

### 3. How to handle inflation

If it is assumed that all the items of cost in the programme will inflate at the same rate and that this will be the same rate as inflation in general, there are two equivalent choices:

- inflate all future costs by this predicted inflation rate and then use a larger discount rate that allows for the effect of general inflation (the inflation adjusted discount rate\*); or
- do not inflate any future costs (i.e. use constant dollars) and use a smaller discount rate that does not allow for inflation (the real discount rate). (All the announced rates, and the rates recommended by analysts, are real rates.)

Method (b) is the simpler and preferred approach.

If it is assumed that different items of cost in the programme will inflate at different rates, there are also two equivalent choices:

- inflate all future costs by their particular predicted inflation rates and then use a larger discount rate that allows for the effect of general inflation (the inflation adjusted discount rate\*); or
- do not inflate any future costs (i.e. use constant dollars) and use a smaller discount rate that does not allow for inflation (the real discount rate), but adjust the discount rate for each item to account for the differential inflation rate between this item and the 'general' rate of inflation, e.g. if general inflation is 8 per cent, this item is expected to inflate 10 per cent, and the real  $r$  is equal to 4 per cent, then  $r$  adjusted for this item is

$$r = 1.04 \times \frac{1.08}{1.10} = 1.021, \text{ i.e. } 2.1 \text{ per cent}$$

Method (b) is again the preferred approach. In general, however, most studies perform the whole analysis in constant price terms and use a single discount rate. (See Annex 4.1 for a tutorial on methods of measuring and valuing capital costs.)

### 4.3. ALLOCATION OF OVERHEAD COSTS: EXAMPLE

The following example demonstrates the various methods of handling overhead costs discussed in Section 4.1.2(6). Suppose we wish to determine the cost of neonatal intensive care (NIC) for a specific group of patients. For each patient we have data on the length of stay in the neonatal intensive care unit

\* Calculation of inflation-adjusted discount rate: if the real discount rate is 5 per cent and general inflation is 8 per cent, then the inflation-adjusted  $r = (1.05)(1.08) = 1.134$  or 13.4 per cent.

Table 4.1. Cost allocation data

|                                        | Annual direct cost <sup>a</sup><br>\$ | Annual units of output <sup>b</sup> | Direct cost per unit<br>\$ | Allocation basis | Annual pd-hrs    | F <sup>2</sup> | Annual lbs laundry |
|----------------------------------------|---------------------------------------|-------------------------------------|----------------------------|------------------|------------------|----------------|--------------------|
| <b>Overhead departments</b>            |                                       |                                     |                            |                  |                  |                |                    |
| Administration                         | 2,000,000                             |                                     |                            |                  | 200,000          | 30,000         | 0                  |
| Housekeeping                           | 1,500,000                             |                                     |                            | pd-hrs           | 300,000          | 4,000          | 80,000             |
| Laundry                                | 1,300,000                             |                                     |                            | ft <sup>2</sup>  | 200,000          | 8,000          | 0                  |
| Other                                  | 10,200,000                            |                                     |                            | lbs              | 300,000          | 158,000        | 120,000            |
| <b>Subtotal</b>                        | <b>15,000,000</b>                     |                                     |                            |                  | <b>1,000,000</b> | <b>200,000</b> | <b>200,000</b>     |
| <b>Final departments (Pt. service)</b> |                                       |                                     |                            |                  |                  |                |                    |
| Laboratory                             | 4,000,000                             | 8,000,000                           | 0.50/WMU                   |                  | 250,000          | 30,000         | 25,000             |
| NICU                                   | 500,000                               | 5,000                               | 100/pt.-day                |                  | 50,000           | 8,000          | 75,000             |
| Other                                  | 30,500,000                            |                                     |                            |                  | 1,700,000        | 562,000        | 1,200,000          |
| <b>Subtotal</b>                        | <b>35,000,000</b>                     |                                     |                            |                  | <b>2,000,000</b> | <b>600,000</b> | <b>1,300,000</b>   |
| <b>Hospital total</b>                  | <b>50,000,000</b>                     |                                     |                            |                  | <b>3,000,000</b> | <b>800,000</b> | <b>1,500,000</b>   |

<sup>a</sup> Direct cost consists of salaries plus supplies. <sup>b</sup> Lab output is in workload measurement units (WMUs) and NICU output is in patient-days.

(NICU) and data on the number and type of laboratory tests performed. For simplicity, let us assume that these were the only services received by the patients – that is, the patients had no operations, no radiological or nuclear medicine investigations, no social work, etc. Furthermore, let us assume that there are only three overhead departments that serve the laboratory and the NICU: administration, housekeeping and laundry. (In principle it would be possible to consider other overhead departments, like plant operations and maintenance, bioengineering, and materials management.)

