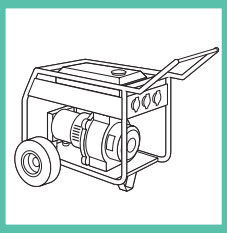
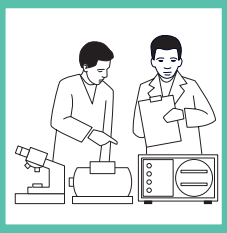


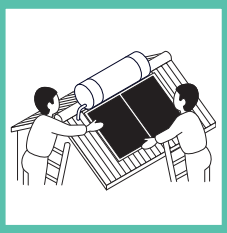
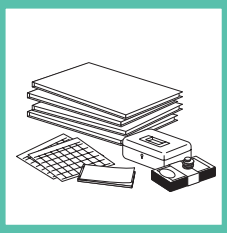
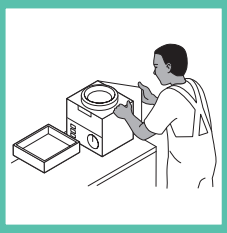

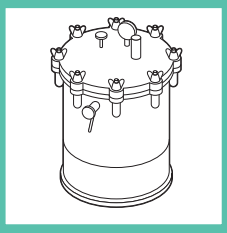

'How to Manage' Series for Healthcare Technology

Guide 2

How to Plan and Budget for Your Healthcare Technology

Management Procedures for Health Facilities and District Authorities

ZIKEN INTERNATIONAL

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Disability KAR Knowledge and Research

TALC Teaching-aids At Low Cost

Dedicated to baby Nathan and Trevor, for their patience and help.

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'How to Manage' Series for Healthcare Technology

Guide 1: How to Organize a System of Healthcare Technology Management

Guide 2: How to Plan and Budget for your Healthcare Technology

Guide 3: How to Procure and Commission your Healthcare Technology

Guide 4: How to Operate your Healthcare Technology Effectively and Safely

Guide 5: How to Organize the Maintenance of your Healthcare Technology

Guide 6: How to Manage the Finances of your Healthcare Technology Management Teams

Keywords: *healthcare technology, management procedures, health service administration, district health services, developing countries, planning, budgeting, financial management, equipment*

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‘How to Manage’ Series for Healthcare Technology

Guide 2

How to Plan and Budget for your Healthcare Technology

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CONTENTS

Foreword

This Series of Guides is the output from a project funded by the UK government's Department for International Development (DFID) for the benefit of developing countries. The output is the result of an international collaboration that brought together:

- researchers from Ziken International and ECHO International Health Services in the UK, and FAKT in Germany
- an advisory group from WHO, PAHO, GTZ, the Swiss Tropical Institute, and the Medical Research Council of South Africa
- reviewers from many countries in the developing world

in order to identify best practice in the field of healthcare technology management.

The views expressed are not necessarily those of DFID or the other organizations involved.

Garth Singleton
Manager, Ziken International Consultants Ltd, Lewes, UK

Preface

The provision of equitable, quality and efficient healthcare requires an extraordinary array of properly balanced and managed resource inputs. Physical resources such as fixed assets and consumables, often described as healthcare technology, are among the principal types of those inputs. Technology is the platform on which the delivery of healthcare rests, and the basis for provision of all health interventions. Technology generation, acquisition and utilization require massive investment, and related decisions must be made carefully to ensure the best match between the supply of technology and health system needs, the appropriate balance between capital and recurrent costs, and the capacity to manage technology throughout its life.

Healthcare technology has become an increasingly visible policy issue, and healthcare technology management (HTM) strategies have repeatedly come under the spotlight in recent years. While the need for improved HTM practice has long been recognized and addressed at numerous international forums, health facilities in many countries are still burdened with many problems, including non-functioning medical equipment as a result of factors such as inadequate planning, inappropriate procurement, poorly organized and managed healthcare technical services, and a shortage of skilled personnel. The situation is similar for other health system physical assets such as buildings, plant and machinery, furniture and fixtures, communication and information systems, catering and laundry equipment, waste disposal, and vehicles.

Preface (continued)

The (mis-)management of physical assets impacts on the quality, efficiency and sustainability of health services at all levels, be it in a tertiary hospital setting with sophisticated life-support equipment, or at the primary healthcare level where simple equipment is needed for effective diagnosis and safe treatment of patients. What is vital – at all levels and at all times – is a critical mass of affordable, appropriate, and properly functioning equipment used and applied correctly by competent personnel, with minimal risk to their patients and to themselves. Clear policy, technical guidance, and practical tools are needed for effective and efficient management of healthcare technology for it to impact on priority health problems and the health system's capacity to adequately respond to health needs and expectations.

This Series of Guides aims to promote better management of healthcare technology and to provide practical advice on all aspects of its acquisition and utilization, as well as on the organization and financing of healthcare technical services that can deliver effective HTM.

The Guides – individually and collectively – have been written in a way that makes them generally applicable, at all levels of health service delivery, for all types of healthcare provider organizations and encompassing the roles of health workers and all relevant support personnel.

It is hoped that these Guides will be widely used in collaboration with all appropriate stakeholders and as part of broader HTM capacity-building initiatives being developed, promoted and implemented by WHO and its partners, and will therefore contribute to the growing body of evidence-based HTM best practice.

The sponsors, authors and reviewers of this Series of Guides are to be congratulated for what is a comprehensive and timely addition to the global HTM toolkit.

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Abbreviations

ACA	annual corrective activities
AEB	annual equipment budget
AHA	American Hospital Association
APA	annual purchase activities
ARA	annual rehabilitation activities
ATA	annual training activities
BP	blood pressure
CD-Rom	compact disc – read only memory
CEEP	core equipment expenditure plan
CEFP	core equipment financing plan
CSSD	central sterile supplies department
CT	computed tomography (scanner)
DVD	digital versatile disc
ECG	electrocardiograph
EDP	equipment development plan
ENT	ear, nose and throat
ETP	equipment training plan
FOB	free-on-board
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit (German Government Technical Aid Agency)
HTM	healthcare technology management
HTMS	healthcare technology management service
HTMWG	healthcare technology management working group
ICU	intensive care unit
IEC	International Electrotechnical Commission
INCO Terms	international commercial terms (for transportation of trade)
ISO	International Organization for Standardization
MOH	Ministry of Health
MTBF	mean-time between failures
NGO	non-governmental organization
OPD	out-patients department
p.a.	per annum

PPM	planned preventive maintenance
UMDNS	united medical devices nomenclature system
UPS	uninterruptible power supply
US $	United States dollars
VEN/VED	vital, essential, not so essential/desirable (prioritizing categories)
WHO	World Health Organization

List of Boxes and Figures

1. INTRODUCTION

Why is This Important?

This introduction explains the importance of healthcare technology management (HTM) and its place in the health system.

It also describes:

- the purpose of the Series of Guides and this Guide in particular
- the people the Guides are aimed at
- the names and labels commonly used in HTM, in this Series.

The Series of Guides is introduced in *Section 1.1*, and this particular Guide on planning and budgeting is introduced in *Section 1.2*.

1.1 INTRODUCTION TO THE SERIES OF GUIDES

Healthcare Technology Management's Place in the Health System

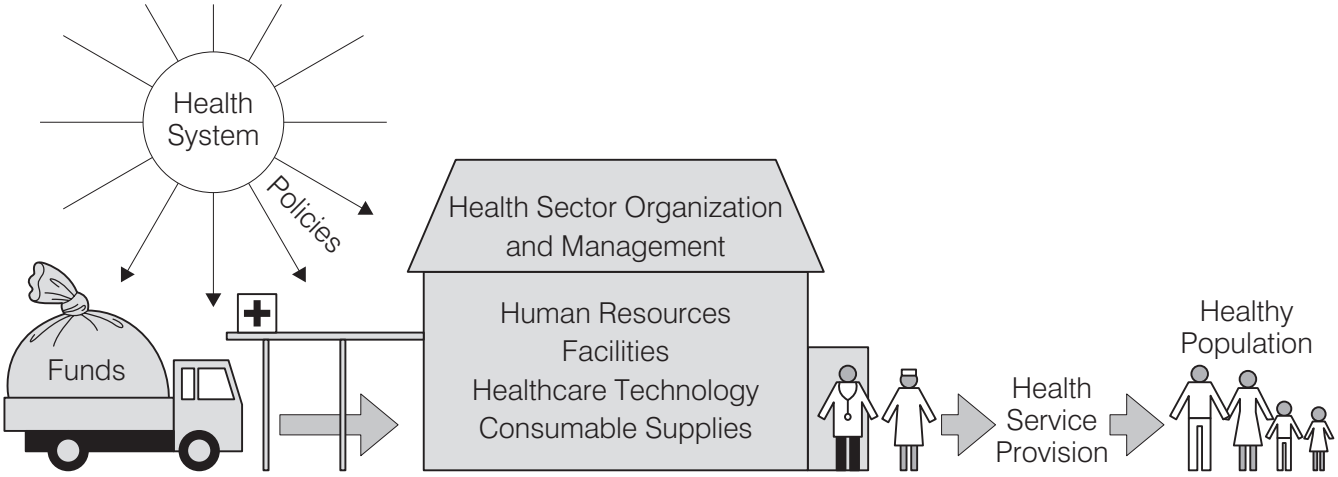
All health service providers want to get the most out of their investments. To enable them to do so, they need to actively manage health service assets, ensuring that they are used efficiently and optimally. All management takes place in the context of your health system's policies and finances. If these are favourable, the management of health service assets can be effective and efficient, and this will lead to improvements in the quality and quantity of healthcare delivered, without an increase in costs.

