Chapter 9

Making a Financially Sound Business Case

9.1 Introduction

It is not uncommon for good projects that could save water – to sit on the shelf. The main reason for this is that the business case fails to meet the organisation's financial criteria. Not many businesses can function without water. However there is a mismatch between the reluctance to pay for the resource and the scarcity of the resource. Consequently to obtain funds, the project's business case needs to demonstrate how the project adds to shareholder value in addition to environmental value. In other words the challenge is to show that *saving water makes good business sense*. Any cost savings from a project flows directly to the bottom line as shown in formula (9.1).

In a manufacturing plant the formula could be expressed as

$$\begin{aligned}\text{Shareholder value added} = {} & (\text{Water associated costs \$/unit} \\ & - \text{Water associated costs after improvement \$/unit}) \\ & \times \text{production capacity.}\end{aligned} \tag{9.1}$$

In other industries the derivation of the formula is not that straightforward.

To obtain funding the business case needs to demonstrate how the project:

- improves the bottom line
- aligns with corporate strategy
- increases shareholder value
- decreases financial, environmental, health and safety or other regulatory risk
- increases the competitive advantage of the organisation by being able to command a premium price for the product or attract more sales
- increases the reputation of the business unit or organisation both internally and externally.

This is especially so when companies are struggling to achieve a return in their core business – due to effects such as

- poor sales
- reduced margins
- global competition
- reduced tariffs
- business confidence in the economy decreases
- high oil prices
- high interest rates
- recession.

In such instances, costs are scrutinised more closely and only core business activities tend to get funded, especially in industries such as bulk chemicals, steel, food, oil, paper and other commodity products, where the end products cannot be easily differentiated from a competitor's products. By the same token these industries have a high reliance on community goodwill.

This chapter explores how one can present a financially sound business case so that projects are implemented – and do not gather dust.

9.2 Management Functions

Financial hurdles are a measure of management performance. Senior management is responsible for increasing shareholder value whether an organisation is public or private. Upper management is also responsible for reducing risks. Therefore the business case in order to be successful needs to meet the performance objectives and priorities of both middle and senior level management. Table 9.1 shows how the level of importance of key decision criteria, rate managers according to seniority within the organisation [1].

9.3 Making a Good Business Case

The task of the water conservation manager, in developing an attractive business case, is to ensure that all costs, savings and risks are identified especially when the project has a high capital expenditure component.

Table 9.1 Degree of importance* of key decision criteria, according to position in the company

Decision Factors Importance Level	Operations Managers and their Report	Middle Management	Chief Operating, Executive and Financial Officers
Product Features, Functionality	$$$	$$	$
Cost savings	$$	$$$	$$$
Return on capital	$	$$	$$$
Reducing Risk	$$	$$	$$$
Image	$	$	$$$

* Degree of importance – Low – $; Medium $$; Very important – $$$.

Very often the tangible (and intangible) costs and benefits of the water-saving project are not adequately identified. Externalities (parameters outside the organisation) need to be factored in. A pollution tax or future water prices are just two examples. Future expansion plans for the site and its impacts on the organisation will also need to be included in the equation. This relates to security of water supply.

With water scarcities potentially impacting on many countries, there is the real threat of governments rewarding those organisations that use water resources more efficiently than others. In other words, companies' expansion plans may be curtailed until they can demonstrate how water- and energy-efficient they are. These opportunity costs need to be considered and factored into the equation.

Sometimes the benefits are totally unrelated to the operations department but may reside in the improving the company's image (sales), increasing the profile amongst customers (sales), lead to a reduction in transport costs or improving labour relations (human resource department).

The business case should also identify the benefits/risks of not implementing the project as well as the associated benefits/risks of implementing the project – and rank them on a scale of 1 to 10 or use a standard risk matrix as shown in Table 9.2.

The matrix needs to include technical, financial, environmental and other business risks. Sensitivity analyses will highlight if the project is overly sensitive to interest rates. Risk assessment is discussed further in a later section.

The project benefits need to be related to metrics that the organisation uses for assessing performance (such as cost of goods sold (COGS) per unit of output) and answer the question – does the project improve COGs?