The first task is to determine a unit of output for those departments that directly serve patients. We will be determining a cost per unit of output, and multiplying this cost by the usage of each patient to determine the cost per patient. Thus, the unit of output must be as homogeneous as possible with respect to cost, and yet be available in the data for each patient. We have selected a *patient-day* as the unit of output of the NICU, and a *workload measurement unit* for the laboratory. Each lab test is assigned a predetermined number of workload measurement units (WMUs) according to the amount of work needed to perform the test.

**Table 4.2.** Method 1 – ignore overhead

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$$\begin{aligned}\text{Lab cost/WMU} &= \$4\,000\,000/8\,000\,000 = \$0.50/\text{WMU} \\ \text{NICU cost/pt-day} &= \$500\,000/5000 = \$100/\text{pt-day}\end{aligned}$$


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**Table 4.3.** Method 2 – direct allocation of overhead  
(Note: Allocation denominator = sum of 'final' department.)

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$$\begin{aligned}\text{Lab cost} &= \text{direct cost} + \text{lab's share of admin} + \text{lab's share of housekeeping} + \\ &\quad \text{lab's share of laundry} \\ &= 4\,000\,000 + \frac{250\,000}{2\,000\,000} (2\,000\,000) + \frac{30\,000}{6\,000\,000} (1\,500\,000) + \frac{25\,000}{1\,300\,000} (1\,300\,000) \\ &= 4\,000\,000 + 250\,000 + 75\,000 + 25\,000 = 4\,350\,000 \\ \text{Lab cost/WMU} &= 4\,350\,000/8\,000\,000 = \$0.54/\text{WMU}\end{aligned}$$

$$\begin{aligned}\text{NICU cost} &= \text{direct cost} + \text{share of admin} + \text{share of housekeeping} + \text{share of laundry} \\ &= 500\,000 + \frac{50\,000}{2\,000\,000} (2\,000\,000) + \frac{8\,000}{6\,000\,000} (1\,500\,000) + \frac{75\,000}{1\,300\,000} (1\,300\,000) \\ &= 500\,000 + 50\,000 + 20\,000 + 75\,000 = 645\,000 \\ \text{NICU cost/pt-day} &= 645\,000/5000 = \$129/\text{pt-day}\end{aligned}$$


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**Table 4.4. Method 3 – Step down allocation of overhead**  
(Note: Allocation denominator = sum of remaining departments in the step down sequence.)

|                       | Admin     | Housekeeping                                 | Laundry                                      | Other                                            | Lab                           | NICU                          | Other                               |
|-----------------------|-----------|----------------------------------------------|----------------------------------------------|--------------------------------------------------|-------------------------------|-------------------------------|-------------------------------------|
| Direct cost           | 2 000 000 | 1 500 000                                    | 1 300 000                                    | 10 200 000                                       | 4 000 000                     | 500 000                       | 30 500 000 50m                      |
| Allocate admin        |           | $2\,000\,000 \div 3 = 214\,286$<br><u>28</u> | $2 = 142\,857$<br><u>28</u>                  | $3 = 214\,286$<br><u>28</u>                      | $2.5 = 178\,571$<br><u>28</u> | $0.5 = 35\,174$<br><u>28</u>  | $17 = 1\,214\,286$<br><u>28</u>     |
| Allocate housekeeping |           |                                              | $1\,714\,286 \div 8 = 179\,04$<br><u>766</u> | $158 = 353\,599$<br><u>766</u>                   | $30 = 67\,139$<br><u>766</u>  | $8 = 17\,904$<br><u>766</u>   | $562 = 1\,257\,740$<br><u>766</u>   |
| Allocate laundry      |           |                                              |                                              | $1\,460\,761 \div 120 = 123\,445$<br><u>1420</u> | $25 = 25\,718$<br><u>1420</u> | $75 = 77\,153$<br><u>1420</u> | $1200 = 1\,234\,446$<br><u>1420</u> |
| Total cost            |           |                                              |                                              | 10 891 330                                       | 4 271 428                     | 630 771                       | 34 206 472 50m                      |
| Units                 |           |                                              |                                              |                                                  | $\div 8\,000\,000$            | $\div 5\,000$                 |                                     |
| Cost/unit             |           |                                              |                                              |                                                  | \$0.53/WMU                    | \$126.15/pr-day               |                                     |

Cost analysis