The health service's most valuable assets which must be managed are its human resources, physical assets, and other resources such as supplies. Physical assets such as facilities and healthcare technology are the greatest capital expenditure in any health sector. Thus it makes financial sense to manage these valuable resources, and to ensure that healthcare technology:

- is selected appropriately
- is used correctly and to maximum capacity
- lasts as long as possible.

Such effective and appropriate management of healthcare technology will contribute to improved efficiency within the health sector. This will result in improved and increased health outcomes, and a more sustainable health service. This is the goal of healthcare technology management – the subject of this Series of Guides.

Figure 1: The Place of Healthcare Technology Management in the Health System



What Do we Mean by Healthcare Technology?

The World Health Organization (WHO) uses the broader term 'health technology', which it defines as including:

'devices, drugs, medical and surgical procedures – and the knowledge associated with these – used in the prevention, diagnosis and treatment of disease as well as in rehabilitation, and the organizational and supportive systems within which care is provided.'

(Source: Kwankam, Y, et al, 2001, 'Health care technology policy framework', WHO Regional Publications, Eastern Mediterranean Series 24: Health care technology management, No. 1)

However, the phrase 'healthcare technology' used in this Series of Guides only refers to the physical pieces of hardware in the WHO definition, that need to be maintained. Drugs and pharmaceuticals are usually covered by separate policy initiatives, frameworks, and colleagues in another department.

Therefore, we use the term healthcare technology to refer to the various equipment and technologies found within health facilities, as shown in *Box 1*.

BOX 1: Categories of Equipment and Technologies Described as 'Healthcare Technology'

medical equipment	walking aids	health facility furniture
communications equipment	training equipment	office equipment
office furniture	fixtures built into the building	plant for cooling, heating, etc.
service supply installations	equipment-specific supplies	fire-fighting equipment
workshop equipment	fabric of the building	vehicles
laundry and kitchen equipment	waste treatment plant	energy sources

For examples of these different categories, see the Glossary in *Annex 1*.

Often, different types of equipment and technologies are the responsibility of different organizations. For example, in the government sector, different ministries may be involved, such as Health, Works, and Supplies; and in the non-government sector, different agencies may be involved, such as Health, and Logistics.

The range of healthcare technology which falls under the responsibility of the health service provider varies from country to country and organization to organization. Therefore each country's definition of healthcare technology will vary depending on the range of equipment and technology types that they actually manage.

For simplicity, we often use the term 'equipment' in place of the longer phrase 'healthcare technology' throughout this Series of Guides.

What is Healthcare Technology Management?

First of all, healthcare technology management (HTM) involves the organization and coordination of all of the following activities, which ensure the successful management of physical pieces of hardware:

- Gathering reliable information about your equipment.
- Planning your technology needs and allocating sufficient funds for them.
- Purchasing suitable models and installing them effectively.
- Providing sufficient resources for their use.
- Operating them effectively and safely.
- Maintaining and repairing the equipment.
- Decommissioning, disposing, and replacing unsafe and obsolete items.
- Ensuring staff have the right skills to get the best use out of your equipment.

This will require you to have broad skills in the management of a number of areas, including:

- technical problems
- finances
- purchasing procedures
- stores supply and control
- workshops
- staff development.

However, you also need skills to manage the place of healthcare technology in the health system. Therefore, HTM means managing how healthcare technology should interact and balance with your:

- medical and surgical procedures
- support services
- consumable supplies, and
- facilities

so that the complex whole enables you to provide the health services required.

Thus HTM is a field that requires the involvement of staff from many disciplines – technical, clinical, financial, administrative, etc. It is not just the job of managers, it is the responsibility of all members of staff who deal with healthcare technology.

This Series of Guides provides advice on a wide range of management procedures, which you can use as tools to help you in your daily work. For further clarification of the range of activities involved in HTM and common terms used, refer to the WHO's definition of the technology management hierarchy in *Annex 1*.

Box 2 highlights some of the benefits of HTM.

BOX 2: Benefits of Healthcare Technology Management (HTM)

- Health facilities can deliver a full service, unimpeded by non-functioning healthcare technology.
- Equipment is properly utilized, maintained, and safeguarded.
- Staff make maximum use of equipment, by following written procedures and good practice.
- Health service providers are given comprehensive, timely, and reliable information on:
  - the functional status of the equipment
  - the performance of the maintenance services
  - the operational skills and practice of equipment-user departments
  - the skills and practice of staff responsible for various equipment-related activities in a range of departments including finance, purchasing, stores, and human resources.
- Staff control the huge financial investment in equipment, and this can lead to a more effective and efficient healthcare service.

Purpose of the Series of Guides

The titles in this Series are designed to contribute to improved healthcare technology management in the health sectors of developing countries, although they may also be relevant to emerging economies, and other types of country. The Series is designed for any health sector, whether it is run by:

- government (such as the Ministry of Health or Defence)
- a non-governmental organization (NGO) (such as a charitable or not-for-profit agency)
- a faith organization (such as a mission)
- a corporation (for example, an employer such as a mine, who may subsidize the healthcare)
- a private company (such as a health insurance company or for-profit agency).

This Series aims to improve healthcare technology at a daily operational level, as well as to provide practical resource materials for equipment users, maintainers, health service managers, and external support agencies.

To manage your technology effectively, you will need suitable and effective procedures in place for all activities which impact on the technology. Your health service provider organization should already have developed a Policy Document setting out the principles for managing your stock of healthcare technology (*Annex 2* provides a number of resources available to help with this). The next step is to develop written organizational procedures, in line with the strategies laid out in the policy, which staff will follow on a daily basis.

The titles in this Series provide a straightforward and practical approach to healthcare technology management procedures:

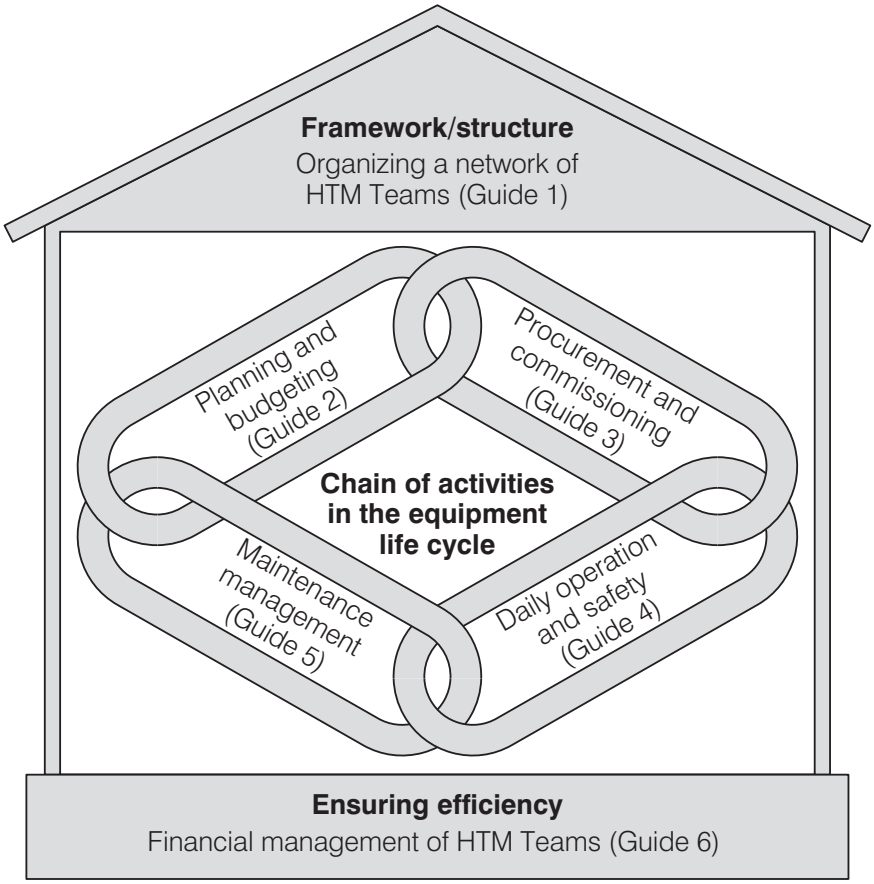
Guide 1 covers the framework in which Healthcare Technology Management (HTM) can take place. It also provides information on how to organize a network of HTM Teams throughout your health service provider organization.