The financial analysis of water conservation projects is dependent upon having accurate information about operating costs. Few companies, however, possess good process-focussed information. In most manufacturing operations, while direct raw material and direct labour costs are tracked closely, many organisations lack systems to track and allocate "indirect" costs

Table 9.2 Risk matrix

Consequences	Likelihood				
Seriousness of event	Likelihood of occurrence				
	Very likely	Likely	Occasional	Unlikely	Very Unlikely
EXTREME	HIGH	HIGH	HIGH	MEDIUM	MEDIUM
MAJOR	HIGH	HIGH	MEDIUM	MEDIUM	LOW
MODERATE	HIGH	MEDIUM	MEDIUM	LOW	NEGLIGIBLE
MINOR	MEDIUM	MEDIUM	LOW	NEGLIGIBLE	NEGLIGIBLE

Table 9.3 Conventional cost accounting

Cost Pools	$ (in 1,000s)
Direct material cost (raw materials that become part of the finished product)	
(A) Inventory difference	11,000
(B) Purchases of direct materials	73,000
Cost of direct materials available for use C = (A+B)	84,000
Direct manufacturing labour costs (D)	17,750
Manufacturing overhead costs (E)	
Indirect labour (work that supports production)	4,000
Indirect supplies (materials not part of the product)	1,000
Utilities (heat, light, power and water)	1,750
Facility costs	500
Depreciation (plant building and equipment)	1,500
Miscellaneous	500
(E)	9,250
Manufacturing costs incurred (F) = C + D + E	111,000
Corporate expenses (administration, marketing and sales)	3,000

(by process or product) and therefore such costs are not readily accessible or are often termed as "fixed costs".

Project benefits need to be related to metrics that the organisation uses for assessing performance such as cost of goods sold per unit output (COGS/unit).

Table 9.3 shows a schedule for cost of goods manufactured under a typical conventional accounting method.

9.3.1 Identifying Hidden Costs

As shown in Table 9.3 it is easy to identify direct costs. The hidden costs, however, are not shown in accounting schedules and these must be identified using a variety of means such as

- measurement
- interviews with operators (for an example, to gauge the amount of time spent in cleaning)
- compiling billing data from water bills to disaggregate water-related charges to fixed and variable costs
- EPA fines for non-compliance and so on.

Examples are given below

Regulatory

- reporting
- monitoring/testing

- inspections
- non-compliance fines for discharges to the environment
- insurance costs.

Conventional production costs

- Cost of raw materials wasted
- Cost of water
- Wastewater discharges
- Internal treatment
- Replacement of equipment
- Trade waste charges
- Monitoring
- Pre-treatment before discharge to the sewer
- Transportation of sludge
- Landfill costs
- Labour charges
- Electricity and gas charges
- Cost of steam
- Maintenance costs.

Project implementation costs

- Design and construction costs
- Site preparation costs
- Management and administration costs
- Utility connection costs
- Plumbing costs
- Electrical costs
- Training and commissioning costs.

Voluntary costs

- R&D costs
- Environmental studies and reports
- Habitat protection
- Training
- Audits
- Community sponsorship programmes.

These costs need to be collected for the existing plant in addition to the savings and other costs that will be accrued with the implementation of the water conservation project. This will identify the incremental costs for the project.

Once these costs are identified then cash flows can be calculated as explained in Section 9.4.

Case Study: Identifying the *True Cost of Water* at a food manufacturing plant

A food manufacturing plant located in Sydney consuming 1000 m^3/day of water had calculated the *true cost of water* as follows:

	Annual cost
Water usage charges at \$1.20/m^3	\$420 000
Sewer usage charges at \$1.19/m^3	\$416 500
Trade waste charges for BOD, oil and grease and suspended solids	\$138 000
Chemicals for wastewater treatment plant ferric chloride	\$55 000
Sludge removal	\$312 000
Bacterial culture	\$20 000
Deodoriser	\$40 000
Trade waste testing	\$21 000
Labour charges to operate treatment plant	\$45 000
Electricity charges	\$100 000
Depreciation expense on pre-treatment equipment	\$60 000
Total cost of water	\$1 627 500
Total cost of water/m^3	\$4.65
If *only* water, sewer usage charges and trade waste were considered, cost of water would only have been/m^3	\$2.78

9.4 Computing Cash Flows

Cash flow calculations are important, since it shows the true picture of expenditure or savings throughout the economic lifetime of the project.

