereas the scope of Types III to V costs is evaluated as comprehensively as possible for reliable illustration purposes. The period of assessment is three years, with 2004 and 2005 being the forecast periods.

To verify the model, output from the model needs to be compared with the outputs from other environmental accounting systems available in the world market using the same input data. The verification protocol entails comparable and consistent results that support the objective of the model based on a diverse range of input data.

5.3 LIFE CYCLE ASSESSMENT OF THE PRODUCTION PROCESS

The life cycle assessment (LCA) of the cigarette manufacturing process was based on the actual performance data collected during the 2003 financial year from January to December 2003. The LCA of the cigarette production process reveals the environmental resources used for the production of a functional unit of cigarettes and its accompanying emissions to air, effluents to water and wastes to landfill and hazardous waste treatment sites. The functional unit is one million cigarettes. For purposes of this life cycle assessment, outputs to the environment due to consumption of the product are not considered. Also, the assessment only considers the life cycle of the cigarette production process within the boundaries of the site, with the exemption of transportation, freight and air travel; which are included in the LCA due to contributive fuel consumption and related air emissions. Therefore, tobacco agriculture and related inputs and outputs were excluded. Table 5.1 is a summary of the LCA for the cigarette production process. Appendix C, Table C.1 presents the comprehensive LCA of the cigarette production process (Buissine, 2003).

Table 5.1 LCA for the cigarette production process.[1]

Functional unit					
One million cigarettes					
Input	**Unit**	**No. of units**	**Output**	**Unit**	**No. of units**
Energy	GJ	25,20	Air emissions	ton CO_2 eq	2,59
Water	kl	14,22	Wastewater	kl	8,25
			Total dissolved solids	kg	1,62
			Chlorine	kg	0,25
			Total waste[2]	kg	78,20

Notes

1 Data from Buissine (2003).

2 Total waste includes the following:

a) Waste to landfill, which is mixed non-hazardous waste.
b) Waste for recycling (off-site), which includes paper, card, metal and tobacco fines.
c) Hazardous waste for removal, which includes oil, glue and plastic.

5.4 COST ALLOCATION AND ENVIRONMENTAL COST INVENTORY

5.4.1 Actual expenditure (2003)

Table 5.2 reflects the actual expenditure for 2003, categorised in terms of the various cost types presented in the model and based on a functional unit of 1 million cigarettes (Buissine, 2003).

Table 5.2 Conventional costs measured by the company.

Conventional costs	Cost per functional unit	Type of cost
Remuneration	R 6 206,61	Type II
Maintenance	R 1 823,71	Type II
Depreciation	R 1 347,27	Type II
Utilities	R 783,30	Type II
Rentals	R 69,69	Type II
Environmental health and safety	R 119,23	Type II
Meals and refreshments	R 28,24	Type II
Recruitment costs	R 11,78	Type I
Service contracts	R 191,60	Type I
Traveling	R 28,70	Type II
Communications	R 35,06	Type II
Training	R 51,39	Type I
Insurance	R 249,49	Type II
Vehicles	R 65,05	Type II
Other	R 77,80	Types I and II
Total	**R 11 088,92**	

5.4.2 Environmental cost inventory and impact assessment (2003)

Table 5.3 shows the consolidated results for the period including impact costs arising out of the manufacturing activities not included in the traditional financial accounting data. At present, the company does not measure and report Type III to V costs, nor are these costs included into the corporate decision making process.

Table 5.3 Results of the impact assessment for 2003.

Cost type	2003
Type I (a)	R 232,64
Type I (b)	R 31,04
Type II	R 10 825,25
Type III	R 0,00
Type IV	R 0,00
Type V	R 0,00
Totals	**R 11 088,92**

5.4.3 Preliminary environmental cost inventory (forecast for 2004-2005)

5.4.3.1 Scenarios

Although not exhaustive, a number of likely scenarios were identified to illustrate the application of the model to future business periods. These scenarios are summarised in Appendix D, Form D.1. Appendix D, Forms D.2 to D.8 presents the detail pertaining to the future expense risk scenario summary form.

5.4.3.2 Preliminary cost inventory and impact assessment

The scenarios presented in Appendix D, Form D.1, resulted in the preliminary cost inventory and impact assessment as contained in Table 5.4, sorted in order of overall significance for 2004 and 2005 in Tables 5.5 and 5.6 respectively.

Table 5.4 Results of the cost inventory for 2004 and 2005.