Guides 2 to 5 are resource materials which will help health staff with the daily management of healthcare technology. They cover the chain of activities involved in managing healthcare technology – from planning and budgeting to procurement, daily operation and safety, and maintenance management.

Guide 6 looks at how to ensure your HTM Teams carry out their work in an economical way, by giving advice on financial management.

How the Guides are coordinated is set out in *Figure 2*.

Figure 2: The Relationship Between the Guides in This Series



Who are These Guides Aimed at?

These Guides are aimed at people who work for, or assist, health service provider organizations in developing countries. Though targeted primarily at those working in health facilities or within the decentralized health authorities, many of the principles will also apply to staff in other organizations (for example, those managing health equipment in the Ministry of Works, private maintenance workshops, and head offices).

Depending on the country and organization, some daily tasks will be undertaken by end users while others may be carried out by higher level personnel, such as central level managers. For this reason, the Guides cover a range of tasks for different types of staff, including:

- equipment users (all types)
- maintenance staff
- managers
- administrative and support staff
- policy-makers
- external support agency personnel.

They also describe activities at different operational levels, including:

- the health facility level
- the zonal administration level (such as district, regional, diocesan)
- the central/national level
- by external support agencies.

Many activities require a multi-disciplinary approach, therefore it is important to form mixed teams which include representatives from the planning, financial, clinical, technical, and logistical areas. Allocation of responsibilities will depend upon a number of factors, including:

- your health service provider
- the size of the organization
- the number of decentralized levels of authority
- the size of your health facility
- your level of autonomy.

The names and titles given to the people and teams involved will vary depending on the type of health service provider you work with.

For the sake of simplicity, we have used a variety of labels to describe different types of staff and teams involved in HTM.

This Series describes how to introduce healthcare technology management into your organization. The term **Healthcare Technology Management Service (HTMS)** is used to describe the delivery structure required to manage equipment within the health system. This encompasses all levels of the health service, from the central level, through the regions/districts, to facility level.

There should be a referral network of **workshops** where maintenance staff with technical skills are based. However, equipment management should also take place where there are no workshops, by involving general health facility staff. We call these groups of people the **HTM Team**, and we suggest that you have a team at every level whether a workshop exists or not. Throughout this Series, we have called the person who leads that team the **HTM Manager.**

At every level, there should also be a committee which regularly considers all equipment-related matters, and ensures decisions are made that are appropriate to the health system as a whole. We have used the term **HTM Working Group (HTMWG)** for this committee, which will advise the Health Management Teams on all equipment issues.

Due to its role, the HTMWG must be multi-disciplinary. Depending on the operational level of the HTMWG, its members could include the following:

- Head of medical/clinical services.
- Head of support services.
- Purchasing and supplies officer.
- Finance officer.
- Representatives from both medical equipment and plant maintenance.
- Representatives of equipment users from a variety of areas (medical/clinical, nursing, paramedical, support services, etc.).
- Co-opted members (if specific equipment areas are discussed or specific interest or need is shown).

The HTM Working Group prepares the annual plans for equipment purchases, rehabilitation, and funding, and prioritizes expenditure across the facility/district as a whole. It may have various sub-groups to help consider specific aspects of equipment management, such as pricing, commissioning, safety, etc.

How to Use These Guides

Each Guide has been designed to stand alone, and has been aimed at different types of readers depending on its content (*Section 1.2*). However, since some elements are shared between them, you may need to refer to the other Guides from time to time. Also, if you own the full Series (a set of six Guides) you will find that some sections of the text are repeated.

We appreciate that different countries use different terms. For example, a purchasing officer in one country may be a supplies manager in another; some countries use working groups, while others call them standing committees; and essential service packages may be called basic healthcare packages elsewhere. For the purpose of these Guides it has been necessary to pick one set of terms and define them. You can then modify them for your own situation.

The terms used throughout the text are outlined, with examples, in the Glossary in *Annex 1*.

We appreciate that you may find it hard to pursue the ideas introduced in these Guides. Depending on your socio-economic circumstances, you may face many frustrations on the road to achieving effective healthcare technology management. We recognize that not all of the suggested procedures can be undertaken in all environments. Therefore we recommend that you take a step-by-step approach, rather than trying to achieve everything at once (*Section 2*).

These Guides have been developed to offer advice and recommendations only, therefore you may wish to adapt them to meet the needs of your particular situation. For example, you can choose to focus on those management procedures which best suit your position, the size of your organization, and your level of autonomy.

For more information about reference materials and contacts for healthcare technology management, see *Annex 2*.

1.2 INTRODUCTION TO THIS SPECIFIC GUIDE

Why Is There a Need for Equipment Planning and Budgeting?

Healthcare technology is such an important part of healthcare today that it cannot easily be ignored. It has a very wide application; for example equipment is used to:

- help *diagnose* whether a patient has malaria
- *treat* a patient by removing their gall stones
- *monitor* the condition of a patient's heart
- provide *therapy* in order to get a patient moving about again
- *control* the environment by supplying heat and light
- *provide* necessities such as running water
- *transport* patients and staff
- *feed* patients and staff
- provide *clean* surroundings.

The expansion in healthcare technologies has brought with it many new challenges. For example:

- Health service providers and the general public believe that this technology offers great promise for improving conditions for the sick.
- The public expects their health services to be continually improving.
- Manufacturers, professional staff, and the private health sector exert pressure to introduce the latest technological advances.
- People commonly believe that quality of care is directly linked to the presence of sophisticated technologies.

Did you know?

- 80 per cent of the world's population is not able to afford US$100 per head per year on health.
- Many sub-Saharan African countries cannot even spend US$15 per head per year on health.
- The majority of equipment is designed in countries that spend between US$1,500 and 2,500 per head per year on health.
- For 80 per cent of the world's population, the standards and technology set by the equipment-manufacturing nations are not sustainable.

Planning and Budgeting Equipment – Why Does It Matter?

1. Planning and budgeting helps you to control the direction of technology development in your country.

Investing in expensive technologies can lead to many potential difficulties. For example:

- The capabilities of the technology may increase at a faster rate than the country's infrastructure and support systems can cope with.
- Large amounts of money may be spent on expensive and complex new technologies which do not always lead to the improvements hoped for, in terms of better access to healthcare and a better quality service.
- When investing in technology, planners may fail to take account of the potential impact on other spending needs (for example, maintenance costs, extra staff requirements, operational costs, replacement funding).
- Planners may fail to take into account the recurrent cost burden of such technologies. This could have a negative impact on long-term health service budgets, creating a serious imbalance in health service provision and existing services.

In order to maintain a quality health service, careful planning of your existing and future healthcare technology needs is essential. Before investing in expensive and complex technologies, ask yourself whether there are other, more effective means by which you could improve the quality and level of health services which you deliver to the public.

Did you know?

- In many poor countries, 50 per cent of health finances goes to the highest referral level, while all the other services have to share the remaining 50 per cent.
- Thus, the equity statement that many countries have in their health plan/policy is not really served.
- It is possible to consider the cost-effectiveness of using different types of equipment.
- Although controversial, it could be argued that providing basic facilities for sterilizing instruments is of a higher level of priority than an X-ray service, for example.

2. Planning your equipment requirements helps to obtain the right balance within your budget between various needs.

It is common in many developing countries to find:

- considerable cuts are made in recurrent expenditures
- funds for salaries are often protected
- money for other costs is frequently limited. For example, fuel is often not available or reagents are insufficient for existing services
- there is no guarantee that the recurrent costs required for new services will be provided sufficiently to run the equipment properly.

