Qualifications

# Diploma in Beverage Packaging (Beer)
# Unit 2.2 Operations Management

## Finance

## DIPOLMA IN PACKAGING (BEER) - MODULE 2

## UNIT 2.2: Operations Management

### ELEMENT 2.2.3: Finance

**ABSTRACT:** This section describes the practices associated with packaging operations finance, capital investment and project management.

**LEARNING OUTCOMES:** On completion of this unit you will understand:

1. Packaging line revenue budgeting.
2. Operating as a cost centre.
3. Financial performance reporting.
4. Capital project justification.
5. The project life cycle.
6. Control of time and cost in managing projects

**SYLLABUS.**

**2.2.3.1 Basic revenue budgeting:**

- Accounting principles and conventions
- Direct and indirect costs
- Fixed and variable costs
- Construction of departmental budgets

**2.2.3.2 Management accounting:**

- Annual budgets and period operating statements
- How actual performance is reported against the budgeted monthly or period figures
- The purpose of year-to-date figures
- Variance reporting:
  - The meaning of variance and the conventions for designating positive and negative variances

**2.2.3.3 Project management:**

- Project justification
- Project life cycle:
  - The key stages of the project life cycle from conception to final acceptance
  - The roles and responsibilities of individuals and groups at each stage and how they interact
- Control of time and cost:
  - Tools and techniques for controlling time and cost
  - The meaning of critical path
  - The likely effect on completion of delaying events and implementing a recovery strategy
  - The differing implications of project variations initiated by the customer or supplier

# Element 2.2.3

## 2.2.3.1 – BASIC REVENUE BUDGETING

### ACCOUNTING PRINCIPLES AND CONVENTIONS

**Background and accounting principles**
At a fundamental level, breweries and packaging companies are in business to make a profit. The profit is returned to shareholders as a dividend but a proportion is normally retained to re-invest in the business to allow it to grow.
In order to manage a business effectively from the financial perspective, it is important to measure:

(a) how many assets there are
(b) how much profit is being generated
(c) when the cash is coming in
(d) how it is being spent

Accounting is nothing more than the measurement of these processes to reflect what has happened to a business over a relevant period of time.

Assets are measured by the **Balance Sheet**, whilst profit and cash are measured by the **Income Statement / Profit and Loss Account** and the **Cash Flow Statement** respectively.

**1. Balance Sheet:**
The balance sheet shows the position that the business is in at the end of the relevant time period. It shows the assets the business has, its liabilities, and the amount of equity belonging to the shareholders.

The reason it is called the balance sheet is because total assets must equal liabilities and shareholders' equity as illustrated below:

Assets = Liabilities + Shareholders' Equity

The 2 sides of this equation must always be equal or balance.

The liabilities and equity section shows where the business gets its funds and the assets section shows how those funds have been used.

The assets section is generally divided into 2 sub-sections, showing the short term and long term assets. In this context, a long term item is one whose life in the business is expected to be longer than 1 year.

Examples of long term or fixed assets include:

- Property
- Plant and machinery
- Financial investments that are to be held for the long term
- Patents
- Licenses

## Finance

Short term assets are those whose lives are shorter than 1 year and include:

- Inventories or stock
- Account receivables / debtors (when credit is given to customers)
- Cash
- Financial investments that are to be held for the short term only (i.e. less than 1 year)

Liabilities are also broken down into short and long term items. Short term liabilities include:

- Accounts payable / creditors (when credit is taken from suppliers)
- Income taxes payable
- Short term borrowings (where the repayment date is within 1 year)

Long term liabilities include borrowings where the repayment date is longer than 1 year from the balance sheet date.

Shareholders' equity is made up of 2 key parts. The capital part represents the shares bought by the investors when the business was set up. This represents the cash that was physically given to the business by the investors, i.e. shareholders. The 2nd (and often more significant) part is retained earnings / profit and loss reserve. This is the cumulative profit earned that has not been paid to the owners in dividends but has been re-invested in the future growth of the business instead.

**2. Income Statement / Profit and Loss Account**
The income statement / profit and loss account measures the sales made and the costs incurred over a particular time period. For external reporting this is usually for a year but internally most businesses will prepare their income statement / profit and loss account on a weekly or a monthly basis.

The income statement / profit and loss account captures a sale when the product or service is delivered to the customer. Cash may or may not change hands at this stage. Costs are recorded in the income statement / profit and loss account to reflect the costs of making the sales during that time period. This is called the matching or accruals concept. This concept states that the costs recorded must match to the sales made in the relevant time period.

Although the jargon in an income statement / profit and loss account may vary (especially from country to country) the costs are always deducted from sales in order of how closely they relate to the sale itself. The order that cost deduction appears is therefore:

- Cost of product sold
- Sales, general and administration costs
- Interest expense
- Tax expense

After costs are deducted from sales, the figure that remains is the bottom line profit (also known as the net income or profit after tax) which belongs to the shareholders, and consequently is reflected as part of shareholders' equity on the balance sheet.

**3. Cash Flow Statement**

The cash flow statement shows how cash has been generated and used over the relevant time period. Most cash flow statement styles will present the flows of cash using 3 main categories:

- Operating cash flows
- Investing cash flows
- Financing cash flows

Operating cash flows will include the flows from the core operations of the business and are driven by trading. Investing cash flows deal with any investments in the future of the business. Any new plant and equipment would be included in this section. And finally the financing section deals with any investments made by shareholders and any dividends paid to them. Any new borrowings or any repayments of existing loans would also be shown in this section.

**Financial ratios (or accounting ratios)**

A financial ratio (or accounting ratio) is a relative magnitude of two selected numerical values taken from an enterprise's financial statements. Often used in accounting, there are many standard ratios used to try to evaluate the overall financial condition of a corporation or other organization. Financial ratios may be used by managers within a firm, by current and potential shareholders (owners) of a firm, and by a firm's creditors. Financial analysts use financial ratios to compare the strengths and weaknesses in various companies. If shares in a company are traded in a financial market, the market price of the shares is used in certain financial ratios.

***Sources of data for financial ratios***

Values used in calculating financial ratios are taken from the balance sheet, income statement and cash flow statement. The statements' data is based on the accounting method and accounting standards used by the organization.

***Purpose and types of ratios***

Financial ratios quantify many aspects of a business and are an integral part of the financial statement analysis. Financial ratios are categorized according to the financial aspect of the business which the ratio measures. Liquidity ratios measure the availability of cash to pay debt. Activity ratios measure how quickly a firm converts non-cash assets to cash assets. Debt ratios measure the firm's ability to repay long-term debt. Profitability ratios measure the firm's use of its assets and control of its expenses to generate an acceptable rate of return. Market ratios measure investor response to owning a company's stock and also the cost of issuing stock. These are concerned with the return on investment for shareholders, and with the relationship between return and the value of an investment in company's shares.

Financial ratios allow for comparisons

- between companies
- between industries
- between different time periods for one company
- between a single company and its industry average

Ratios are not generally useful unless they are benchmarked against something else, like past performance or another company. Thus, the ratios of firms in different industries, which face different risks, capital requirements, and competition are usually hard to compare.

Figure 1 shows a summary of the more common key financial ratios.

**SUMMARY OF KEY FINANCIAL RATIOS**

| Ratio | How calculated | What it means |
|---|---|---|
| **LIQUIDITY** | | |
| Current | Current assets / Current liabilities | The extent to which a firm can meet its short-term obligations. |
| Quick | Current assets - inventory / Current liabilities | The extent to which a firm can meet its short-term obligations without relying upon the sale of its inventory. |
| **LEVERAGE** | | |
| Debt-to-asset | Total debt / Total assets | The percent of funds provided by creditors. |
| Debt-to-equity | Long-term debt / Total equity | The balance between debt and equity in a firm's long-term capital structure. |
| **ACTIVITY** | | |
| Fixed asset turnover | Sales / Fixed assets | Sales productivity and plant and equipment utilization. |
| Total asset turnover | Sales / Total assets | Whether a firm is generating sufficient volume of business for the size of its asset investment. |
| **PROFITABILITY** | | |
| Gross profit margin | Sales – cost of goods sold / Sales | The total margin available to cover operating expenses and yield a profit. |
| Return on total assets | Net income before interest and taxes / Total assets | The total return to assets investment. |
| **GROWTH** | | |
| Sales | Annual percentage growth in sales | Business's growth rate in sales. |
| Net income | Annual percentage | Business's growth rate in income. |

**Figure 1: Summary of key financial ratios**

**Accounting conventions**

There are a numerous conventions, some driven by regulation, that are used in the field of accountancy. For the purposes of these notes, just two will be highlighted both being used for convenience as much as convention.

(a) **Size of numbers:**

Small companies will tend to show financial numbers in full so £1,000 will be shown as 1,000.0 or perhaps 1,000.00. Large companies will tend to show financial numbers in ways which reduce the zeros. Thus £1,000,000 will be shown as £1,000.0 or £1,000.00 with or without a heading at the top of columns of numbers showing £'000 or £k. For internal purposes, of course, there will be an ongoing understanding of the magnitude of the numbers without an accompanying explanation. Figure 2 shows how the figures are displayed for convenience:

Before:

| | Month | Year to Date | Forecast |
|---|---|---|---|
| | £ | £ | £ |
| Payroll | 282,876 | 1,506,712 | 3,786,789 |
| Maintenance | 72,089 | 202,889 | 746,111 |

After:

| | Month | Year to Date | Forecast |
|---|---|---|---|
| | £'000 | £'000 | £'000 |
| Payroll | 282.9 | 1,506.7 | 3,786.8 |
| Maintenance | 72.1 | 202.9 | 746.1 |

**Figure 2: Displaying financial data**

(b) **Losses and negative numbers:**

Losses and negative numbers can be shown in several ways. In past times of pen and ink, accounts often showed losses in red – probably as a means of highlighting the number. Hence the terms "in the red" or (hopefully) "in the black".

In modern times, losses and negative numbers can be shown with either a minus sign or with brackets around the number (again seen as a means of making the particular number more noticeable in a column of numbers).

Thus: - 1,209.0 or (1,209.0)

In a column of numbers, the negative would be displayed as shown in Figure 3.

| Month | Price variance |
|---|---|
| Jan | 180.0 |
| Feb | (50.0) |
| Mar | 30.0 |
| Year to date total | 160.0 |

**Figure 3: Displaying a negative number**

With computer software systems, all three negative conventions are possible and the issue does vary from company to company. Even within companies, line or departmental accounts can use minus signs for losses (as an example) but then use brackets for the "rolled" up management accounts. Provided systems are compatible, there need not be a problem.

**Cost accounting**

Whilst some packaging operations will be run as profit centres, the vast majority will be treated as cost centres with the operating costs being part of the "cost of goods sold".

It follows therefore that the principles of manufacturing (packaging) cost accounting need to be developed here.

Manufacturing consists of activities convert raw materials into finished goods. Packaging operations take "raw materials" (beer, carbonated soft drinks) and package them into primary and secondary packs – so the principles will apply equally well.