Cash flows show the expenditure (outflows) and avoided costs (inflows) of money incurred and generated by a project. Without an understanding of cash flows it is difficult to understand the profitability of a project. Whilst the majority of projects cash inflows mirror the avoided costs that the organisation is saving due to the project, it is important to recognise other cash inflows. Examples included production capacity increases, reduction in marketing costs or on-selling of by-products. A simple example includes a food manufacturing company that was able to sell their sludge from the DAF plant at a higher value ever since they stopped the dosing of polymeric coagulants.

Cash flows can be separated into

- One-time cash flows
- Operating cash flows
- Working-capital cash flows.

One-time cash flows are those that are required to be expended only once – for instance, capital equipment.

Operating cash flow is the expenditure required to keep the plant running.

Working-capital cash flows are required to purchase raw materials until goods are sold and cash deposited in the bank.

The project needs to be assessed over its entire *economic lifetime*. This is defined as the period of time over which a project is expected to add economic value to a business. Typically, economic lifetimes are between 3 and 10 years. This is not to be confused with the *physical lifetime* of the equipment – which is the useful lifetime of the equipment. The economic lifetime is less than the physical lifetime of the equipment.

Any expected inflationary trends and price increases need to be included in costs and savings.

Once all of the costs are known it is useful to arrange them in a timeline over the lifetime of a project – as shown in the case study below.

Case Study: Computing Cash Flows

A cereal company's water conservation project consisted of the installation of a membrane plant at a cost of $1M. The installation costs were $300 000. As a result of the membrane plant the plant can reuse 75% of its incoming water – currently at 1000 m^3/day. The true cost of water has been calculated at $2.40/m^3. Operation and maintenance costs are $210 000/yr. The economic lifetime of the project is 5 years and inflation is assumed to be 3%. The cost of capital is 20%. The cash flows over its economic lifetime are shown in Figure 9.1.

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Capital cost	$1,000,000					
Installation cost	$300,000					
Operating costs		210 000	216 300	222 789	229 473	236 357
Membrane replacement						
Water savings		630 000	648 900	668 367	688 418	709 071
Net cash flows		420 000	432 600	445 578	458 945	472 714
		–$880,000	–$447,400	–$1,822	$457,123	$929,837

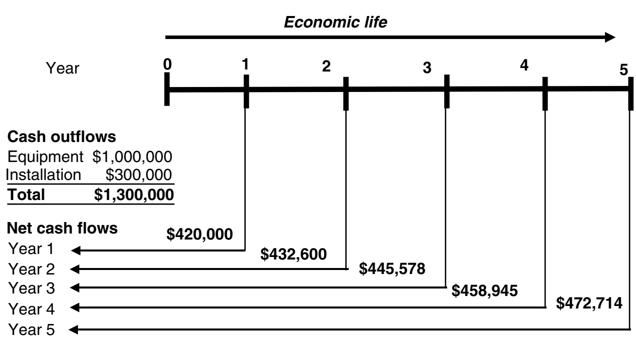

Figure 9.1 Computing Cash flows

It must be noted that if depreciation and after-tax cash flows are considered, then a more accurate financial picture of the project is gained. For this it is important to know the depreciation schedules to be applied for the equipment and the marginal tax rates. By depreciating the initial capital equipment over the allowable time horizon, taxable income reduces – and the after-tax cash flows correspondingly increase.

9.5 Investment Appraisal Methods

One of the most important steps in the capital budgeting cycle is working out if the benefits of investing large capital sums outweigh the costs of these investments. The payback period is the most popular method. Traditionally a payback period of 2 years or less is commonly quoted. Many organisations do not take a longer term view unless it is an investment in core business activities or needs to be done due to compliance requirements. Whilst the payback method is a quick and easy way of assessing the project profitability it does not take into account *the time value of money* and *the cash flows that occur after the initial investment is recouped*.