Did you know?

- European Community countries spend more than US$53 per person on medical equipment per year, Japan more then $92, and the United States more than $118.
- But sub-saharan African countries spend on average less than $1 per person on medical equipment per year, and the less developed countries in Asia spend only around $12
- In most countries, capital expenditure on buildings and equipment is typically not more than five per cent of the total annual healthcare expenditure.
- In some developing countries, however, this can rise to as much as 40 per cent over short periods (1–2 years), due to the injection of donor funds for the occasional construction or rehabilitation project.
- In many developing countries, 66 per cent or more of the recurrent health budget is spent on staff salaries.
- This leaves only a small fraction of the total budget for all the remaining requirements – maintenance of buildings and equipment, skill development, and consumables.
- As a result, many staff do not have the tools required to do their jobs.

Health service providers may concentrate on obtaining the right staff for the delivery of healthcare. But there is little use in allocating a large proportion of the health budget on salaries, if the staff do not have the necessary tools to work with. Without functioning facilities, equipment, and medicines, it does not matter if the knowledge, skills and staff levels are high. The delivery of services will be poor.

Poor investment in technology will also have a negative impact on staff motivation, leading to poor performance. Therefore, when planning and allocating your budgets, it is important to maintain the right balance between staffing and technology costs.

3. Planning is essential, in order to make the most of your assets.

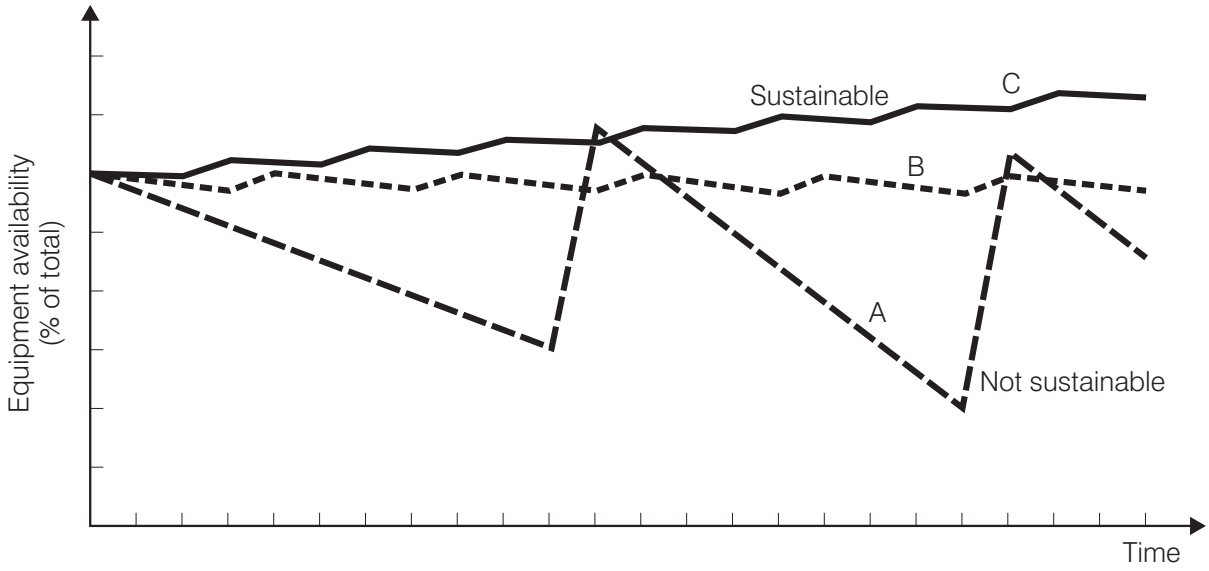
Developing countries have limited funds, so it is important to ensure that any investment in healthcare technology has been properly thought through.

Good management practices will create sustainable circumstances for your healthcare technology. To achieve this, you will need to plan and budget for the regular replacement of equipment, effective maintenance, and training needs. *Figure 3* illustrates how effective management can improve the performance of your healthcare technology.

Did you know?

- In one South American country, it is estimated that the replacement value of medical equipment is US$5 billion.
- But 40 per cent of this equipment is not functioning.
- This represents a loss of assets of US$2 billion.

Figure 3: Healthcare Technology Performance Related to Your Management Style



Curve A: Crisis Management:
- major periodic injections of new equipment
- poor preservation of existing stock

Curve B: Stable Healthcare Technology Management:
- preservation (maintenance) of equipment
- regular planned replacement

Curve C: Good Healthcare Technology Management:
- preservation of equipment
- regular planned replacement
- improved performance through internal learning processes

Source: Remmelzwaal, B, 1994, 'Foreign aid and indigenous learning', Science Policy Research Unit, University of Sussex, UK

Who is this Guide Aimed at?

This Guide is particularly suitable for the following:

- Managers, and planning and finance officers within your organization
- Technical (maintenance) and administrative staff in your Healthcare Technology Management Service
- Other types of staff who have various responsibilities relating to planning and budgeting, such as:
  - administrators, heads of department
  - purchasing, human resources, supplies and stores personnel
- Policy makers.

All these staff should have a good understanding of equipment planning and budgeting issues, in their common effort to provide an effective and sustainable health service.

The recommendations and procedures outlined in this Guide are aimed at personnel at various levels of your organization (facility, district/region, central). The Guide explains what the responsibilities are at all levels of the system, to enable you to see the bigger picture.

Tip • The principles of planning and budgeting are the same wherever the money comes from – whether received from patients, government funds, private support or any other source.

What Topics are Covered?

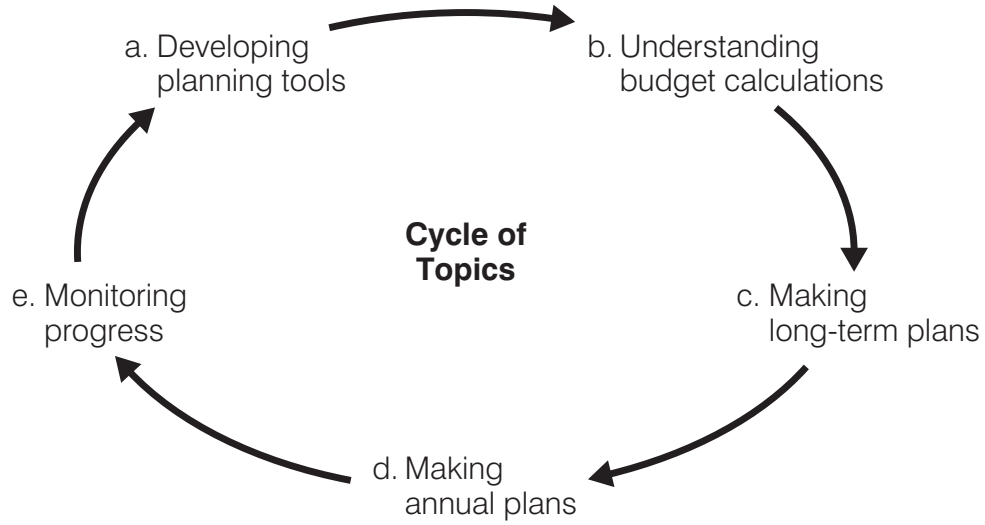
Managing the planning and budgeting of equipment involves understanding and developing a series of 'tools'. These tools enable you to make your equipment plans and calculate your budgets, which will ensure that you have sufficient stocks of functioning equipment to be able to deliver your health services.

This Guide answers the following questions for your healthcare technology sector:

- What is my current equipment situation – where am I starting from?
- What are my future plans for my equipment?
- How do I make budget calculations for capital expenditure?
- How do I make budget calculations for recurrent expenditure?
- How do I develop the plans and budgets for my equipment in the long-term and short-term?
- How do I review my plans and budgets annually, and monitor progress?

Figure 4 shows how the topics covered in this Guide fit together to create a planning and budgeting cycle. In *Section 8*, we go on to discuss the way in which this planning and budgeting cycle relates to your annual calendar.

Figure 4: Cycle of Planning and Budgeting Topics Followed in This Guide



Tip

- Putting into place the procedures outlined in this Guide may appear to be a daunting task, on first sight. However, by taking a step-by-step approach, you can minimize the effort involved. The discussion of tools (*Sections 3–6*) covers one-off exercises which you can undertake to set up the tools initially. *Section 7* goes on to explain how to set up the long-term plans and budgets. Finally, *Section 8* goes on to explain how to regularly review and update the existing tools, plans, and budgets during the annual planning process.
- If this Guide is still too daunting, *Annex 6* offers advice on a shortened version of planning and budgeting for those just starting out.