Cost type	2004	2005
Type I (a)	R 233,21	R 233,79
Type I (b)	R 69,03	R 70,92
Type II	R 10 825,25	R 10 863,23
Type III	R 16,94	R 10,81
Type IV	R 9,38	R 14,75
Type V	R 502,91	R 1 025,36
Totals	**R 11 656,72**	**R 12 218,86**

Table 5.5 Results of the impact assessment for 2004.

Risk no	Description	Cost	Cost type	Risk category	Risk value
7	Global warming effect	R 502,91	V	H	37
2	Cost effect of AIDS	R 2,68	VI	M	30
5	Electricity supply interruption	R 16,88	III	M	28
6	Noise and odour pollution	R 6,70	VI	M	26
3	Increasing draw on COID fund	R 0,07	III	L	13

Table 5.6 Results of the impact assessment for 2005.

Risk no	Description	Cost	Cost type	Risk category	Risk value
7	Global warming	R 1 025,36	V	H	39
2	Cost of AIDS	R 4,78	VI	M	30
6	Noise and pollution complaints	R 9,96	VI	M	28
5	Electricity supply interruption	R 10,76	III	M	23
3	Increasing draw on COID fund	R 0,05	III	L	11

5.4.3.3 *Preliminary budget expenditure*

The anticipated fiscal requirements in terms of budget expenditure for the scenarios presented in Appendix D are reflected in Table 5.7.

Table 5.7 Fiscal requirements for 2004 and 2005.

Cost type	2004	2005
Type I (a)	R 233,21	R 233,79
Type I (b)	R 69,03	R 70,92
Type II	R 10 825,25	R 10 863,23
Totals	**R 11 127,49**	**R 11 167,94**

5.4.4 Amended environmental cost inventory (forecast for 2004-2005)

5.4.4.1 *Interventions and corrective actions*

Possible interventions and corrective actions aimed at delivering a more acceptable situation with respect to environmental impacts and costs were identified as listed in Appendix E, Forms E.2 to E.8. Form E.1 of Appendix E presents a summary of the amended expenditures for 2004 and 2005, resulting from these interventions and corrective actions.

5.4.4.2 *Amended environmental cost Inventory and impact assessment*

The amended cost inventory and impact assessment that is expected to result from the successful execution and implementation of the interventions and corrective actions are reflected in Tables 5.8, 5.9 and 5.10 respectively.

Table 5.8 Results of the amended cost inventory for 2004 and 2005.

Cost type	2004	2005
Type I (a)	R 233,58	R 233,03
Type I (b)	R 69,78	R 49,21
Type II	R 10 832,10	R 10 870,10
Type III	R 16,94	R 10,81
Type IV	R 8,04	R 5,18
Type V	R 502,91	R 99,37
Totals	**R 11 663,35**	**R 11 267,70**

Table 5.9 Results of the amended impact assessment for 2004.

Risk no	Description	Cost	Cost type	Risk category	Risk value
7	Global warming	R 502,91	V	H	37
2	Cost of AIDS	R 1,34	VI	M	28
5	Electricity supply interruption	R 16,88	III	M	28
6	Noise and pollution complaints	R 6,70	VI	M	26
3	Increasing draw on COID fund	R 0,07	III	L	13

Table 5.10 Results of the amended impact assessment for 2005.

Risk no	Description	Cost	Cost type	Risk category	Risk value
2	Cost of AIDS	R 1,20	VI	M	24
5	Electricity supply interruption	R 10,76	III	M	23
7	Global warming	R 99,37	V	M	20
6	Noise and pollution complaints	R 3,99	VI	M	19
3	Increasing draw on COID fund	R 0,05	III	L	11

5.4.4.3 *Amended budget expenditure*

The anticipated fiscal requirements in terms of budget expenditure incorporating the execution and implementation of the identified interventions and corrective actions are reflected in Table 5.11.

Table 5.11 Amended fiscal requirements for 2004 and 2005.

Cost type	2004	2005
Type I (a)	R 233,58	R 233,03
Type I (b)	R 69,78	R 49,21
Type II	R 10 832,10	R 10 870,10
Totals	**R 11 135,46**	**R 11 152,34**

5.5 DOCUMENTATION OF RESULTS

The costs developed in the risk scenarios given in Appendix D were calculated to a total present value cost based on the production of 1 million cigarettes over a two-year evaluation period. Types I to IV costs were discounted to present day using a 12% discount rate, while Type V costs were discounted with a 3% discount rate. The choice of discount rate here is purely arbitrary and is not intended to imply any statement on the appropriateness of either value.