Manufacturing costs consist of:

- Direct material
- Direct labour
- Manufacturing overhead

Thus:

**Manufacturing Cost** = **Direct Material** + **Direct Labour** + **Manufacturing Overhead**

**Direct and indirect costs**

***Direct costs*** are those costs which can be physically and directly associated with the finished product. So, direct materials and direct labour are direct costs.
Examples of direct material costs include:

- beer
- syrup in the bottling of soft drinks
- bottles
- labels
- cans
- can ends
- cardboard
- stretch film

Examples of direct labour costs include:

- bright beer team salaries, pay-roll taxes and other benefits
- syrup make up team salaries, pay-roll taxes and other benefits
- packaging line team salaries, pay-roll taxes and other benefits

***Indirect costs,*** which are considered part of manufacturing overhead, are those costs which cannot be easily allocated to the finished product and can be associated with a whole variety of associated and supporting activities. Indirect materials, indirect labour and other areas of manufacturing overhead are categorized as indirect costs.

Examples of indirect material costs include:

- processing aids
- cleaning chemicals
- lubricants
- engineering spares and other maintenance materials

Examples of indirect labour costs include:

- shared centrally based engineering salaries, pay-roll taxes and other benefits
- shared laboratory technician salaries, pay-roll taxes and other benefits
- administration (e.g. Management, HR, Planning, IT) salaries, pay-roll taxes and other benefits

Examples from the remaining manufacturing overhead include:

- depreciation
- insurance
- leasing costs (e.g. fork-lift trucks)
- rent
- electricity
- fuel
- water
- effluent
- protective clothing
- cleaning
- telephone
- stationery
- waste disposal
- security

**Fixed and variable costs**

All costs are fixed, variable, semi-fixed or semi-variable. Although the last two categories will be touched on later, the prime focus will be on fixed and variable costs.

***Fixed costs*** are business expenses that are not dependent on the level of goods or services produced by the business.

They tend to be time-related, such as salaries or rents being paid per month and are generally considered as overhead costs. These packaging overhead costs are recovered through the sales or transfer price charged for the product being packaged.

Fixed costs are those that stay the same in total regardless of the number of units produced or sold. Although total fixed costs are the same, fixed costs per unit changes as fewer or more units are produced. Straight-line depreciation is an example of a fixed cost. It does not matter whether the machine is used to produce 1,000 units or 10,000,000 units in a month, the depreciation expense is the same because it is based on the number of years the machine will be in service.

Examples of other fixed costs include:

- salaries, pay-roll taxes and other benefits
- insurance
- leasing costs (e.g. fork-lift trucks)
- rent
- electricity
- fuel
- water
- effluent
- protective clothing
- cleaning
- telephone
- stationery
- waste disposal
- security

***Variable** costs* are the costs that change in total each time an additional unit is produced or sold. With a variable cost, the per unit cost stays the same but the more units produced or sold, the higher the total cost. Direct materials are a variable cost. If it costs £0.20 to stretch-wrap a pallet of finished cases to stabilize them, the total cost for 10 pallets is £2.00 (10 pallets × £0.20 per pallet) and the total cost for 100 pallets is £20.00 (100 pallets × £0.20 per pallet).

Graphically, the fixed cost looks like a straight horizontal line while the variable cost line slopes upward. By adding the two together, the total cost can be calculated as shown in Figure 4.

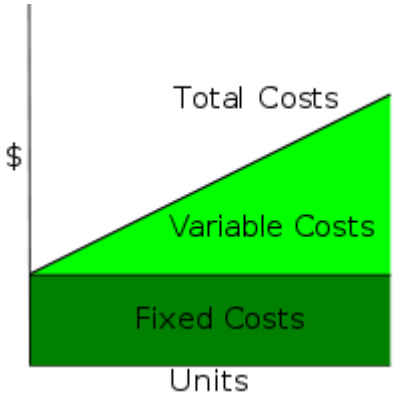


**Figure 4: Fixed, variable and total costs**

If only life was that simple! In practice, some of these costs are treated as semi-fixed and some semi-variable.

***Semi-fixed costs*** are costs that are constant within a defined level of activity but that can increase or decrease when activity reaches upper and lower levels. These are not common – an example might be a contract supply of a supporting service with a "minimal" level of service, a "normal" level and an "exceptional" level.

***Semi-variable** costs* are costs which contain both a fixed-cost component and a variable-cost component. The fixed cost element is a part of the cost that needs to be paid irrespective of the level of activity achieved by the business. On the other hand the variable component of the cost is payable proportionate to the level of activity.

A semi-variable cost has a similarity to a traditional telephone bill. The business pays line rental and on top of that a price that depends on how heavily the service is used. So it changes with output.

The cost of energy, such as electricity, is another good example as it is integral to production of goods and services. This component straddles both the fixed and variable categories because electrical power is essential for the basic operation of the business in lighting, heating, refrigeration etc – this portion is a sunk cost that is foregone regardless of production (i.e. base

load). As demand ramps up, more energy is required to ramp up the production process in the use of plant and equipment. The cost of electrical energy will then rise accordingly as production activities increase. Therefore, the cost of electricity can be viewed as semi-variable, although for most breweries and packaging companies (especially 7 x 24 operations), electricity as well as other utilities is considered a fixed cost. As an aside, it is interesting to note that in producing a fixed-cost electricity budget, it is best practice to base the calculation on both the fixed (base-load) and variable (production volume) elements.

Another example is employees who work overtime. This group is paid on a fixed wage or salary plus they are also rewarded based on the overtime they work. Clearly the overtime element is a variable component, although the total cost is generally treated as fixed.

**Construction of departmental budgets**
The most rigorous way of constructing budgets is from a "zero base" – hence the term "zero based budgeting".

***Zero based budgeting***
Under zero based budgeting managers are required to justify all budgeted expenditures, not just changes in the budget from the previous year. The base line is zero rather than last year's budget.

In traditional approach of budgeting, the managers start with last year's budget and add to it (or subtract from it) according to anticipated needs. This is an incremental approach to budgeting in which the previous year's budget is taken for granted as a baseline. This approach is called incremental budgeting and will be considered shortly.

Zero based budgeting approach requires considerable documentation. In addition to all of the schedules in the usual master budget (the master budget is a summary of company's plans that sets specific targets for sales, production, distribution and financing activities), the departmental manager must prepare a series of decision packages in which all of the activities of the department are ranked according to their relative importance and the cost of each activity is identified. Higher level managers can then review the decision packages and cut back in those areas that appear to be less critical or whose costs do not appear to be justified.
Zero based budgeting is a good idea as it ensures strict financial discipline. The only issue is the frequency with which a ZBB review is carried out. In theory, the review should be performed every year. Critics of such type of budgeting charge that properly executed zero based budgeting is too time consuming and too costly to justify on an annual basis. In addition, it is argued that annual reviews soon become mathematical and that the whole purpose of zero based budgeting is then lost. Whether or not a company should use annual reviews is a matter of judgment. In some situations, annual zero based reviews may be justified; in other situations they may not because of the time and cost involved. However, most managers would at least agree that on occasion zero based reviews can be very helpful.

Advantages and disadvantages of zero based budgeting:

**Advantages / benefits:**
1. Efficient allocation of resources, as it is based on needs and benefits.
2. Drives managers to find cost effective ways to improve operations.
3. Detects inflated budgets.
4. Useful for service departments where the output is difficult to identify.
5. Increases staff motivation by providing greater initiative and responsibility in decision-making.
6. Increases communication and coordination within the organization.
7. Identifies and eliminates wasteful and obsolete operations.
8. Identifies opportunities for outsourcing.
9. Forces cost centres to identify their mission and their relationship to overall goals.

**Disadvantages / Limitations:**
1. Difficult to define decision units and decision packages, as it is time-consuming and exhaustive.
2. Forced to justify every detail related to expenditure. The research and development (R&D) department is threatened whereas the production department benefits.
3. Necessary to train managers. Zero based budgeting (ZBB) must be clearly understood by managers at various levels to be successfully implemented. Difficult to administer and communicate the budgeting because more managers are involved in the process.
4. In a large organization, the volume of forms may be so large that no one person could read it all. Compressing the information down to a usable size might remove critically important details.
5. Honesty of the managers must be reliable and uniform. Any manager that exaggerates skews the results.

***Incremental budgeting***
This is the usual and traditional approach and is more pragmatic in terms of time and cost in budget preparation for mature and ongoing businesses. Managers start with last year's budget (taken for granted as a baseline) and add to it (or subtract from it) according to anticipated needs.

Changing needs from year to year could include (merely as examples):

- Growing / shrinking sales volumes or product / package mix
- New product launches
- Marketing activity
- Introduction of additional packaging plant capacity
- Revised shift patterns
- Increased / decreased material prices
- Increased salaries
- Increased / decreased utility costs

As stated previously, most packaging departments operate as cost centres. There will usually be two cost budgets: a fixed cost budget and a variable cost budget the sum of the two being the total packaging (or production) budget for the operation.

The breakdown of annual figures into monthly (and occasionally weekly) totals is known as "calendarization". Calendarized budgets reflect the company's financial year which, may or may not coincide, with the calendar year (they often run with the country's tax year). Some companies work on 12 monthly periods (periods 1 – 12), others split the year equally into 13 periods (periods 1 – 13).

**Fixed cost budget:**
Examples of the items included in the fixed cost budget were listed previously. Figure 5 shows a detailed fixed cost budget framework with the periods marked 1 -12 (could also be actual months Jan, Feb etc).