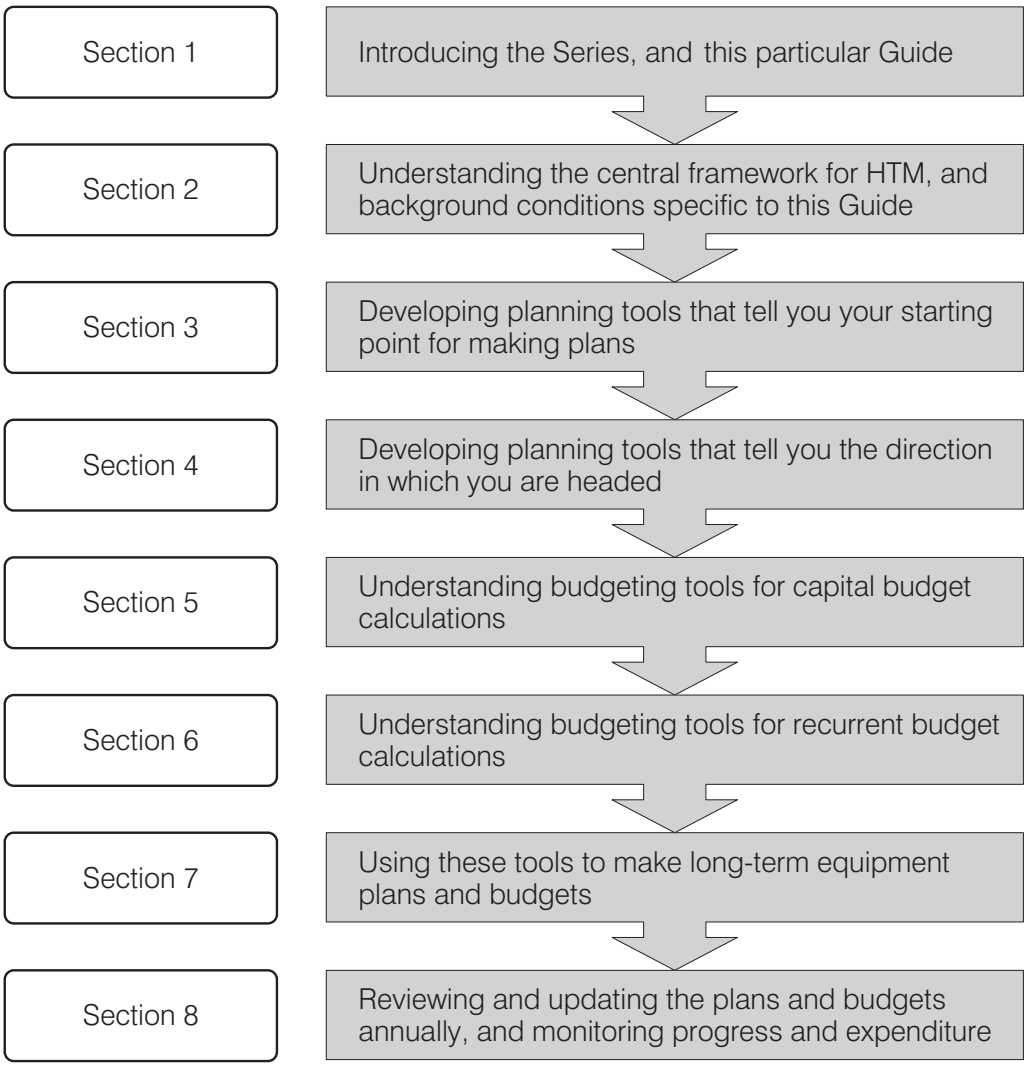
The system introduced in this Guide provides a solid approach to managing equipment planning and budgeting. However, we recognize that there are other ways of organizing these issues which may be more appropriate for your administrative system. The most important thing is to implement a well-functioning system.

As you read through the recommendations in this Guide, you may find it useful to refer to advice in other Guides in the Series, as indicated in the text. Additional useful reference materials and contacts are given in *Annex 2*.

How is This Guide Structured?

The structure of *Guide 2* highlights the different steps you must take in order to plan and budget for your healthcare technology, as shown in *Figure 5*.

Figure 5: The Structure of Guide 2



Who Does What in Planning and Budgeting?

Depending on how many staff you have with management skills, planning and budgeting tasks may take place at any level. This will depend on:

- your country
- your health service provider
- which level of the health service you work at
- the degree of autonomy of your health facility.

However if you have limited management skills at your level, and planning and budgeting presents a heavy workload, much of this work should be undertaken at a higher level in your organization.

We suggest that the HTM Working Group (*Section 1.1*) has a large role to play in advising the Health Management Team on all equipment matters. Depending on the size of your facility or what level of the health service you are operating at, your HTM Working Group may prefer to set up a number of smaller sub-groups.

The suggestions given in this Guide are only intended as examples of the type of background required for the members of the sub-groups. It is likely that many staff will sit on more than one sub-group. If you are short of staff, you could use fewer members, as relevant to the operational level of the sub-group.

In this Guide, the following groups and sub-groups are suggested:

A **planning sub-group**, which is responsible for equipment development planning could have the following types of members:

- Head of the Health Facility or Head of Medical Services (as team leader)
- HTM Manager
- Finance Officer
- maintenance staff from various disciplines
- Nursing Services Manager
- Support Services Manager
- co-opted members (it is important to involve relevant users as each department is considered).

A **stock sub-group**, which evaluates the usage rates and recurrent stock requirements for equipment-related consumable items could have the following types of members:

- Purchasing and Supplies Officer
- HTM Manager
- Stores Controller
- representatives from equipment user departments (as appropriate to the equipment being considered).

A **training sub-group**, which considers equipment-related training issues, could include the following types of staff:

- Human Resource Manager
- Head of Medical Services
- Head of Support Services
- HTM Manager
- In-service Training Coordinator
- Infection Control Officer, senior users, and maintenance staff (as appropriate to the equipment being considered).

A **pricing sub-group**, which is responsible for developing equipment price lists and stock values, and which could include the following types of staff:

- Purchasing and Supplies Officer
- HTM Manager
- Medical Equipment Maintenance Technician.

A **Specification Writing Group** which is responsible for developing a library of generic equipment specifications, and the technical and environmental data sheet. This could include the following types of staff:

- HTM Manager
- maintenance staff from various disciplines
- Purchasing and Supplies Officer
- Stores Controller
- managers and representatives from equipment user departments – clinical, paramedical, and support services (as appropriate to the equipment being considered).

A **Commissioning Team**, which is responsible for overseeing or undertaking the installation and commissioning of new equipment. This could include the following types of staff:

- HTM Manager
- maintenance staff from various disciplines
- Purchasing and Supplies Officer
- Stores Controller
- Support Services Manager
- representatives from equipment user departments (as appropriate to the equipment being considered)
- where necessary, stores and grounds staff to help move and open crates.

A **Tender Committee**, which will decide which quotes to accept for the equipment and services you plan and budget for. A full description of this team is described in *Guide 3*.

Tip

- There may seem to be a large number of sub-groups but the aim is to spread the work around different members of staff so that the HTM Working Group (*Section 1.1*) does not have to do everything.
- If you have a small health facility with few staff, the groups created to undertake planning and budgeting could be much smaller. Try to use relevant staff with experience and involve those who show an interest in the task.

A wide range of people will be involved in planning and budgeting, as can be seen from the membership of these sub-groups. It is important for everybody involved to understand the planning and budgeting process that will be followed in this Guide. This process is described in *Box 3*.

BOX 3: The Planning and Budgeting Process Described in this Guide

Steps in the Process	People Responsible	Actions Described in this Guide
Plan and budget within the framework of guidance and direction from the central level of your health service provider	Health service managers at central level in consultation with managers at other levels	**Framework Requirements** (*Section 2*) ◆ follow regulations and standards set by government ◆ develop a Healthcare Technology Policy including decisions on standardization, maintenance provision, finances for HTM activities, and the organizational structure for an HTM Service ◆ define the overall 'Vision' for healthcare delivery at each level of the health service ◆ develop 'Model Equipment Lists' which define the essential equipment stock for the healthcare to be delivered at each level ◆ use 'Generic Equipment Specifications' for acquisition of equipment ◆ develop good policies for purchasing, donations, replacement, and disposal of equipment.