There are **four** common measures of profitability. These can be classified as "Simple" and "Discount Counted Cash flow" methods and are shown in Table 9.4.

9.5.1 Payback Method

When deciding between two or more competing projects, the usual decision is to accept the one with the shortest payback.

Payback is often used as a "first screening method". By this, we mean that when a capital investment project is being considered, the first question to ask is 'How long will it take to pay back its cost?' The company might have a target payback period, and so it would reject a project unless it's payback period was less than the target.

The payback period measures the length of time taken for the return on an investment exactly to equal the amount originally invested. If a number of options are considered, then these are ranked from the shortest to longest payback period. The payback period is calculated as follows.

Table 9.4 Measures of profitability

Measure	Method
Simple	Payback Return on investment
Discounted Cash flow	Net present value Internal Rate of Return

Initial capital investment: $ Initial Investment

$$\text{Pre-tax cash flows (CF) for years 1 to } n = \Sigma\,(CF_{Y1} + CF_{Y2} + CF_{Y3} + \cdots + CF_{Yn}) \quad (9.2)$$

Payback period is equal to the year when

$$\$\ \text{Initial Investment} = \Sigma\,(CF_{Y1} + CF_{Y2} + CF_{Y3} + \cdots + CF_{Yn}) \quad (9.3)$$

Worked example

A project has an initial investment of $10,000 and the cash inflows are given below:

Years	0	1	2	3	4
Cash inflows/outflows	−10,000	2,500	5,000	4,000	2,500

The payback period lies between year 2 and 3.
The sum of money recovered at the end of Year 2 = $7,500
The sum of money to be recovered by the end of 3rd year = $10,000 − 7,500 = $2,500
Therefore payback period = [2 + 2,500/4,000] = 2.6 years

Or if the annual cash flows are constant, then equation (9.3) simplifies to:

$$\text{Payback period} = \frac{\$\ \text{Initial Investment}}{CF} \quad (9.4)$$

The advantages of the payback method are

- It is popular; involves quick simple calculation and an easily understable concept.
- It provides an important summary method. How quickly will the initial investment be recouped? Short payback means investors are rewarded quickly
- It is a particularly useful approach for ranking projects under tight liquidity conditions.
- It is appropriate in situations where risky investments are made in uncertain markets that are subject to fast design and product changes or where future cash flows are particularly difficult to predict.
- The method is often used in conjunction with NPV or IRR method and acts as a first screening device to identify projects which are worthy of further investigation.

There are several disadvantages of using the payback period method. These include the following:

- It lacks objectivity. Who decides the length of the optimal payback period? No one does – decided by comparing one investment opportunity against another.
- It ignores the timing of cash flows. Cash flows post payback are ignored.
- It ignores the time value of money. This means that it does not take into account the fact that $1 today is worth more than $1 in 1 year's time. An investor who has $1 today can either consume it immediately or alternatively can invest it at the prevailing interest rate, say 30%, to get a return of $1.30 in a year's time.
- It is unable to distinguish between projects with the same payback period.
- The focus is on cash flows rather than overall business profitability. It may lead to excessive investment in short-term projects.

9.5.2 Return on Investment Method

The ROI method is also called the Return on Capital Employed (ROCE) or the Average Rate of Return. It expresses the profits arising from a project as percentage of the initial capital cost. If it exceeds a target rate of return, the project will be undertaken.

However the definition of profits and capital cost are different depending on what is included. For instance, the profits may be taken to include depreciation. For our purposes ROI is defined as:

$$\text{ROI} = (\text{Annual CF Savings/Initial capital cost}) \times 100 \tag{9.5}$$

For an example the initial investment is $200,000 and the savings every year are $20,000. Then the ROI is:

$\text{ROI} = \$20\,000/\$200\,000 \times 100 = 10\%$
Payback period = 10 years

If the ROI is greater than the target rate, the project is accepted. The ROI has similar advantages and disadvantages highlighted above for the payback period.