The items are grouped:

- Payroll costs
- Controllable costs
- Site
- Operational
- Non-controllable
- Maintenance costs
- Capital related (revenue)
- Fuel, water and effluent

The group "controllable" represents, in fact, the various controllable costs not listed specifically elsewhere. For example, clearly maintenance is a controllable cost – it is discretionary in that maintenance can be deferred or delayed if necessary, similar to training.

| **Annual Canning Budget – Fixed Cost** | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | Total |
| **Payroll costs:** | | | | | | | | | | | | | |
| Salaries | | | | | | | | | | | | | |
| Health insurance | | | | | | | | | | | | | |
| Pensions | | | | | | | | | | | | | |
| Overtime | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| **Controllable costs:** | | | | | | | | | | | | | |
| Training | | | | | | | | | | | | | |
| Protective clothing | | | | | | | | | | | | | |
| Recruitment | | | | | | | | | | | | | |
| Catering | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| Site: | | | | | | | | | | | | | |
| Cleaning premises | | | | | | | | | | | | | |
| Telephone | | | | | | | | | | | | | |
| Photocopiers | | | | | | | | | | | | | |
| Cleaning materials | | | | | | | | | | | | | |
| Waste disposal | | | | | | | | | | | | | |
| Computer expenses | | | | | | | | | | | | | |
| Security | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| Operational: | | | | | | | | | | | | | |
| Chemicals | | | | | | | | | | | | | |
| Machine hire | | | | | | | | | | | | | |
| Fork lift truck leasing | | | | | | | | | | | | | |
| Fork lift truck fuel | | | | | | | | | | | | | |
| Technical equipment/mats | | | | | | | | | | | | | |
| Stock losses | | | | | | | | | | | | | |

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Non-controllable:** | | | | | | | | | | | | | |
| Depreciation | | | | | | | | | | | | | |
| Rates | | | | | | | | | | | | | |
| Rent | | | | | | | | | | | | | |
| Insurance | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| Maintenance costs: | | | | | | | | | | | | | |
| Spares/materials | | | | | | | | | | | | | |
| Contractors | | | | | | | | | | | | | |
| Building repairs | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| Capital related: | | | | | | | | | | | | | |
| Plant write-off | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| Fuel, water and effluent: | | | | | | | | | | | | | |
| Gas | | | | | | | | | | | | | |
| Fuel oil | | | | | | | | | | | | | |
| Electricity | | | | | | | | | | | | | |
| Water | | | | | | | | | | | | | |
| Effluent | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| **Total** | | | | | | | | | | | | | |

**Figure 5: Annual canning department fixed cost budget**

**Variable cost budget:**
The variable cost budget will be prepared, with the previous year as baseline, but taking into account up to date "sales" forecasts for the coming year together with planned pack changes etc. It is important, of course, to use monthly (and occasionally weekly) figures as production volumes will not be uniform throughout the year due to seasonal factors, building stock etc. The variable cost budget will primarily include direct material costs with the principle materials being itemized separately with often a sundries provision for smaller items:

**Bottling:**
- Bottles
- Crowns
- Caps
- Labels
- Cartons
- Trays
- Multi-pack
- Sundries (glue, ink, plastic films etc)

**Canning:**
- Cans
- Ends
- Hi-cone
- Trays
- Multi-pack
- Sundries (ink, plastic films etc)

**Kegging:**
- Caps
- Labels
- Sundries (printer ribbons etc)

**Cask:**
- Finings
- Shives
- Keystones
- Labels
- Sundries (printer ribbons etc)

An important consideration is that of material utilization and hence "losses" (beer, bottles, cans, cardboard etc) is always an important area of control. In practice losses will be monitored and reported separately but for budgetary purposes gross figures are used.

Actual costs are normally calculated by taking a standard cost for a unit of material and then multiplying by the anticipated volumes in the production plan. A simplistic annual bottling variable cost budget is shown in Figure 6 with, in this case, the periods being marked as the actual months.

| Annual Bottling Budget – Variable Cost | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
| | | | | | | | | | | | | | |
| Bottles | | | | | | | | | | | | | |
| Crowns | | | | | | | | | | | | | |
| Caps | | | | | | | | | | | | | |
| Labels | | | | | | | | | | | | | |
| Cartons | | | | | | | | | | | | | |
| Trays | | | | | | | | | | | | | |
| M/Pack | | | | | | | | | | | | | |
| Sundries | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| Total | | | | | | | | | | | | | |

**Figure 6: Annual Bottling variable cost budget**

It should be noted that in a number of countries, the packaging business will be required to collect tax or duty on the finished alcohol product before the goods are finally dispatched. In the United Kingdom this has often been referred to as "duty at the gate". The correct allocation of the tax or duty is often added to the variable cost account which also becomes a platform for the associated management of the flow of funds.

### 2.2.3.2 – MANAGEMENT ACCOUNTING

Management's activities and responsibilities can be classified into the following three broad functions:

- Planning
  - Looking ahead
  - Establishing objectives e.g. short-term profit
  - Adding value to the business
- Directing
  - Co-ordinate diverse activities and human resources
  - Co-ordinating diverse activities and human resources
  - Implementing planned objectives
  - Motivating employees
  - Recruiting and training employees
- Controlling
  - Keeping activities on track
  - Determining whether objectives are met
  - Decide changes needed to get back on track

It may be said that good decision making is the outcome of good judgement in planning, directing and controlling.

To ensure financial control of operations, it is vital that accounts are produced speedily in sufficient detail to allow decisions to be made.

**ANNUAL BUDGETS AND PERIOD OPERATING STATEMENTS**

Large companies are generally required to report financial performance on an annual basis, declare a profit or a loss and pay taxes due on any profit. It is convenient therefore to control packaging operations against an annual budget split into convenient periods (normally either 12 calendar months or 13 x 4 weekly operating periods).

It is usual to produce period operating statements in timely fashion as soon as practically possible after the period end (often within one week of the new period). This allows management to evaluate financial performance and, if necessary, take corrective action.

**HOW ACTUAL PERFORMANCE IS REPORTED**

Financial performance is reported by comparing actual performance against the budgeted figure for the period. This is carried out for each period leading to an accumulated set of figures for the annual period.

**The purpose of year-to-date figures**

The performance in each period is added to previous periods in the financial year to produce year-to-date (YTD) figures. The principal purpose is to allow a forecast of the year end position to be produced which is vitally important for management control.

Although most packaging operations operate as cost centres, a better than budget performance can add to the organization's profit whilst a worse than budget performance can reduce the organization's profit.

Period forecasts take the form of the accumulated period performance plus the anticipated performance for the remainder of the year (Rest of Year).

As an example for a 12 period year forecasts are designated:

1 + 11, 2 + 10, 3 + 9, 4 + 8 .....8 + 4, 9 + 3, 10 + 2 and 11 + 1

It is worth noting that the 0 + 12 is the starting budget and the Period 12 performance provides the Year End figures.

**Variance reporting**

A variance is defined as the difference between actual and budgeted performance. A variance can be better than budget or worse than budget.

The conventions for designating positive and negative variances are similar to profits (positives) and losses (negatives). Quite simply, worse than budget figures are shown with either a minus sign or with brackets around the number. Taking the latter designation, at the top of a column of variances there will often be heading:

VARIANCE
B(W)

Drawing all these themes together, Figure 7 shows an example of a packaging department fixed cost operating statement for the end of Period 5 (31st May).

| Month Actual | Month vs BUD B(W) | £'000 | YTD Actual | YTD vs BUD | ROY F/C | 5+7 F/C | 5+7 vs BUD B(W) |
|---|---|---|---|---|---|---|---|
| | | **Payroll costs:** | | | | | |
| 934.8 | 25.7 | Salaries | 4,735.2 | 39.9 | 6,393.3 | 11,128.5 | 254.3 |
| 88.2 | 3.0 | Health insurance | 460.8 | (7.4) | 607.7 | 1,068.5 | 12.7 |
| 52.1 | 2.2 | Pensions | 262.3 | 8.5 | 366.4 | 628.7 | 15.4 |
| 0.0 | 0.0 | Overtime | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | | | | | | |
| | | **Controllable costs:** | | | | | |
| 4.6 | 0.4 | Training | 15.8 | 1.6 | 32.6 | 48.4 | 1.6 |
| 6.7 | 3.6 | Protective clothing | 150.6 | (17.6) | 48.1 | 198.6 | 0.0 |
| 0.0 | 3.8 | Recruitment | 30.2 | (9.5) | 18.6 | 48.8 | 0.0 |
| 6.6 | 2.2 | Catering | 57.7 | (13.3) | 35.0 | 92.7 | 0.0 |
| | | | | | | | |
| | | Site: | | | | | |
| 15.0 | 3.6 | Cleaning premises | 75.1 | 18.2 | 114.7 | 189.8 | 0.0 |
| 3.0 | 1.0 | Telephone | 27.9 | (5.8) | 24.4 | 52.3 | 0.0 |
| 0.2 | 0.6 | Photocopiers | 2.0 | 2.2 | 9.0 | 11.0 | 0.0 |
| 28.2 | (2.3) | Cleaning materials | 141.5 | 0.5 | 231.5 | 373.0 | 0.0 |
| 23.8 | (14.9) | Waste disposal | 70.6 | (23.9) | 37.3 | 107.9 | 0.0 |
| 0.3 | 8.9 | Computer expenses | 44.8 | 6.1 | 89.0 | 133.8 | 0.0 |
| 16.1 | 1.7 | Security | 68.2 | 23.9 | 135.5 | 203.7 | 0.0 |
| | | | | | | | |
| | | Operational: | | | | | |
| 8.2 | (7.2) | Chemicals | 20.6 | (15.2) | (6.6) | 14.0 | 0.0 |
| 0.1 | 7.5 | Machine hire | 0.1 | 41.6 | 98.5 | 98.6 | 0.0 |
| 9.6 | 0.0 | Fork lift truck leasing | 48.0 | 0.0 | 67.2 | 115.2 | 0.0 |
| 2.2 | (0.6) | Fork lift truck fuel | 8.4 | (0.4) | 11.2 | 20.0 | (0.4) |
| 0.0 | 1.7 | Technical equipment/mats | 0.0 | 9.5 | 25.0 | 25.0 | 0.0 |
| 7.3 | (0.4) | Stock losses | 68.9 | (31.2) | 30.1 | 99.0 | 0.0 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | **Non-controllable:** | | | | | |
| 634.9 | 14.2 | Depreciation | 3,187.6 | (39.0) | 4,588.7 | 7,776.3 | (72.9) |
| 25.0 | 21.9 | Rates | 198.6 | 35.7 | 291.8 | 490.4 | 72.0 |
| 0.0 | 0.0 | Rent | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 24.7 | 0.0 | Insurance | 123.6 | 0.0 | 173.1 | 296.7 | 0.0 |
| | | | | | | | |
| | | Maintenance costs: | | | | | |
| 214.0 | (45.5) | Spares/materials | 1,117.1 | 86.4 | 1,606.9 | 2,724.0 | (100.0) |
| 0.0 | 0.0 | Contractors | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 44.8 | (25.1) | Building repairs | 196.1 | (68.3) | 115.0 | 311.1 | 0.0 |
| | | | | | | | |
| | | Capital related: | | | | | |
| 33.3 | 0.0 | Plant write-off | 166.7 | 0.0 | 233.3 | 400.0 | 0.0 |
| | | | | | | | |
| | | Fuel, water and effluent: | | | | | |
| 47.2 | 8.3 | Gas | 259.5 | 7.7 | 386.5 | 646.0 | (24.3) |
| 0.0 | 0.0 | Fuel oil | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 108.4 | (3.0) | Electricity | 580.6 | (1.5) | 957.1 | 1,537.7 | (43.1) |
| 32.4 | 4.9 | Water | 165.6 | 7.2 | 246.0 | 411.7 | (10.2) |
| 24.1 | (2.1) | Effluent | 114.6 | (4.6) | 154.0 | 268.6 | (4.6) |
| | | | | | | | |
| **2,395.8** | **14.1** | **Total** | **12,398.7** | **51.3** | **17,119.9** | **29,518.6** | **100.5** |

Key:

- Budget = BUD
- Year to date = YTD
- Forecast = F/C
- Rest of Year = ROY
- Better / Worse = B(W)

**Figure 7: Packaging department fixed cost operating statement**

## 2.2.3.3 – PROJECT MANAGEMENT

**FUNDAMENTAL CONSIDERATIONS**

Project management is the discipline of planning, organizing, securing and managing resources to achieve specific goals. A project is a temporary exercise with a defined beginning and end (usually time-constrained, and often limited by funding or deliverables), undertaken to meet unique goals and objectives, typically to bring about beneficial change or added value. The temporary nature of projects stands in contrast with business as usual (or operations), which are repetitive, permanent, or semi-permanent functional activities to produce products or services. In practice, the management of these two systems is often quite different, and as such requires the development of distinct technical skills and management strategies.