Continued opposite

BOX 3: The Planning and Budgeting Process Described in this Guide (continued)

Increase the availability of planning skills for equipment at all service levels, by developing planning 'tools' through one-off exercises	HTM Managers	**Knowing where you are starting from** (*Section 3*) ◆ establish an Equipment Inventory to keep up-to-date records of the current equipment stock.
	HTM Working Groups and sub-groups	◆ estimate the equipment stock values ◆ define the usage rates of equipment-related consumable items so that realistic estimates can be made of the finances required for equipment accessories, consumables, and spare parts.
	Finance Officers	◆ set up budget lines to record and monitor expenditure on all the different equipment activities.
	Health Management Teams	**Knowing where you are headed** (*Section 4*) ◆ develop a library of literature and sources of advice which will help with equipment planning and budgeting ◆ adapt the Vision for healthcare delivery at their service level ◆ adopt good policies for purchasing, donations, replacement, and disposal of equipment.
	HTM Working Groups	◆ adapt the Model Equipment List for their service level.
	HTM Working Groups and sub-groups	◆ develop Generic Equipment Specifications and technical and environmental data.
Ensure realistic estimates are made for all equipment-related allocations at all service levels, by using budgeting 'tools' which teach you how to calculate the expenditures required	HTM Working Groups and sub-groups	**Capital budget calculations** (*Section 5*) ◆ calculate expenditure requirements for replacement items ◆ calculate expenditure requirements for new purchases ◆ calculate expenditure requirements for support activities linked to purchases and donations.
	HTM Managers and their Teams	◆ calculate expenditure requirements for pre-installation work ◆ calculate expenditure requirements for major rehabilitation work.

Continued overleaf

BOX 3: The Planning and Budgeting Process Described in this Guide (continued)

Ensure realistic estimates are made for all equipment-related allocations at all service levels, by using budgeting 'tools' which teach you how to calculate the expenditures required	HTM Managers and their Teams Heads of Section HTM Working Groups and sub-groups	**Recurrent budget calculations** (*Section 6*) ◆ calculate recurrent expenditure requirements for maintenance. ◆ calculate recurrent expenditure requirements for consumable operating costs. ◆ calculate recurrent expenditure requirements for administrative expenses ◆ calculate recurrent expenditure requirements for ongoing training.
Use the tools to make long-term plans and budgets	HTM Working Groups and sub-groups	**Long-term planning** (*Section 7*) ◆ establish an Equipment Development Plan covering the priorities for equipment needs across their service level over time ◆ establish an Equipment Training Plan to cover the ongoing rolling programme of training required in relation to equipment activities ◆ establish a Core Equipment Expenditure Plan which prioritizes equipment spending across the facility over the long-term ◆ establish a Core Equipment Financing Plan which identifies sources of funds for the long-term plans.
Review the plans and budgets annually, and monitor progress in order to improve planning and budgeting	HTM Teams HTM Working Groups and sub-groups	**Annual planning** (*Section 8*) ◆ update the Equipment Inventory. ◆ update the Equipment Development Plan ◆ update the Equipment Training Plan ◆ cost the capital and recurrent requirements for the current year, and update the Core Equipment Expenditure Plan and Core Equipment Financing Plan ◆ prioritize across their service level to obtain the Annual Purchase Activities, Annual Rehabilitation Activities, Annual Corrective Activities, Annual Training Activities, and therefore obtain their Annual Equipment Budget.

Continued opposite

BOX 3: The Planning and Budgeting Process Described in this Guide (continued)

Review the plans and budgets annually, and monitor progress in order to improve planning and budgeting	HTM Working Groups	**Monitoring progress** (*Section 8*) ◆ ensure annual plans are implemented ◆ study the implications arising from planning and budgeting.
	Heads of Department and HTM Managers	◆ request help for any deviations from plans such as emergency purchases, maintenance and consumable contingencies ◆ monitor actual expenditure against allocations.
	Health Management Teams	◆ seek the funding identified ◆ consider linking allocation of budgets to whether departments achieve their performance targets ◆ monitor progress with establishing all planning and budgeting 'tools' ◆ ensure that the information generated by the 'tools' is used to improve stock control, training, procurement, etc.

Tip • Remember – if you do not think you can undertake all this work initially, *Annex 6* contains a shortened version of planning and budgeting for equipment based on parts of this Guide.

2. FRAMEWORK REQUIREMENTS

Why is This Important?

In order to deliver quality health services, it is essential to undertake effective healthcare technology management.

There are various framework requirements to help you do this. These include legislation, regulations, standards, and policies.

These framework requirements create the boundary conditions within which you undertake healthcare technology management. They include central or national guiding principles, policy issues, and high-level assumptions that can impede or assist you in your work.

It is very difficult to function effectively if these framework requirements do not exist, and you should lobby your organization to develop them.

Depending on how autonomous your health facilities are, you may be able to develop these framework requirements at facility, region/district, or central level.

In most industrialized countries, laws, regulations, policies and guidelines form an indispensable part of health service management. For many developing countries, however, these regulatory procedures have yet to be developed.

Guide 1 provides a fuller analysis of how to develop these instruments, and shows that effective healthcare technology management (HTM) is essential in order to deliver quality health services. *Section 2.1* summarizes these points and offers advice on:

- the regulatory role of government
- establishing standards for your health system
- policy issues for HTM
- the importance of introducing an HTM Service
- managing change.

Section 2.2 goes on to discuss the background conditions specific to this Guide, and provides advice on:

- authorities responsible for guidance on equipment planning and budgeting
- central plans and policies, management skill requirements, and economies of scale for planning and budgeting.

2.1 FRAMEWORK REQUIREMENTS FOR QUALITY HEALTH SERVICES

Regulatory Role of Government

The World Health Organization (WHO) identifies four distinct functions for health systems:

- The provision of health services.
- The financing of health services.
- The creation of health resources (investment in facilities, equipment, and training).
- The stewardship of health services (regulation and enforcement).

Health service provision and financing, as well as resource creation may be taken on by both the government and private sector. Thus, there are various options for organizing health systems:

- Mainly public.
- Mainly private for-profit (for example, run by a commercial organization), and private not-for-profit (for example, run by faith organizations, NGOs).
- A mixture of government and private organizations.

However in all these systems, the government is solely responsible for the regulation of health services. The reason for this is that the government has a duty to ensure the quality of healthcare delivered in order to protect the safety of the population. These regulations may then be enforced directly by government bodies or they may be enforced by publicly funded bodies, such as professional associations, which apply government sanctioned regulations.

Most governments would agree that the protection of health and the guarantee of safety of health services is vital. However, in many countries this regulatory function is underdeveloped, with weak legal and regulatory frameworks.

To regulate health services, the government should:

- adopt suitable quality standards for all aspects of health services, including acceptable international or national standards for healthcare technology, drugs, and supplies in order to ensure their efficacy, quality and safety
- establish systems to ensure standards are met, so that the bodies enforcing regulations have legal sanctions they can use if standards are infringed
- establish wide-ranging policies covering all aspects of the utilization, effectiveness, and safety of healthcare technology, drugs, and supplies
- establish systems to ensure these policies can be implemented.

For health services, the Ministry of Health is the body most likely to develop these government regulations. Other health service providers need to be guided by government laws, and should look to the Ministry of Health for guidance or follow their direction if required to do so by law or regulation.

Establishing Standards for your Health System

The government should agree on which quality standards have to be met by the health services in general. These will cover areas such as:

Standard
a required or agreed level of quality or attainment set by a recognized authority, used as a measure, norm, or model.

- procedures and training
- construction of facilities
- healthcare technology, drugs, and supplies
- safety
- the environment
- quality management.

Since drawing up these standards can be both time consuming and expensive, governments may often choose to adopt acceptable international standards (such as ISO), rather than develop their own. However, they must be suitable and applicable to your country situation and fit in with your country's vision for health services.

The adoption of suitable international or national standards for healthcare technology is of particular relevance to this Guide. Such standards would cover areas such as:

- manufacturing practices
- performance and safety
- operation and maintenance procedures
- environmental issues (such as disposal).

These are important since countries can suffer if they acquire sub-standard and unsafe equipment. Again, in the majority of cases ministries of health would save money and time by adopting internationally recognized standards. For more information on introducing internationally recognized standards into your procurement procedures, refer to *Guide 3* on procurement and commissioning.

It is not enough simply to establish these standards; they also need to be adhered to. For this reason, you should establish a national supervisory body that has the power to ensure that health service providers comply with the standards in force. To be effective, such an enforcement agency must be allocated sufficient financial and personnel resources. It should also be linked or networked with corresponding international bodies.