9.5.3 Discounted Cash Flow Methods

The most accurate methods to calculate project profitability are Net Present Value (NPV) and Internal Rate of Return (IRR) methods since both methods takes the *time value of money* into account. They rely on the concept of opportunity cost to place a value on cash inflows arising from a capital investment. The opportunity cost takes into account the interest charges on the capital expenditure, otherwise known as the cost of capital, future value of a project and future cash flows. The future cash flows are discounted by the cost of capital to bring them to present values. Put simply these methods recognise the fact that a dollar earned today is better than earning a dollar tomorrow.

$$\text{Future Value (FV)} = \text{PV} \times (1 + \text{r})^n \tag{9.6}$$

$$\text{PV} = \text{FV}/(1 + \text{r})^n \tag{9.7}$$

where

PV – Present Value
R – interest rates
N – time period in which interest is earned.

For an example, if interest charged is 10%, the income that is required in Year 3 to equal to $1000 dollars earned today is

$$\text{FV} = \$1000/(1 + 0.1)^3 = \$1\,331$$

It is customary to consider the future cash flows in present day dollars by considering the PV of those cash inflows.

The interest assigned to a project is the organisation's *cost of capital*. The cost of capital is different from the prevailing bank interest charges since it reflects the organisation's capital structure. In simple terms the cost of capital takes into account the rate of interest on outstanding debt, the opportunity cost of money (prevailing bank interest rates for investments) and the relative risk of the investment.

9.5.4 Net Present Value Analyses

Net Present Value (NPV) is equal to the present value of future returns, discounted at a marginal cost of capital, minus the present value of the cost of the investment. It can also be defined as NPV being the increase in the shareholder's wealth as a result of the investment at a given cost of capital. NPV is calculated as

$$\text{NPV} = \Sigma\ (\text{PV}_0 + \text{PV}_1 + \text{PV}_2 + \text{PV}_3 + \text{PV}_4 + \ldots + \text{PV}_n) \tag{9.8}$$

where $\text{PV}_0 \ldots \text{PV}_n$ are the present values of cash flows in Years 0 to n.

Given that $PV_i = CF_i/(1+r)^i$

$$NPV = \frac{CF_1}{(1+r)^1} + \frac{CF_2}{(1+r)^2} + \frac{CF_3}{(1+r)^3} + \cdots + \frac{CF_n}{(1+r)^n} - I_0$$

$$NPV = \sum_{i=0}^{n} \frac{CF_i}{(1+r)^i} - I_0$$

where

I_0 – initial investment
r – cost of capital or the discount rate
n – project investment duration in years.

In the case study given earlier, the NPV calculation is given in Table 9.5.

For interpretation of NPV values the following rules of thumb are useful.

$NPV > 0$	Project financially *viable*. Financial returns greater than costs, value produced.
$NPV = 0$	Project financially *viable*. Financial returns equal to costs, value unchanged.
$NPV < 0$	Project financially *unviable*. Financial returns less than costs, value consumed.

In the example given the company's project increases shareholder value over and above the 20% cost of capital and therefore should be implemented.

It must be noted that NPVs for projects are more sensitive to changes in the discount rate than others, and this sensitivity will be dependent on the timing of the cash flows. Generally, projects with cash flows loaded towards the early years will be less sensitive to discount rates than if cash flows were loaded towards the later years.

Table 9.5 Net Present Value analysis of cereal company

Year	Cash flow	Discount factor (DF) at 20% discount rate $DF = 1/(1+0.2)^n$	PV Cash flows
0	−$1,300,000	1.0000	−$1,300,000
1	$420,000	0.8333	$350,000
2	$432,600	0.6944	$300,417
3	$445,578	0.5787	$257,858
4	$458,845	0.4823	$221,328
5	$472,714	0.4019	$189,973
$NPV = \Sigma PV_{(yr\ 1-5)}$			$19,575

9.5.5 Internal Rate of Return

Internal Rate of Return (IRR) is the discount or interest rate at which the net present value of an investment is equal to zero. In other words IRR answers the question 'What level of interest will this project be able to withstand?' Once this is determined the risk of changing interest rates conditions can be minimised. The IRR is the annual percenatage return achieved by a project, at which the sum of the discounted cash inflows over the life of the project is equal to the sum of the capital invested.