The primary challenge of project management is to achieve all of the project goals and objectives while honouring the preconceived constraints. Typical constraints are scope, time, and budget. The secondary, and more ambitious, challenge is to optimize the allocation of necessary inputs and integrate them to meet pre-defined objectives.

Projects can be either “capital” or “revenue” in nature, that is, the funding is either from the capital account (budget) or from the revenue account (budget).

**1. Capital projects**

Capital projects are generally long term investments requiring relatively large sums to acquire, develop, improve and / or maintain a capital asset such as land, buildings, plant and equipment.

The capital sum invested is normally “depreciated” over the asset's estimated useful life. Depreciation is the gradual conversion of the cost of a tangible capital asset or fixed asset into an operational expense (called depreciation expense) which then normally appears in the fixed cost budget (see earlier).

The objectives of depreciation are to:

a) Reflect reduction in the book value of the asset due to obsolescence or wear and tear.

b) Spread a large expenditure (purchase price of the asset) proportionately over a fixed period to match revenue received from it.

c) Reduce the taxable income by charging the amount of depreciation against the company's total income. In effect, charging of depreciation means the recovery of invested capital, by gradual sale of the asset over the years during which output or services are received from it. Depreciation is computed at the end of an accounting period (usually a year), using a method best suited to the particular asset.

The periods of time over which fixed assets are depreciated (depreciation terms) vary considerably. Some examples are:

- Packaging plant 5 to 15 years
- Electronic equipment 5 to same term as asset
- Utilities 10 to 30 years
- Buildings 10 to 50 years

Some practical examples of capital projects include:

- New packaging line
- New end-of-line packaging machine
- Energy efficient lighting scheme
- Replacement roof for bottling hall
- Robot to replace manual handling of casks
- Off-line nitrogen analyser
- Upgrading of fire alarm system to meet legislative requirements
- Battery back-up system for computer room

**2. Revenue projects**

Revenue projects are generally one-off short term investments requiring relatively small sums to restore the original functionality of a piece of plant or equipment, to make minor improvements or up-grades to a facility and to fund initiatives such as cultural change.

Restoring the original functionality of a piece of plant or equipment can easily be confused with maintenance but in the context of on-off revenue projects, these tend to be infrequent non-routine significant expenditures which appear as special inclusions in the annual fixed cost budget. Such revenue projects can often be associated with the prefix “re”. Examples include:

- Replace
- Restore
- Repair
- Return
- Revert

Revenue budgets may be categorised as “minor” projects, categorized by the cost to carry out the work. Companies decide at what level to regard a project as a capital project with all the attendant disciplines of large project management. In addition, minor projects are “written-off” as the cost is incurred (i.e. they are not depreciated) with the consequential hit to the fixed cost revenue budget.

It is worth pointing out that what would normally be regarded as a revenue project may be regarded as capital simply due to the level of expense (and avoiding taking a major hit on the revenue budget!). In the capital project examples above “Replacement roof for bottling hall” clearly is aimed at restoring original functionality but is likely to be very high cost and would therefore be categorized as capital.

Some practical examples of revenue projects include:

- Replacement chains for a large conveyor system
- Effluent drain upgrade
- Replacement plate pack for a heat exchanger
- Repainting of packaging hall structural steelwork
- Upgrade of keg washer with re-designed nozzles
- Refrigeration compressor overhaul
- Introduction of trays to collect water under keg-washer for re-cycling
- Train whole workforce in the principles of waste minimization

**PROJECT JUSTIFICATION**

The basis on which a project is justified can vary widely but would generally come under one of the following headings (not ranked in importance):

1. Profit earning opportunity
2. Safety
3. Cost reduction
4. Capacity increase
5. Quality
6. Legal / environmental
7. Plant replacement
8. Strategic

**1. Profit earning opportunity**

Examples might include:

- Bottle packaging where only can and keg had existed before.
- New secondary packing machine for novel pack format.
- Plant to accommodate additional bottle / can size to enhance existing range.
- Equipment to facilitate special bottle / can formats and promotions.
- Plant and equipment to introduce new type of beer or carbonated soft drink.

**2. Safety**

Examples might include:

- Introduction of non-slip flooring in packaging line wet areas.
- Fitting of lifting beam above a heavy pump to facilitate safe removal for maintenance.
- Introduction of traffic / pedestrian segregating Armco barriers.
- Provision of carbon dioxide fixed and portable monitors.
- Fitting of reversing alarms to fork lift trucks.

**3. Cost reduction**

Examples might include:

- Cask / keg handling robot to replace manual handling.
- Plant and equipment to accommodate lighter weight bottles.
- Change from old multi-lane keg line to rotary filling technology.
- Ugrading of overhead lighting to digital technology.
- Plant to facilitate the recycling of waste water.

**4. Capacity increase**

Examples might include:

- Additional packaging line.
- Extra labeller to remove a bottle-neck.
- Quick-release “no tool” change parts to speed up small pack line changeovers.
- Additional filtration plant to facilitate increased throughput of bright beer.
- Expansion of warehouse.

**5. Quality**

Examples might include:

- Introduction of pressureless combining units for empty can handling.
- Upgrading of external keg / cask washer with modern nozzle technology.
- Improved empty bottle inspection (EBI) equipment.
- Improved keg flash pasteurizer control system.
- Introduction of returnable bottle (RB) re-coating technology to improve the appearance of scuffed bottles.

**6. Legal / environmental**

Examples might include:

- Upgraded fire alarm system to comply with regulatory requirement.
- Noise suppression equipment.
- Fitting of environmental emissions suppression equipment to meet permit conditions.
- Provision of bunds to contain potential chemical spills.
- Provision of chemical spill kits.

**7. Plant replacement**

Examples might include:

- New boiler(s) to replace aging units with increasing maintenance and operating costs.
- Worn out roadway.
- Rusting water storage tank.
- Scheduled replacement of fork lift trucks.
- Worn out keg turner.

**8. Strategic**

Examples might include:

- "Green field" packaging plant.
- Plant to introduce PET packaging.
- Introduction of water sprinkler system in finished goods warehouse to meet terms of insurance.
- Introduction of remote distribution depot.
- Investment in own lorry distribution fleet instead of using a contractor.

It will be realized that many of the above examples will have more than one justification. So whilst the primary justification for introducing improved empty bottle inspection (EBI) equipment might be quality, a reduction in glass and beer losses (cost saving) would be anticipated. Similarly most replacements would not be simply like-for-like but would provide an element of increased performance or reduced operating cost.

**INVESTMENT APPRAISAL TECHNIQUES**

Effective investment appraisal does not consider an investment in isolation. Instead, the organization should consider how the investment could contribute to its overall strategic objectives.

Some investments can offer strategic benefits for the business. For example, the organization might invest in extending its product range so that it can supply more of the products that its key customers want. An investment like this could help strengthen its brand and its relationship with customers.

Often, one of the key benefits of making an investment can be the skills the business learns and the future opportunities that may arise. For example, the organization might invest in developing and trialling a new product even if it doesn't expect to make any profits at that stage. If the trial is successful, the organization can use what it has learned to make a larger, more profitable investment in bringing the product into full-scale production.

On the other hand, making an investment can limit the organization's flexibility to respond to future changes. For example, the business would not want to invest heavily in new packaging equipment unless it was confident of the demand for its products. Timescales can also be an important strategic issue. For example, shareholders may prefer investments that are expected to produce a quick return.

At the most basic level a useful test for a possible investment is to consider the alternatives. For example, instead of buying a new item of packaging plant machinery the organization could:

- do nothing
- do the minimum necessary to maintain the existing plant
- achieve a similar outcome a different way, e.g. by outsourcing production
- invest in an alternative project instead

**Financial aspects of investment appraisal**

Different appraisal techniques are used to assess the effects an investment will have on an organization's cash flow. The expected return can be compared to the cost of funding and to the returns offered by other potential investments.

The assessment should consider all the financial consequences of an investment. For example, buying more expensive machinery might be worthwhile if it is more efficient and uses cheaper supplies.

As well as the financial impact, any indirect effects should be considered. Identifying these soft benefits is often as important as the financial evaluation and may help the decision-making process. Soft benefits could be:

- greater flexibility and quality of production
- faster time-to-market resulting in a bigger market share
- improved company image, better staff morale and job satisfaction, leading to greater productivity
- quicker decisions due to better availability of information

It is also important to evaluate these benefits in financial terms wherever possible. For example, a manufacturer of packaging machine parts could take a general benefit such as quality and break it down with estimated savings:

- Reduced reworking means less disruption to the production process, less manufacturing down-time and fewer design changes, resulting in an overall saving of 25 per cent.
- The current warranty and service costs of £10,000 per annum are likely to be halved.
- Quality assurance staff will be reduced by one as needs for inspections are lower.
- Better quality products will increase sales by 6 per cent and will also improve the company's current position of fourth among its competitors.

Four financial investment techniques will be considered:

1. Accounting rate of return
2. Payback period
3. Discounting future cash flow
4. Net present value and internal rate of return
5. Economic value added

**1. Accounting rate of return**

The accounting rate of return (ARR) is a way of comparing the expected profits from an investment to the cost of the investment.

The ARR is normally calculated as the average annual profit expected over the life of an investment project, compared with the average amount of capital invested. For example, if a project requires an average investment of £100,000 and is expected to produce an average annual profit of £15,000, the ARR would be 15 per cent.

The higher the ARR, the more attractive the investment is. The ARR can be compared to the organization's target rate of return, and to the ARR on other potential investments.

The ARR is widely used to provide a rough guide to how attractive an investment is. The main advantage is that it is easy to understand.

***Disadvantages***

Unlike other methods of investment appraisal, the ARR is based on profits rather than cash flow. So it is affected by subjective, non-cash items such as the rate of depreciation used to calculate profits.

The ARR also fails to take into account the timing of profits. In calculating ARR, a £100,000 profit five years away is given just as much weight as a £100,000 profit next year. In reality, the organization would prefer to get the profit sooner rather than later.

There are also several different formulas that can be used to calculate an ARR. If the ARR is used to compare different investments, the organization must be sure that it is calculating the ARR on a consistent basis.

**2. Payback period**

Payback period is a simple technique for assessing an investment by the length of time it would take to repay it. It is usually the default technique for smaller businesses and focuses on cash flow, not profit.

For example, if a project requiring an investment of £100,000 is expected to provide annual cash flow of £25,000, the payback period would be four years. Similar calculations can be used to work out the payback period for a project with uneven annual cash flows.