Much healthcare technology in developing countries is received through foreign aid and donations, but such products don't always meet international standards. Therefore, your country will need to negotiate with external support agencies. The best way to do this is to develop regulations for donors that supply equipment (see *Annex 2*, and *Guide 3* on procurement and commissioning).

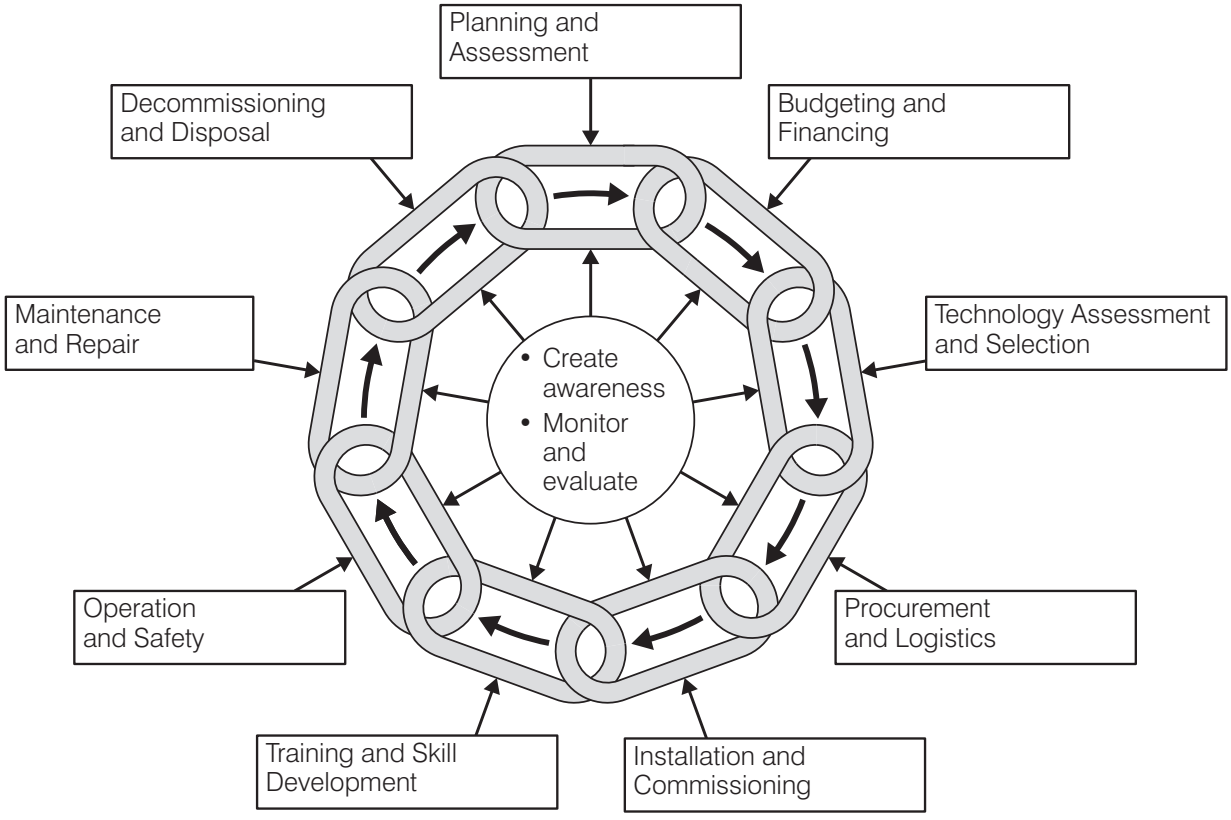
The legal system plays an important role in enforcing such standards, by ensuring that any infringements can be effectively prosecuted. It is therefore essential that the legal system is allocated sufficient financial and human resources to enforce claims against any institution operating equipment that does not meet the prescribed standards.

Developing Policies for Health Services

Every country needs to establish wide-ranging policies covering all aspects of health services. National health policies are usually developed by the Ministry of Health. If these policies are linked to regulations, then other health service providers must also follow them. Each health service provider can expand them internally, and must establish systems to ensure they are implemented.

One key framework requirement for this Series of Guides is that your health service provider should have started work on a Healthcare Technology Policy (for guidance on this process, see *Annex 2*). Such a policy usually addresses all the healthcare technology management (HTM) activities involved in the life-cycle of equipment, as shown in *Figure 6*.

Figure 6: The Healthcare Technology Management Cycle



Here we will consider just four issues that provide key background conditions:

- A Vision for health services.
- Standardization.
- The provision of maintenance.
- Finances.

A Vision for Health Services

Every health service provider needs a realistic Vision of the service it can offer. This should include a clear understanding of its role in relation to other health service providers in the national health service. Only when this Vision is known can the health service provider decide what healthcare technology is needed, and prioritize the actions required to develop its stock of equipment.

It is unhelpful if lots of individual health facilities pull in different directions, with no coordinated plan for the health service as a whole. The central authority of each health service provider should be responsible for considering what sort of healthcare should be offered at each level of their health service. Preferably they will collaborate with the Ministry of Health, or follow their guidance if regulated to do so.

If there is no health service plan, there is no framework on which to base decisions. *Section 4.2* provides further information on developing a Vision and planning your healthcare technology stock.

Standardization of Healthcare Technology

Standardization
(also known as rationalization, normalization and harmonization) – the process of reducing the range of makes and models of equipment available in your stock, by purchasing particular named makes and models.

Introducing an element of standardization for healthcare technology will help you to limit the wide variety of makes and models of equipment found in your stock. By concentrating on a smaller range for each equipment type, your technical, procedural, and training skills will increase and your costs and logistical requirements will decrease (see *Guide 1*).

It is easier to achieve standardization if equipment is planned and ordered on a country-wide, district-wide or health service provider basis. It is therefore important to combine forces with other facilities or health service providers, and it may be wise to follow standardization strategies of the Ministry of Health. It is important that these standardization efforts do not just apply to products purchased by health facilities, but also to donations.

Standardizing your healthcare technology may be difficult for a number of reasons. Your country and local businesses may have their own trade practices and interests. National donors may have tied-aid practices, while the procurement procedures of international funding agencies, health service institutions, and individuals may act against your standardization strategies (see *Guide 3*).

You may need to hold discussions with organizations such as the Ministry of Industry and/or Trade, the chambers of commerce or specific business associations, as well as external support agencies. However, it is well worth persevering, as standardization offers many benefits, both in terms of cost and efficiency.

Provision of Maintenance

Proper maintenance is essential to ensure that the equipment you have purchased continues to meet the standards required throughout its entire working life.

Undertaking maintenance belongs to the service provision function of health systems, and could therefore, in principle, be carried out by the government, the private sector, or by a mixture of the two.

It is useful to organize the maintenance system along similar lines to the health service provision already existing in your country. For instance, if the health sector is predominantly run by the government, it is probably simplest to let the government run the maintenance organization as well. In contrast, if private organizations run the health services, it makes little sense for the maintenance activities to be carried out by a government body. In the majority of cases, a mixed system is most likely.

However, the government may wish to take a regulatory role and establish regulations that guarantee that healthcare technology performs effectively, accurately, and safely. The rules established are valid for all health service providers, irrespective of their type of organization.

Specific maintenance requirements would not need to be prescribed by the regulatory body. Instead, it is up to individual health service providers to decide how these will be provided. However, the nature and the complexity of some maintenance services often calls for partnerships between the public and private health service providers. Partnerships may also exist between health service providers and private sector sources of maintenance support. For more details, refer to *Guide 1*.

To provide maintenance services, you will normally need to establish good links between maintenance workshops. This will create a network that supports the needs of all your health facilities. Maintenance is, of course, only one of many HTM activities that need to be carried out. However, the fact that maintenance workshops usually already exist in most countries serves as a useful starting point for establishing a physical HTM Service across your health service provider organization and across your country. For more details on how to organize an HTMS, refer to *Guide 1*.

Finances

To ensure that healthcare technology is utilized effectively and safely throughout its life, your health service provider will need to plan and allocate adequate capital and recurrent budgets. See *Sections 5 and 6* for more advice on this.

In a government-organized system these funds have to be provided by government budgets, while private systems or mixed systems must generate the required funds from their customers, or from benefactors and donors.

Depending on your health service provider and country, your HTM Service may be able to generate income by charging for services provided. Whether this income can be used to further improve the HTM Service depends on the policies of the responsible financing authority (such as the treasury or central finance office). *Guide 6* provides advice on this.