Microsoft Excel has a function that enables the calculation of the IRR. In the example given, the IRR is 20.7% which is greater than the organisation's cost of capital (20%). It can also be calculated manually by varying the discount rates in the NPV calculation until NPV = 0.

If the IRR is greater than the hurdle rate, the project needs to be accepted.

Whilst the NPV method gives an absolute dollar value, the IRR measure gives a relative measure of profitability.

The disadvantage of the IRR method is that it does not take into account the magnitude of the project. It only gives a relative measure of profitability as a percentage. The same IRR can be achieved by implementing a low NPV value project as well as a high NPV value project. For example, a project with a NPV of $100 and another with a NPV of $100 000 can have the same IRR. By implementing the second project it adds to the firm's bottom line. Therefore a choice based only on IRR alone may lead to erroneous ranking. Especially when assessing multiple projects it is useful to consider both the NPV and the IRR together to make an informed decision.

The objective of the organisation needs to be to select projects that adds to the bottomline not necessarily to maximise the profitability of individual projects.

9.6 Assessing Project Risk

In conjunction with assessing project financial feasibility, project risk too needs to be assessed. Risk management involves the identification, mitigation and evaluation of risks. As mentioned previously risks can be classified as

- financial
- technical
- regulatory (public safety)
- environmental.

The two features that characterise risks are

- the probability of an event occurring – likelihood
- the impact of the event on the project if the risk materialised – severity.

Table 9.6 Guidelines for the use of reclaimed water for industrial water systems

Type of reuse	Type of treatment	Reclaimed water quality	Reclaimed water monitoring	Controls
Closed system cooling system	Process specific	Site specific	Site specific depending on water-quality requirements and end use	Additional treatment by user to prevent scaling, corrosion and biological growth, fouling and foaming.
Open system cooling system (human contact possible)	Secondary and Pathogen reduction	Site specific Thermotolerant coliforms <1000 cfu/100 ml	pH, BOD and SS weekly Thermotolerant coliforms – weekly Disinfection – daily	Additional treatment by user to prevent scaling, corrosion and biological growth, fouling and foaming. Windblown spray minimised.

An accurate assessment of these two aspects will enable an organisation to understand the risks, evaluate the likelihood and severity scenarios, prioritise the risks and put in place actions to mitigate the highest risks.

Technical risk can be mitigated by selecting proven technologies, carrying out detailed laboratory and on-site pilot studies.

Financial risk can be mitigated by carrying out sensitivity analyses, hedging and having in place water-tight contracts with suppliers.

Regulatory risk can be mitigated by involving the relevant approving authorities early in the project-development phase. Water reuse projects may be subject to the state or national regulatory guidelines. These specify different requirements for water quality depending on the end use of water as well as the daily or weekly monitoring to be carried out by the project proponent [2–5]. Table 9.6 shows Agriculture and Resource Management Council of Australia and New Zealand *Guidelines for Sewerage System – Use of Reclaimed Water* requirements for recycled water projects for use in cooling towers and in the open systems where human contact is possible. Once the regulatory risks have been quantified then a risk mitigation methods needs to be developed and incorporated into risk management plan. The risk management plan should clearly spell out who is responsible to take corrective measures to address a specific event in the event of equipment failure.

References

[1] Gordon P.J. Executive Order, *Pollution Engineering*, pp. 20–22. March 2002.

[2] US EPA. *Water Reuse Manual*. September 2004.

[3] Agriculture and Resource Management Council of Australia and New Zealand. *Guidelines for Sewerage System – Use of Reclaimed Water*. November 2000.

[4] EPA Victoria. *Guidelines for Environmental Management – Use of Reclaimed Water*. March 2003.

[5] AWWA Research Foundation *Industrial Water. Quality Requirement for Reclaimed Water*. 2004.