Payback period is a widely used method of assessing an investment. It is easy to calculate and easy to understand. By focusing on projects which offer a quick payback, it helps the organization avoid giving too much weight to risky, long-term projections.

***Disadvantages***

Payback period ignores the value of any cash flows once the initial investment has been repaid. For example, two projects could both have a payback period of four years, but one might be expected to produce no further return after five years, while the other might continue generating cash indefinitely.

Although payback period focuses on relatively short-term cash flows, it fails to take into account the time-value of money. For example, a £100,000 investment that produced no cash flow until the fourth year - and then a payback of £100,000 - would have the same four-year payback period as an investment that produced an annual cash flow of £25,000. In reality, the first is likely to be a riskier and less attractive investment.

A more complex version of payback period can be calculated using discounted cash flows. This gives more weight to cash flows the organization expects to receive sooner.

**3. Discounting future cash flow**

As a rule, money now is better than money in the future. There are two key reasons:

- Money has a time value. If the organization has money now, it can use it - for example, by putting it on deposit. Conversely, if the organization wants money now but will only get it in the future, it would have to pay to borrow it.
- The further the organization looks ahead, the greater the risks are. If it expects an investment to return £1,000 in a year's time, it may well be right. If it is looking ten years into the future, things might well have changed.

Discounting cash flow takes these concerns into account. It applies a discount rate to work out the present-day equivalent of a future cash flow.

For example, suppose that £100 is expected to be received in one year's time, and a discount rate of 10 per cent is used. If £90.91 is put on deposit at 10 per cent for one year, at the end of the year the sum would be £100. In other words, the present value of that £100 can be calculated as £90.91.

Similar calculations can be used to work out the present value of cash flows expected to be received further into the future. For example, suppose that £100 is expected to be received in two years' time and, again, a discount rate of 10 per cent is used. If £82.64 is put on deposit at 10 per cent for two years, at the end of two years the sum would be £100. In other words, the present value of that £100 is £82.64.

Discounted cash flows can be used to assess a potential investment.

**4. Net present value and internal rate of return**

Discounting cash flow allows the organization to put cash flows received at different times on a comparable basis.

Discounting cash flow can be used to evaluate potential investments. There are two types of discounting methods of appraisal - the net present value (NPV) and internal rate of return (IRR).

The NPV calculates the present value of all cash flow associated with an investment i.e. the initial investment outflow and the future cash flow returns. The higher the NPV the better. For example, if an investment of £100,000 generates annual cash flow of £28,000 and a discount rate of 10 per cent is used, the NPV for five years of cash flow is £6,142. However, if the annual cash flow starts at £26,000 and goes up by £1,000 a year, giving the same total amount of cash over five years - £140,000 - the NPV, using a discount rate of 10 per cent, will be £5,422.

Alternatively, the discount rate that would give an investment an NPV of zero can be calculated. This is called the investment rate of return (IRR). The higher the IRR the better. The organization can compare the IRR to its own cost of capital, or the IRR on alternative projects.

The key advantage of NPV and IRR is that they take into account the time value of money – the fact that money expected sooner is worth more than money expected further in the future.

***Disadvantages***

NPV and IRR are sophisticated and relatively complicated ways of evaluating a potential investment. Most spreadsheet packages include functions that can calculate these.

Choosing the right discount rate to use to calculate NPV is difficult. The discount rate needs to take into account the riskiness of an investment project and should at least match the cost of capital.

**5. Economic value added**

In a number of countries the concept of Economic Value Added or Economic Profit is used as another tool for assessing capital investment. Economic Value Added or EVA (a registered trademark of Stern Stewart & Co and of EVA Dimensions LLC) is an estimate of a firm's economic profit – the value created in excess of the required return of the company's investors (being shareholders and debt holders).

EVA is the profit earned by the firm less the cost of financing the firm's capital or more precisely, EVA is the net operating profits after taxes generated in the business less a capital charge, the latter being the product of the cost of capital and the economic capital.

The principle is that value is created when the return on the firm's economic capital employed is greater than the cost of that capital. So in the context of capital investment, Economic Value Added will increase if the new capital invested earns more than the cost of the capital.

***Disadvantages:***

- EVA is more complex than the other methods described above and relies on adjustments to the Generally Accepted Accounting Principles (GAAP) to make the calculations.
- The calculations themselves are difficult and require a trade-off between accuracy and simplicity (and hence are not pursued in these notes).
- It can be difficult finding correct cost of equity.
- EVA is not suitable for all kinds of companies.

**Investment risk and sensitivity analysis**

- A realistic assessment of risks is essential in considering a range of different outcomes. In practice, the biggest risk for many investments is the disruption they can cause. For example, it can take longer than expected to implement new plant and equipment and train employees. The disruption can also lead to a loss of business.
- The underlying assumptions need to be tested for clarity and reliability.
- If the organization is making a significant investment, it can be worth assessing the expected return using a range of different assumptions.
- Appraising an investment from several different angles (i.e. a rounded appraisal) can be the most effective way of deciding whether it is worth pursuing.
- Techniques like payback period can be used as an initial screen: if an investment doesn't meet the organization's payback target, it can be eliminated.
- If a project passes this first test, more complex calculations such as net present value can then be used.
- Crucially, non-financial factors should be considered in assessing how the investment fits with the organization's overall strategy.

**Non-financial factors for investment appraisal**

Although the financial case for making an investment is a vital part of the decision-making process, non-financial factors can also be important.

Key non-financial factors may include:

- meeting the requirements of current and future legislation
- matching industry standards and good practice
- improving staff morale, making it easier to recruit and retain employees
- improving relationships with suppliers and customers
- improving the organization's business reputation and relationships with the local community
- developing the capabilities of the business, such as building skills and experience in new areas or strengthening management systems
- anticipating and dealing with future threats, such as protecting intellectual property against potential competition

For example, the environmental impact of a potential investment might need to be taken into account. To some extent, this may be reflected in financial factors, e.g. the energy savings offered by new machinery. However, other effects - such as the effect on the organization's reputation - will also be important.

**Weighting non-financial factors**

In some cases, non-financial criteria may be essential requirements. For example, the organization would not invest in new machinery that breaks health and safety regulations.

In other cases, the organization may need to balance financial and non-financial factors. It will need to decide how important each factor is to its business. An appraisal like this can take into account how well the investment fits with the overall business strategy.

**PROJECT LIFE CYCLE**

**KEY STAGES OF THE PROJECT LIFE CYCLE**

Figure 8 shows in detail the key stages and broad phases of a capital project.

| KEY STAGE | BROAD PHASES |
|---|---|
| 1. Project conception | Conception |
| 1a. Feasibility study | |
| 1b. Include in Business Plan | |
| 2. User brief | Budget preparation |
| 3. Design (pre-contract) | |
| 3a. Specification including commercial requirements | |
| 3b. Safety and regulatory requirements | |
| 3c. Project management requirements:<br>Civil<br>Process<br>Electrical<br>Mechanical<br>Process control<br>Instrumentation | |
| 3d. Preliminary approval | |
| 4. Selection of potential vendors | |
| 5. Tender invitation | |
| 6. Budget preparation | |
| 6a. Full approval | Approval |
| 7. Negotiation /selection of vendor(s) | Pre-contract and order |
| 8. Pre-contract meeting | |
| 8a. Contractor safety induction | |
| 9. Order | |
| 10. Detailed design | Design and build off-site |
| 10a. Write functional design specification (FDS) | |
| 10b. Civils design | |
| 10c. Mechanical services | |
| 10d. Electrical Services | |
| 10e. Safety studies e.g. HAZOP | |
| 10f. Operating manual and spares requirements | |
| 11. Manufacture plant | |
| 12. Test plant (at factory) | |
| 13. Build and erect on site | Site installation and testing |
| 14. Pre-commission and testing | Project acceptance |
| 14a. Training and final safety assessment | |
| 15. Takeover | |
| 16. Commission | |
| 17. Performance test | |
| 18. Acceptance / handover | |
| 19. Project close | |
| 19a. Contract closure | |
| 20. Post-completion review | Post completion |
| 20a. Contractor safety appraisal | |

**Figure 8: Key stages and broad phases of a capital project**

It should be noted that for smaller capital projects or most revenue projects the stages may well be shortened or amalgamated.

**ROLES AND RESPONSIBILITIES**

Figure 9 shows the roles and responsibilities of individuals and groups at each stage of the project. Again, with smaller capital projects and revenue projects, the roles may be combined with one individual taking responsibility for several.

| KEY STAGE | ROLES AND RESPONSIBILITIES OF INDIVIDUALS AND GROUPS |
|---|---|
| 1. Project conception | End user / project sponsor (could be team leader, team, R & D, dept manager), with help as required from engineering, finance, marketing etc documents basic outline with project justification, cost and timescale. |
| 1a. Feasibility study | Project sponsor, engineering and finance arrange feasibility study if necessary with funding from a "preliminary investigation" budget (later capitalized if the project proceeds). |
| 1b. Include in Business Plan | Team leader, dept manager, engineering, finance. |
| 2. User brief | User / project sponsor produces detailed requirements including business rationale, scope, objectives, success criteria, risks, constraints, assumptions, quality and safety requirements (template often used).<br>User brief with financial analysis form basis of project appraisal request (PAR) – see 3d. |
| 3. Design (pre-contract) | Engineering in consultation with end user / project sponsor for agreement and approval. |
| 3a. Specification including commercial requirements | Engineering / purchasing dept draw up detailed specification. |
| 3b. Safety and regulatory Requirements | End user and engineering specify safety and regulatory requirements. |
| 3c. Project management requirements:<br>Civil<br>Process<br>Electrical<br>Mechanical<br>Process control<br>Instrumentation | Engineering specifies project management skills and allocates internal / external resources. This may include an overall project manager as well as separate project management technical and non-technical disciplines. |
| 3d. Preliminary approval | Project appraisal request (PAR) placed before authorizing body e.g. board of directors. Often presented by project sponsor. |
| 4. Selection of potential vendors | Engineering, purchasing in consultation with end user. |
| 5. Tender invitation | Engineering and purchasing produce a tender invitation document with full project scope requirements and commercial terms and conditions together with a firm date by which tenders are to be submitted. |
| 6. Budget preparation | Engineering and finance produce detailed budget with calendarized cash flow. |
| 6a. Full approval | Approval is normally carried out by the board of directors for large projects or the site senior manager(s) for smaller projects. The project sponsor would generally present the project appraisal request (PAR) with the success criteria including the financial assessment. The project sponsor may well be supported by appropriate specialists, finance etc. |
| 7. Negotiation /selection of vendor(s) | Engineering and purchasing negotiate potential terms of exact scope and supply. Often much of the negotiation will be around cost. |