Table 5.3 presents conventional costs measured by the company. Comparing the total expenditure value of this table, with the total expenditure values for 2004 and 2005, as presented in Table 5.4, it becomes evident the impact that Types III to V costs have on a company's financial status. These costs can, in effect, increase expenditures per annum up to 10%, depending on the individual cost magnitudes contributing to the total expense value of every individual year. Therefore, knowledge of the impact of possible future risk and cost scenarios, to identify high cost contributors, can assist the process of identifying interventions and corrective actions.

The effect of no intervention and corrective actions for high contributing environmental impacts and costs is reflected in Table 5.4. The total expense value of 2005 is 4,6% more than the 2004 value. Should corrective actions not be employed, this financial effect can have a cumulative negative impact on a company's financial status in future years.

Table 5.8 shows the effect of interventions and corrective actions. The total expenditure value for 2004 is higher than without interventions and corrective actions. However, the 2005 total expenditure value is significantly lower (see Table 5.4). Implementing interventions and corrective actions seemingly result in higher capital expense. This is evident from the results of Tables 5.7 and 5.11 that indicate increased budget expenditure as compared with the total expense value of 2003.

The positive effect of these interventions and corrective actions, however, is displayed through a lowered total expense value of Types III to V. Figure 5.3 shows the preliminary expenditures of 2005 without interventions and corrective actions. Comparing this figure with Figure 5.4, which displays the amended 2005 expenditures with interventions and corrective actions incorporated, the difference is distinct. Without interventions and corrective actions, Types III to V costs contribute 8% of expenditure per functional unit, whereas implemented, this contribution decreases to only 1%.

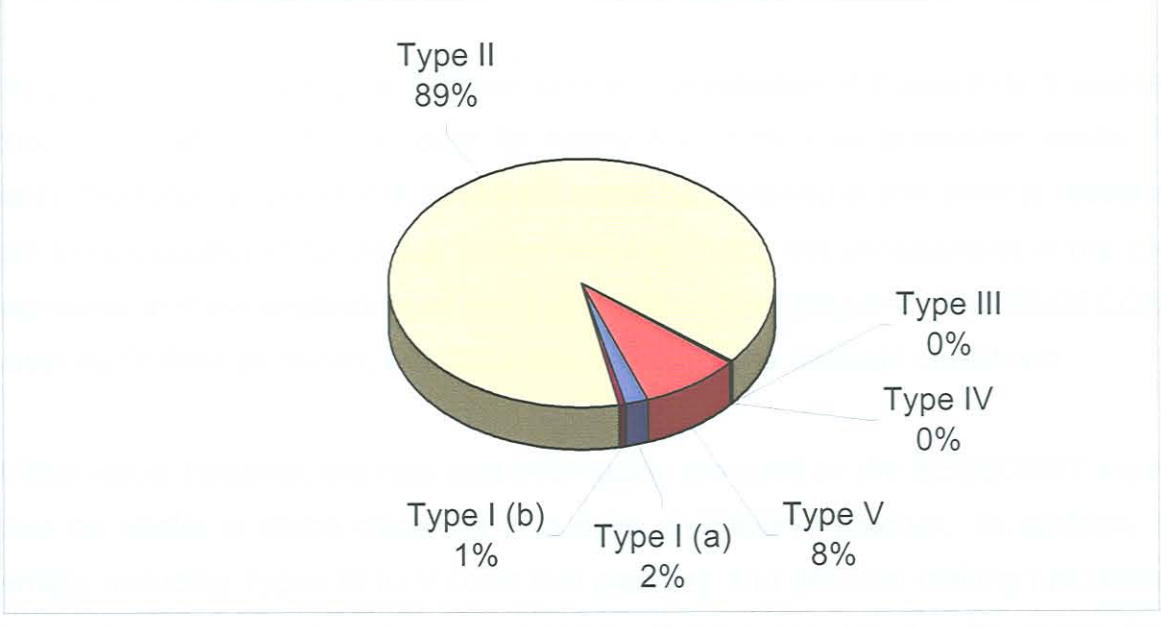

Figure 5.3 Preliminary expenditure for 2005.