| | |
|---|---|
| 8. Pre-contract meeting | Project manager, end user and vendor(s) agree ways of working including progress meetings and minutes, change control, day-to-day communications, site procedures, safety requirements, domestic arrangements etc. The ways of working generally follow a Quality Plan specifically designed to ensure |
| 8a. Contractor safety induction | Project manager, end user, vendor(s) / contractors agree safety requirements (including the operation of work permits, the monitoring and reporting of accidents etc) and appoint safety officials for the duration of the project. The specific requirements of any regulations are put in place e.g. the Construction Design and Management (CDM) regulations in the UK and the equivalent in other countries where applicable. |
| 9. Order | Purchasing place the official order / sign contract once all the precise terms are agreed. |
| 10. Detailed design | Vendor and engineering with appropriate meetings and reviews with end user. |
| 10a. Write functional design specification (FDS) | Vendor, engineering with appropriate meetings and reviews with end user specify requirements for any computer based system(s). |
| 10b. Civils design | Vendor, engineering (often with a quantity surveyor) with appropriate meetings and reviews with end user produce the civil design. |
| 10c. Mechanical services | Vendor, engineering with appropriate meetings and reviews with end user specify mechanical requirements (including adherence to any company standards in addition to national). |
| 10d. Electrical Services | Vendor, engineering with appropriate meetings and reviews with end user specify electrical requirements (including adherence to any company standards in addition to national). |
| 10e. Safety studies e.g. HAZOP | Vendor, engineering, end user arrange appropriate safety assessments based on the detailed design. Representatives at the meetings should include the actual plant operators and technicians. |
| 10f. Operating manual and spares requirements | Vendor, engineering, end user agree requirements. Provisional operating manuals and drawings (generally in electronic format) often arranged for building and commissioning. |
| 11. Manufacture plant | Vendor, engineering and project manager monitor manufacture with appropriate review meetings. Visits from end user team(s) during manufacturing of plant are to be encouraged. Opportunity for early end user operator and technician training. |
| 12. Test plant (at factory) | Vendor, engineering, project manager and end user team(s). Further opportunity for early operator and technician training. |
| 13. Build and erect on site | Vendor, project manager, all necessary engineering disciplines, site utility engineers, end user team(s). The site build is an important stage in training. There may be separate safety and quality assurance roles to ensure site procedures and standards are met. |
| 14. Pre-commission and testing | Vendor, project manager, engineering disciplines, end user teams, supporting services. |
| 14a. Training and final safety assessment | Vendor, project manager, engineering, end user teams plus any separate safety representative. |
| 15. Takeover | Vendor, project manager, engineering, end user. Takeover can be interpreted as having beneficial use of the plant i.e. producing goods or services leading to sales. At this point the site team(s) take responsibility for operating and maintaining the plant i.e. take ownership. |

| | |
|---|---|
| 16. Commission | Vendor, project manager, engineering, end user and all operational supporting and interfacing functions e.g. raw materials to be available for production. Production started and (probably) ramped up gradually. |
| 17. Performance test | Vendor, project manager, engineering and end user teams test the plant against strict performance criteria e.g. speed, different pack types and sizes, changeovers, start-up, shut-down, cleaning cycles, quality, safety etc. Generally a stage payment will depend on the success or failure of these tests. |
| 18. Acceptance / handover | Vendor, project manager, engineering and end user. The end user agrees that the plant meets its performance criteria and that vendor site support can be wound down and move to remote support. Also agreement that training requirements and documentation (training manuals, as-built drawings are in place – often electronic). |
| 19. Project close | Vendor, project manager, engineering and end user. Finalization of all activities to formally close the project. |
| 19a. Contract closure | Vendor, project manager and purchasing. Complete and settle each contract (including the resolution of any open items) and close each contract applicable to the project or project phase. |
| 20. Post-completion review | Project sponsor / end user, engineering, finance. Usually in the form of a meeting to review all important aspects of the project –<br>- Were the success criteria met?<br>- What went well and what went badly?<br>- What are the lessons for future projects? |
| 20a. Contractor safety appraisal | End user, project manager, engineering, vendor(s) / contractors. Usually in the form of a meeting to review all safety aspects of the project to learn important lessons for future projects. |

**Figure 9: Project roles and responsibilities of individuals and groups**

**CONTROL OF TIME AND COST**

**Tools and techniques for controlling time and cost**

Like any human undertaking, projects need to be performed and delivered under certain constraints. Traditionally, these constraints have been listed as "scope," "time," and "cost". These are also referred to as the "project management triangle", where each side represents a constraint (see Figure 10 below). One side of the triangle cannot be changed without affecting the others. A further refinement of the constraints separates product "quality" or "performance" from scope and turns quality into a fourth constraint.

The time constraint refers to the amount of time available to complete a project. The cost constraint refers to the budgeted amount available for the project. The scope constraint refers to what must be done to meet the project's success criteria. These three constraints are often competing constraints: increased scope typically means increased time and increased cost, a tight time constraint could mean increased costs and reduced scope, and a tight budget could mean increased time and reduced scope.

The discipline of project management is about providing the tools and techniques that enable the project team (not just the project manager) to organize their work to meet these constraints.

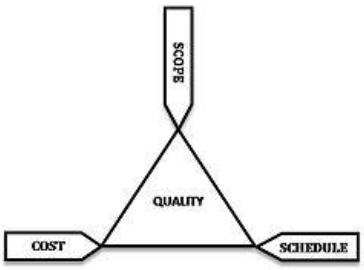


**Figure 10: The project management triangle**

**a) TIME**

Two basic techniques for controlling time will be considered:

1. Gantt Chart
2. Programme Evaluation and Review (PERT)

***1) Gantt Chart***

A Gantt chart is a type of bar chart developed by Henry Gantt (1861 – 1919) that illustrates a project schedule. Gantt charts illustrate the start and finish dates of the terminal elements and summary elements of a project. Terminal elements and summary elements comprise the work breakdown structure of the project. Some Gantt charts also show the dependency (i.e. precedence network) relationships between activities. Gantt charts can be used to show current schedule status using percent-complete shadings and a vertical "TODAY" line as shown in Figure 11.

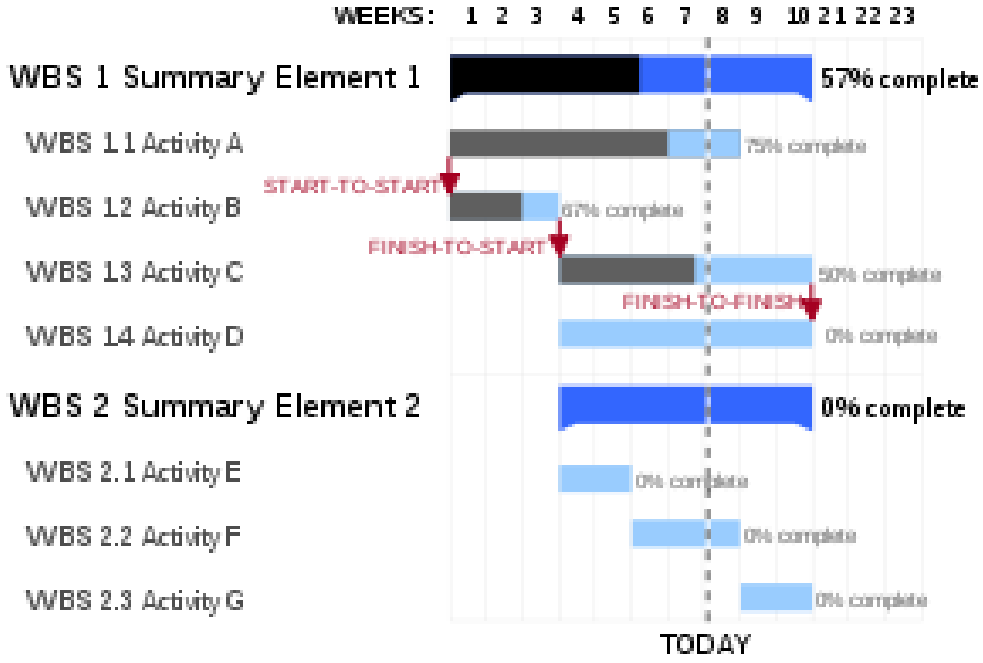


**Figure 11: Simple Gantt Chart**

In the 1980s, personal computers allowed for widespread creation of complex and elaborate Gantt charts. The first desktop applications were intended mainly for project managers and project schedulers. With the advent of the Internet and increased collaboration over networks at the end of the 1990s, Gantt charts became a common feature of web-based applications, including collaborative groupware.

In the following simple example (Figure 12) there are seven tasks, labelled A to G. Some tasks can be done concurrently (A and B) while others cannot be done until their predecessor task is complete (C cannot begin until A is complete).

| ID | Task Name | Duration | Start | Finish | Predecessors |
|---|---|---|---|---|---|
| 1 | Start | 0 days | Mon 23/04/12 | Mon 23/04/12 | |
| 2 | A | 4 days | Mon 23/04/12 | Thu 26/04/12 | 1 |
| 3 | B | 7 days | Mon 23/04/12 | Tue 01/05/12 | 1 |
| 4 | C | 4.5 days | Fri 27/04/12 | Thu 03/05/12 | 2 |
| 5 | D | 6 days | Fri 27/04/12 | Fri 04/05/12 | 2 |
| 6 | E | 5 days | Thu 03/05/12 | Thu 10/05/12 | 3,4 |
| 7 | F | 8 days | Mon 07/05/12 | Wed 16/05/12 | 5 |
| 8 | G | 3 days | Thu 10/05/12 | Tue 15/05/12 | 6 |
| 9 | Finish | 0 days | Wed 16/05/12 | Wed 16/05/12 | 7,8 |

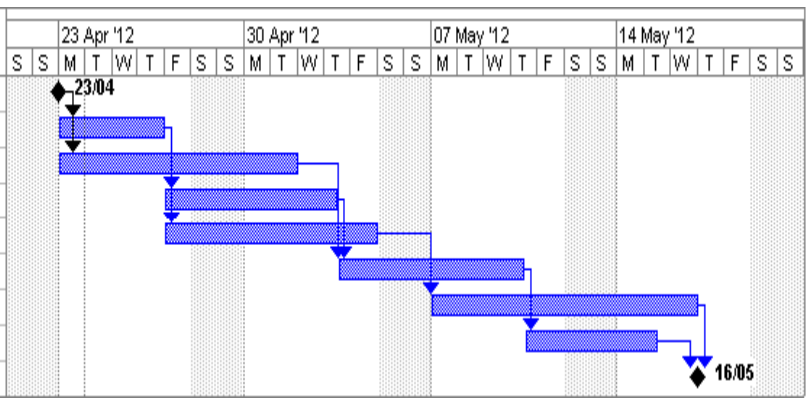


**Figure 12: Gantt chart example** (created using Microsoft Project)

In the example, Saturday and Sunday are not work days and are thus excluded from the schedule. It follows that some bars on the Gantt chart will be longer if they cut through a weekend (e.g. all tasks except A).

***Advantages and disadvantages of Gantt:***

***Advantages:***

- Gantt charts have become a common technique for representing the phases and activities of a project work breakdown structure (WBS) so they can be understood by a wide audience all over the world.
- Microsoft Project and similar software makes the creation of Gantt charts very simple. Integral tools for appending notes to tasks, assigning resources, tracking (in many forms and formats) and reporting (in many forms and formats) facilitate effective management and communications.
- Gantt charts are probably the most commonly used technique for controlling a project programme.

***Disadvantages:***

- Although a Gantt chart is useful and valuable for small projects that fit on a single sheet or screen, they can become quite unwieldy for projects with more than about 30 activities. Larger Gantt charts may not be suitable for most computer displays. A related criticism is that Gantt charts communicate relatively little information per unit area of display. That is, projects are often considerably more complex than can be communicated effectively with a Gantt chart.
- Gantt charts only represent part of the triple constraints (cost, time and scope) of projects, because they focus primarily on schedule management. Moreover, Gantt charts do not represent the size of a project or the relative size of work elements, therefore the magnitude of a behind-schedule condition is easily mis-communicated. If two projects are the same number of days behind schedule, the larger project has a larger impact on resource utilization, yet the Gantt does not represent this difference.
- Although project management software can show schedule dependencies as lines between activities, displaying a large number of dependencies may result in a cluttered or unreadable chart.
- Because the horizontal bars of a Gantt chart have a fixed height, they can misrepresent the time-phased workload (resource requirements) of a project, which may cause confusion especially in large projects. Activities can appear to be the same size, but in reality they may be different orders of magnitude. A related criticism is that all activities of a Gantt chart show planned workload as constant. In practice, many activities (especially summary elements) have front-loaded or back-loaded work plans, so a Gantt chart with percent-complete shading may actually mis-communicate the true schedule performance status.

***2) Programme Evaluation and Review (PERT)***

The Programme (or Project) Evaluation and Review Technique, commonly abbreviated PERT, is a statistical tool, used in project management, that is designed to analyze and represent the tasks involved in completing a given project.

Through an electronic computer, the PERT technique processes data representing the major, finite accomplishments (events) essential to achieve end-objectives, the inter-dependence of those events, and estimates of time and range of time necessary to complete each activity between two successive events. Such time expectations include estimates of "most likely time", "optimistic time", and "pessimistic time" for each activity. The technique is a management control tool that sizes up the outlook for meeting objectives on time; highlights danger signals requiring management decisions; reveals and defines both criticality and slack in the flow plan or the network of sequential activities that must be performed to meet objectives; compares current expectations with scheduled completion dates and computes the probability for meeting scheduled dates; and simulates the effects of options for decision - before decision.

PERT was developed primarily to simplify the planning and scheduling of large and complex projects. It was developed for the U.S. Navy Special Projects Office in 1957 to support the U.S. Navy's Polaris nuclear submarine project. It was able to incorporate uncertainty by making it possible to schedule a project while not knowing precisely the details and durations of all the activities. It is more of an event-oriented technique rather than start- and completion-oriented, and is used more in projects where time, rather than cost, is the major factor.

***PERT conventions:***

- A PERT chart is a tool that facilitates decision making. The first draft of a PERT chart will number its events sequentially in 10s (10, 20, 30, etc.) to allow the later insertion of additional events.
- Two consecutive events in a PERT chart are linked by activities, which are conventionally represented as arrows (see Figure 13 below).
- The events are presented in a logical sequence and no activity can commence until its immediately preceding event is completed.
- The planner decides which milestones should be PERT events and also decides their “proper” sequence.
- A PERT chart may have multiple pages with many sub-tasks.

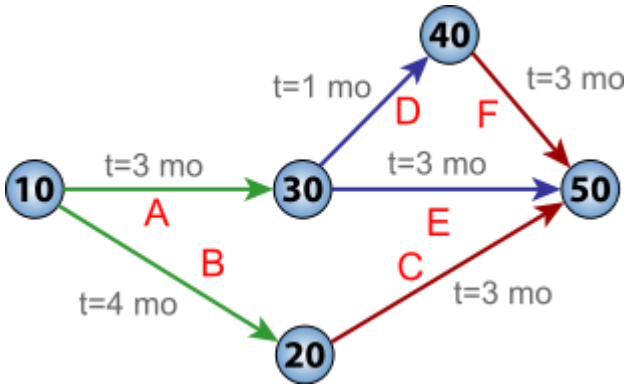


**Figure 13: PERT network chart for a seven-month project with five milestones (10 through 50) and six activities (A through F).**

***PERT terminology:***

- *PERT event*: a point that marks the start or completion of one or more activities. It consumes no time and uses no resources. When it marks the completion of one or more tasks, it is not "reached" (does not occur) until *all* of the activities leading to that event have been completed.
- *predecessor event*: an event that immediately precedes some other event without any other events intervening. An event can have multiple predecessor events and can be the predecessor of multiple events.
- *successor event*: an event that immediately follows some other event without any other intervening events. An event can have multiple successor events and can be the successor of multiple events.
- *PERT activity*: the actual performance of a task which consumes time and requires resources (such as labour, materials, space, machinery). It can be understood as representing the time, effort, and resources required to move from one event to another. A PERT activity cannot be performed until the predecessor event has occurred.
- *optimistic time* (O): the minimum possible time required to accomplish a task, assuming everything proceeds better than is normally expected
- *pessimistic time* (P): the maximum possible time required to accomplish a task, assuming everything goes wrong (but excluding major catastrophes).
- *most likely time* (M): the best estimate of the time required to accomplish a task, assuming everything proceeds as normal.
- *expected time* ($T_E$): the best estimate of the time required to accomplish a task, accounting for the fact that things don't always proceed as normal (the implication being that the expected time is the average time the task would require if the task were repeated on a number of occasions over an extended period of time).
  $T_E = (O + 4M + P) \div 6$
- *float or slack* is a measure of the excess time and resources available to complete a task. It is the amount of time that a project task can be delayed without causing a delay in any subsequent tasks (*free float*) or the whole project (*total float*). Positive slack would indicate *ahead of schedule*; negative slack would indicate *behind schedule*; and zero slack would indicate *on schedule*.
- *critical path*: the longest possible continuous pathway taken from the initial event to the terminal event. It determines the total calendar time required for the project; and, therefore, any time delays along the critical path will delay the reaching of the terminal event by at least the same amount.
- *critical activity*: An activity that has total float equal to zero. An activity with zero float is not necessarily on the critical path since its path may not be the longest.
- *Lead time*: the time by which a *predecessor event* must be completed in order to allow sufficient time for the activities that must elapse before a specific PERT event reaches completion.
- *lag time*: the earliest time by which a *successor event* can follow a specific PERT event.
- *fast tracking*: performing more critical activities in parallel
- *crashing critical path*: Shortening duration of critical activities

***Advantages and disadvantages of PERT:***

***Advantages:***

- A PERT chart explicitly defines and makes visible dependencies (precedence relationships) between the work breakdown structure (WBS) elements.
- PERT facilitates identification of the critical path and makes this visible.
- PERT facilitates identification of early start, late start, and slack for each activity.
- PERT provides for potentially reduced project duration due to better understanding of dependencies leading to improved overlapping of activities and tasks where feasible.
- A large amount of project data can be organized & presented in a diagram for use in decision making.

***Disadvantages:***

- There can be potentially hundreds or thousands of activities and individual dependency relationships.
- PERT is not easily scalable for smaller projects.
- The network charts tend to be large and unwieldy requiring several pages to print and requiring special size paper.
- The lack of a timeframe on most PERT charts makes it harder to show status although colours can help (e.g. specific colour for completed nodes).
- When the PERT charts become unwieldy, they are no longer used to manage the project.

**Critical path**

The concept of critical path is very important in terms of project management. The critical path is the longest necessary path through a network of activities when respecting their interdependencies. So it is the longest sequence of activities in a project plan which must be completed on time for the project to complete on the due date. An activity on the critical path cannot be started until its predecessor activity is complete; if it is delayed for a day, the entire project will be delayed for a day unless an activity following the delayed activity is completed a day earlier.

The earlier example of the Gantt chart is reproduced here as Figure 14 below where the critical path is in shown in red.

| ID | Task Name | Duration | Start | Finish | Predecessors |
|---|---|---|---|---|---|
| 1 | Start | 0 days | Mon 23/04/12 | Mon 23/04/12 | |
| 2 | A | 4 days | Mon 23/04/12 | Thu 26/04/12 | 1 |
| 3 | B | 7 days | Mon 23/04/12 | Tue 01/05/12 | 1 |
| 4 | C | 4.5 days | Fri 27/04/12 | Thu 03/05/12 | 2 |
| 5 | D | 6 days | Fri 27/04/12 | Fri 04/05/12 | 2 |
| 6 | E | 5 days | Thu 03/05/12 | Thu 10/05/12 | 3,4 |
| 7 | F | 8 days | Mon 07/05/12 | Wed 16/05/12 | 5 |
| 8 | G | 3 days | Thu 10/05/12 | Tue 15/05/12 | 6 |
| 9 | Finish | 0 days | Wed 16/05/12 | Wed 16/05/12 | 7,8 |

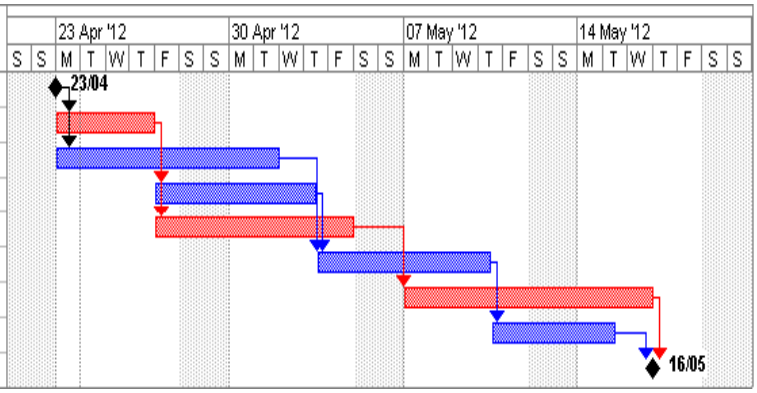


**Figure 14: Gantt chart example showing the critical path in red** (created using Microsoft Project)

The critical path is a concept which applies to all projects and therefore to all techniques to manage project programmes. "Crashing the critical path" is a phrase which is common parlance for shortening the duration of critical activities.

**Delaying events and recovery strategies**

Despite the best efforts of project managers, from time to time projects will suffer from delays and it will be important, wherever possible, to get back on track.

Delays can arise from multiple causes – examples include:

- Inclement weather
- Late supply of plant, equipment, building materials etc
- Absence or accidents
- Software problems
- Late connection of utilities
- Change of project scope
- Delays imposed by regulating authorities
- Insufficient time being allowed in the original plan for one or more tasks
- Waiting for key information

Various step by step approaches to recovery are available with most following the basic problem solving techniques outlined in Section 2.2.2.2. Here is one of those (Straker, 1995):

- Identify problem
- Define problem
- Identify cause
- Identify solution
- Implement
- Review
- Follow-up

A simple 5 step approach is shown in Figure 15.

| | |
|---|---|
| Step 1 | Identify and define the problem |
| Step 2 | Identify the cause |
| Step 3 | Identify potential solutions |
| Step 4 | Negotiate solution |
| Step 5 | Execute recovery plan |

**Figure 15: 5 Step Project Recovery Plan**

Initially, of course, it is vitally important to realize that a problem exists and to admit it! It is often the case where humans interact that individuals can be defensive and even in denial. This can be referred to Step 0.