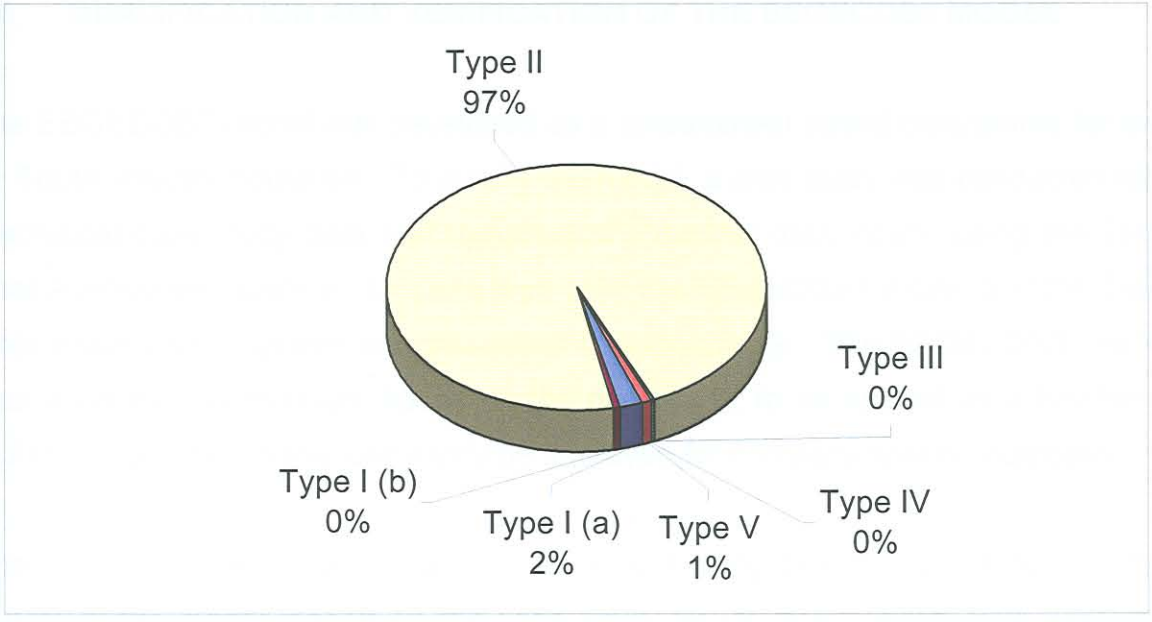

Figure 5.4 Amended expenditure for 2005.

Notwithstanding financial benefits, implementing interventions and corrective actions also decreases the risk significance of future expenditures. Table 5.6 presents the management priority table of 2005. With interventions and corrective actions implemented, the overall risk priority changes, whereas the overall trend in risk values is a decrease from the preliminary expenditure scenarios to the amended expenditure scenarios. Table 5.10 presents the amended management priority table for 2005, based on the amended expenditures scenarios with interventions and corrective actions implemented.

The graph depicted in Figure 5.3 illustrates the contribution of Types III to V costs to production costs that can account for nearly 8% of the total production costs. In reality, the future expense risk scenarios would be reviewed at this point to reassess both the probability of future risk scenario occurrences, the uncertainties in the cost magnitude and the implication of each scenario on the company. The EEGECOST model could then be re-run, with the application of these different conditions.

At face value, however, the new cost information provided by the EEGECOST model could be useful to frame decisions in a more quantitative manner. In addition, by formally including Types III to V costs into planning and decision making processes, improved management and communication of risks can result. Feedback from BATM on the use and observation of the EEGECOST model is given in Appendix F.

5.6 QUALIFICATION AND VERIFICATION OF THE EEGECOST MODEL

The EEGECOST model was developed as a spreadsheet based programme for use by South African industries. To qualify the model, a pilot study was conducted with theoretical case study data and hypothetical industrial data inputs, using the Total Cost Assessment system. Outputs from both the EEGECOST model and the Total Cost Assessment system are presented in Appendix G. The EEGECOST model was adjusted and finalised, based on the pilot study, to be applied as a functional tool for corporate use that can easily be improved for company specific purposes.

Then, to verify the model as a sole decision making tool for corporate use, the results of the model, based on the case study results from BATM, were weighted against the objective of the model as being compared to the objectives of the Total Cost Assessment (TCA) and the Full Cost Accounting (FCA) systems with the same case study inputs (see Table 5.12).

Verifying the model, it became clear that the model has some shortcomings and that the model is only as good as its data input. However, the process also revealed the direct corporate benefits achievable when implementing the model. The results from the verification process highlighted the benefits of the EEGECOST model through:

- the value added to corporate decision making as compared to no model,
- the ability of the model to withstand corporate application,
- the usability and credibility of the model, and
- the ability of the model to be consistent with its results as being compared to the objective of the model.

Table 5.12 Comparison of the EEGECOST model with the TCA and FCA systems.

Values	EEGECOST model	TCA	FCA
Objective	To be a standalone decision making tool	To incorporate all environmental and social impact costs	To analyse costs related to public goods and services
Cost allocation to type	√	√	X
Cost allocation to environmental media	√	X	√
Future risk assessment	√	√	X
Risk valuation	√	X	X
Iterative operation	√	√	X
Reporting support	√	X	X