The project recovery plan will inevitably be different from the original project plan. Time has been lost and cost incurred so the proposed solution will require negotiating and approving. Unless the delay is to be accepted, one or more deliverables will need to change. Additional overtime working will increase the cost. Similarly, requiring a supplier to make a change to the design of plant or equipment will almost certainly incur additional cost. Time may perhaps be recovered by pragmatically adopting a non-critical change in project scope. For example, it may be possible to complete some of the cosmetic finishes once the plant has been taken over and beneficial use achieved.

In addition to re-authorizing any significant change, it is important that the project leadership is strong and that morale is maintained. Projects can become dogged with problems if a clear and robust recovery procedure is not in place. Addressing the root causes of problems in a timely fashion should ensure the on-going smooth running of the project. However, the project team should be aware of:

- Old problems re-surfacing
- Repeated behavioural issues
- Root causes not being truly addressed
- Un-fixable problems e.g. troublesome technology or software
- Problem stigma tainting the project team
- Managers over-reaction to problems
- Management imposition of simplistic solutions

**b) COST**

Control of cost can be achieved in a variety of ways. Whilst not an exhaustive list, the following areas will be considered:

1. Project budgeting
2. Financial performance monitoring and reporting
3. Control of project variations
4. Contractual terms
5. Incentives
6. Use of cost contingency
7. Use of specialist Quantity Surveyors

***1) Project budgeting***

One of the most important factors in achieving good financial control is to produce a detailed, sectionalized and calendarized budget for the project. It is easier to monitor and manage discrete areas of expenditure both in terms of the actual expenditure and cash flow.

For large projects there may well be stage payments to be made – possibly very large. These will generally be contractually linked to achieving a particular milestone (stage of build or achieving a certain output etc).

***2) Financial performance monitoring and reporting***

One of the project management key tasks is to monitor and report financial performance. This is usually achieved using a computerized system which automatically updates and generates appropriate reports. The frequency of reporting will depend on the differing needs of the various interested parties. The project manager will undoubtedly monitor expenditure against budget on a perpetual basis. Reports may be produced for specific daily, weekly or monthly project management meetings as required.

In addition, project financial performance reports will be produced for the end user's finance department and amalgamated into a capital report for senior company management and the board of directors. The headings for such a capital report are shown as an example in Figure 16.

| **Capital Report £'000 (Period ending 31st July 2011)** | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **Total Project Forecast** | | | **Current Year Status** | | | | | **Project Status to Date** | | |
| **Project Title** | **PAR No.** | **PAR Value** | **To Complete** | **Vari-Ance B(W)** | **Budget** | **Comm-itted** | **Spend** | **F'cast** | **Vari-Ance B(W)** | **% Comm-itted** | **Total Comm-itted** | **Total Spend** |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |

**Figure 16: Example of period capital report**

It will be noted from Figure 16 that individual project financial performance is generally reported in terms of a variance against budget – the principles of variance reporting were explained in Section 2.2.3.2. This is done for each section of the project budget as well as the rolled-up total figure.

***3) Control of project variations***

The subject of controlling project variations will be covered a little later. Clearly from a project cost point of view, variations which increase cost are unwelcome and may lead to an overspend of the overall project budget.

***4) Contractual terms***

The supplier contract or contracts will be subject to negotiated and agreed Terms and Conditions (T's & C's). These will, amongst many other things, cover payment terms (30 days, 60 days etc) for routine supplies but also include stage payments against agreed project milestones for larger works (buildings, major items of plant etc). All these payments can, of course, be forecast and built into the project calendarized cash flow.

Contracts for building new lines or introducing new items of plant and equipment (or even overhauling existing items) may well include terms requiring the supplier to continue their site presence for training personnel in the operation of the line and maintenance. There may be very specific requirements for contractual performance trials and ramp-up periods with a reducing supplier support presence as the team(s) become more confident and performance reaches the design level.

***5) Incentives and penalties***

For larger projects, especially civil works it has become common to incentivize the supplier to beat the target programme whilst, of course, maintaining project quality and safety performance. Clearly it can be in the project sponsor / end user's interest to have the new facility to supply goods or services available earlier than originally forecast. This can, in turn, lead to additional profit for the organization which can "fund" the incentive.

Equally large contracts can include penalties in the form of penalty clauses leading to financial redress, often in the form of liquidated damages.

Liquidated damages (also referred to as liquidated and ascertained damages) are damages whose amount the parties designate during the formation of a contract for the injured party to collect as compensation upon a specific breach (e.g., late performance).
When damages are not predetermined / assessed in advance, then the amount recoverable is said to be 'at large' (to be agreed or determined by a court or tribunal in the event of breach).

At common law, a liquidated damages clause will not be enforced if its purpose is to punish the wrongdoer/party in breach rather than to compensate the injured party (in which case it is referred to as a penal or penalty clause). One reason for this is

that the enforcement of the term would, in effect, require an equitable order of specific performance. However, courts sitting in equity will seek to achieve a fair result and will not enforce a term that will lead to the unjust enrichment of the enforcing party.

In order for a liquidated damages clause to be upheld, two conditions must be met.

- First, the amount of the damages identified must roughly approximate the damages likely to fall upon the party seeking the benefit of the term.
- Second, the damages must be sufficiently uncertain at the time the contract is made that such a clause will likely save both parties the future difficulty of estimating damages.

***6) Use of cost contingency***

The use of a budget contingency is highly contentious in terms of modern project management. This historical device was considered a pragmatic solution to cover scope creep, unavoidable variations etc. The major criticism is that contingencies often get spent simply because they are there and the project management team come under intense pressure to "please" their customer by exceeding to minor changes.

In more modern terms contingencies are often considered a soft option and a result of:

- poor planning
- lack of a detailed assessment of the project scope
- insufficient time for the compilation of a detailed budget
- the fear and implications of a project overspend
- previous poor financial project management

It may be argued that for fast track projects where there is a very short time available for the budget preparation stage that a contingency is appropriate (say 5 or even 10%). An example might be the purchase an installation of a new end of line packing machine for a marketing department promotion on a fixed date in the near future.

***7) Use of specialist Quantity Surveyors***

A quantity surveyor (QS) is a professional working (generally but not always) within the construction industry concerned with building costs. Hence quantity surveyors are often employed when a project involves significant building or other civil works.
Although all QSs will have followed a similar course of education and training, there are many areas of specialization in which a QS may concentrate. The main distinction amongst QSs is between those who carry out work on behalf of a client organization, often known as a "professional quantity surveyor", and those who work for construction companies, often known as a "main contractor's quantity surveyor".

For the client organization the QS usually reports to Project Manager and provides advice in the decision-making process throughout the management of a project from initial inception to final completion. The QS handles estimating and cost control, the tendering process and, after contract award, the commercial interface. QSs should be able to carry out estimating and measurement of construction works prior to tender, producing the bill of quantities; produce tender documentation and manage the tender process; clarify and evaluate tenders; and manage the resultant contract through monthly valuations, variations control, contract administration and assessment of claims.

The QS's traditional independent role on the team comprising client, architect, engineers and contractor has given him a reputation and appreciation for fairness. This, combined with his expertise in drafting and interpretation of contract documents, enables him to settle issues, value the works fairly and regularly, project final costs, avoid disputes and ensure the effective progress of a project.

QS control construction costs by accurate measurement of the work required on a regular basis, the application of expert knowledge of costs and prices of work, labour, materials and plant required, an understanding of the implications of design decisions at an early stage to ensure that good value is obtained for the money to be expended.

The technique of measuring quantities from drawings, sketches and specifications prepared by designers, principally architects and engineers, in order to prepare tender/contract documents, is known in the industry as taking off. The quantities of work taken off typically are used to prepare bills of quantities (BoQ), which usually are prepared in accordance with a published Standard Method of Measurement(SMM) as agreed to by the QS profession and representatives of the construction industry. This activity is usually completed before the commencement of work on site on a traditional (BoQ) project, the Contractor will then price this document in competitive tender and be paid according to a measure undertaken on site and applied to each specific work item.

Those QSs who emphasize the cost discipline often use the term "Construction Cost Consultant". They ensure that projects are designed and constructed in such a manner as to secure value for money, cost certainty and programme dates.

A contractor's QS is responsible for the performance of operations that mirror those of the owner's QS; i.e., the measurement and pricing of construction work, but specifically that actually performed by the contractor (and the contractor's subcontractors) as opposed to the construction work described and measured in the construction contract between the owner and the contractor. Such a difference in quantity of work may arise from changes required by an owner, or by an architect or engineer on an owner's behalf. Typically, the settlement of a change (often referred to in a contract as a 'variation').

**Project variation initiated by the customer or supplier**

A project variation can come in a number of forms via a request to:

- expand or reduce the project scope
- modify a policy, procedure, plan or process
- modify expenditure
- modify the programme

Variations can be initiated by:

- the customer / end user
- the supplier / contractor

Project variations can be categorized in two ways:

1. Design or construction changes affecting existing contracts.
2. Oversights or internal changes which do not affect existing contracts.

It is imperative that both of these categories of variation are properly controlled i.e. there is a formal change control procedure.

**Control of project variations**

For effective control of variations it is vital that the following procedures or processes are in place within the project ways of working:

a) Communicating a potential variation to the project manager.
b) Scoping, pricing and processing variations.
c) Authorizing the implementation of any variation before commencement of work.
d) Incorporating variations into project budgets and forecasts.

***Change procedure (example)***

- A project variation is brought to the attention of the project manager who decides whether the variation is valid (there must be strict rules to avoid spurious variations or “nice to have” end user requests). If in agreement, the project manager raises a ***change alert*** which is a notification of a proposed project variation. A ***change alert*** identifies all engineering / design related modifications including design errors, oversights, end user initiated changes in scope, changes by suppliers / contractors and third parties (e.g. regulatory changes).

- The project manager then arranges for a ***change notice*** to be prepared. A ***change notice*** is a notification to the end user / customer of a scope variation including estimated cost and programme impacts. The ***change notice*** is sent to the end user / customer for preliminary authorization to proceed with the change.

- If the ***change notice*** is approved, the project manager arranges for a ***change order*** to be prepared for authorization. A ***change order*** is a detailed proposal to the end user / customer for a scope variation. The ***change order*** includes detailed costs and programme changes which, once approved by the end user / customer, are formally incorporated into the appropriate contracts. Supplier contracts will allow for valid variations but under strict terms.

- The project manager is responsible for updating the budget and programme with any changes and ensuring that the changes are communicated to all interested parties.

- The project manager assigns a unique number to the change (at the ***change alert*** stage) and maintains a ***change register*** to ensure all changes can be tracked.