The Importance of Introducing an HTM Service

We have established the importance of:

- adopting standards for healthcare technology
- developing healthcare technology policies
- establishing systems to ensure the policy is implemented.

All these aims could be achieved if each health service provider practised healthcare technology management (HTM) as part of the everyday life of their health service. The best way to do this is to have an HTM Service incorporated into each health service provider organization.

Box 2 (*Section 1.1*) shows that HTM provides a wide range of benefits. *Guide 1* attempts to express this in terms of the sorts of savings that can be made if HTM is effectively carried out. Taking maintenance as an example, we can see that it has not only a positive impact on the safety and effectiveness of healthcare technology, but that it also has two important economic benefits:

- it increases the life-span of the equipment
- it enhances the demand for health services, since demand for services is crucially dependent upon the availability of functioning healthcare technology.

Healthcare technology that is out of order quickly leads to a decline in demand, which will in turn reduce the income and quality of services of the health facilities. You will lose clients if, for example, it becomes known that malfunctioning of sterilization equipment may endanger the health of the patients. Similarly, patients will avoid visiting health facilities that do not possess functioning diagnostic equipment.

Thus the justification for introducing an HTM Service is that it will benefit you economically and clinically, by ensuring that healthcare technology continues to meet the standards required throughout its working lifetime.

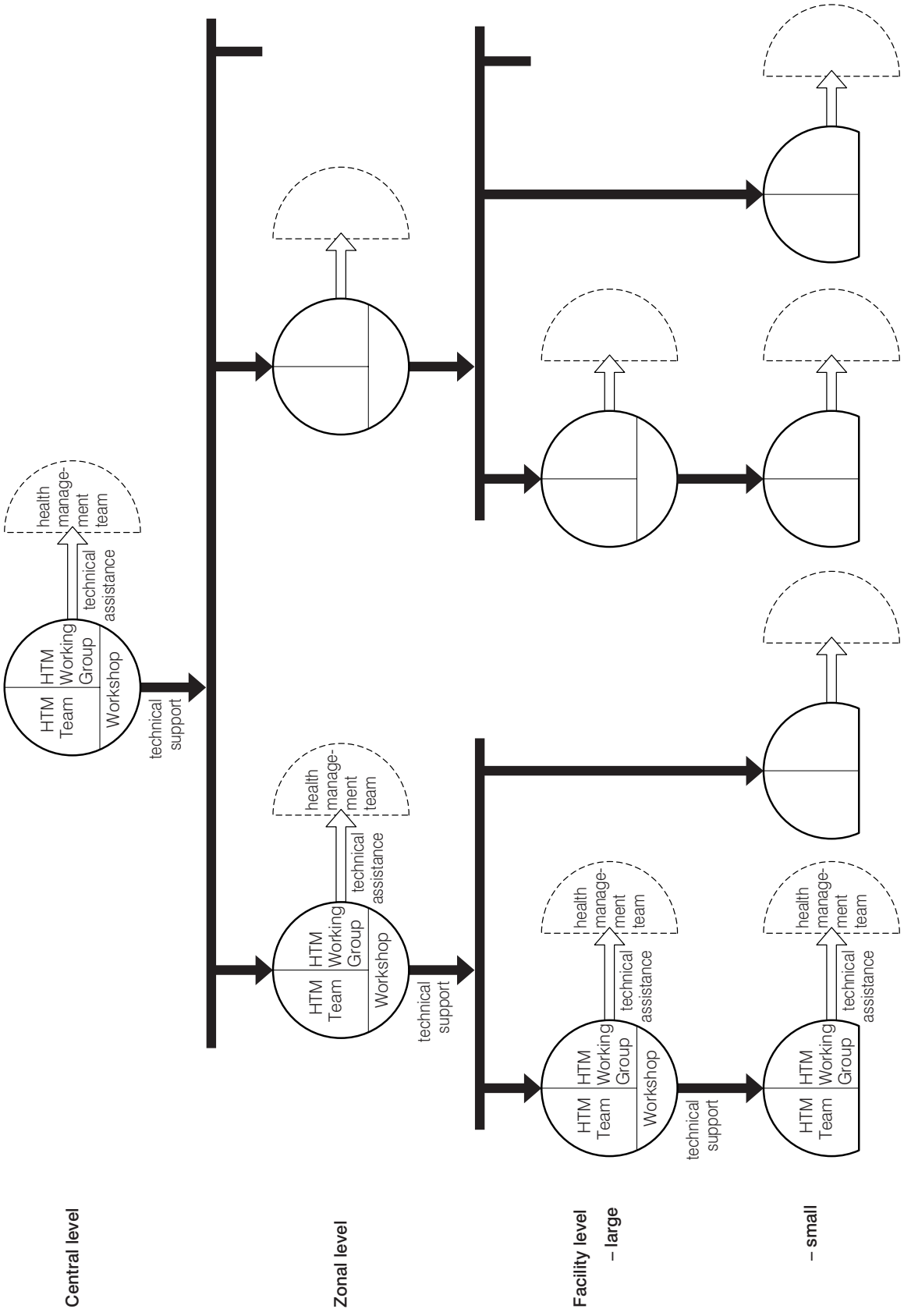
The activities of an HTM Service belong to the service provision function of health systems. However, the government may wish to take a regulatory role and establish regulations that guarantee that HTM occurs. To achieve this, it will be necessary to have:

- a government body to provide regulations that will ensure the continued performance and safety of healthcare technology throughout its life
- a control mechanism to check that all health service providers pursue these healthcare technology management activities effectively
- legal or other sanctions that are enforceable if the rules are infringed.

The government body responsible for providing regulations could be the central level of the national HTM Service. Each health service provider could then develop its own HTM Service. It should involve a network of teams and committees that enable HTM to be practised in all facilities. In order to establish an effective HTM Service, you will need to provide sufficient inputs, such as finance, staff, workshops, equipment, and materials. Only in this way will you get the outputs and benefits that you require. For details of how to develop such an HTM Service, see *Guide 1*.

The organizational chart for the HTM Service will vary depending on the size of your country and your health service provider organization, and whether you are just starting out. However, *Figure 7* provides an example of the relationship between HTM Teams and HTM Working Groups (*Section 1.1*) that we envisage.

Figure 7: Sample Organizational Chart for the HTM Service



How to Manage Change

The regulatory requirements presented in this Section may appear somewhat idealistic, compared to the reality in many health systems. However, the aim is not to highlight the deficiencies of existing systems, but to provide a blueprint for a functioning healthcare technology management system. Hopefully, this will enable you to get the right framework conditions in place, and thus improve the effectiveness and the safety of your health services.

We are **not** recommending that your health service provider:

- throw out all their current HTM strategies and start again
- make sudden and sweeping changes that are likely to fail if they are over ambitious.

Rather it is better to take a step-by-step approach, introducing changes gradually, with a careful review process. To implement an HTM system with all the complexities described in this Series of Guides will take several years, and to try to achieve everything at once could be disastrous. However for healthcare technology management to improve, it is important to act.

It is possible to write down all the correct procedures and yet still fail to improve the performance of staff. To ensure that your HTM procedures are effective, it is important for there to be good managers who can find ways to motivate staff (*Section 8*). Simply ordering staff to implement new procedures usually does not work. It is much better to discuss and develop the procedures with the staff who will implement them. This could take the form of discussion, working groups or training workshops. People who are involved in developing ideas about their own work methods are more likely to:

- understand the objectives
- understand the reasons why processes are necessary
- be encouraged to change their way of working
- be more interested in making changes which result in improvement
- see that the aim of the HTM procedures is to improve their delivery of healthcare.

We recognize that many readers will face difficulties such as staff shortages, poor finances, lack of materials, a lack of influence and time, and possibly even corruption. Introducing new rules and procedures into a system or institution that has no real work ethic, or which possibly employs dishonest workers, will not have any significant effect.

Therefore, strategies may be required to bring about cultural and behavioural change. For example:

- when materials are short, instead of focussing upon breakages and loss, place more emphasis upon the importance of staff working hard and putting in the hours
- favour good managers who are seen to be present and doing what they preach
- encourage an atmosphere where staff are praised for good work, rather than a culture of judgement and criticism.

Introducing rules and administrative procedures alone will not be sufficient to bring about cultural change. You will also need to find ways of increasing performance and productivity, and acknowledging/rewarding good behaviour is essential. For example:

- it is better to break a tool while actively undertaking maintenance, rather than breaking nothing but never doing any work
- it is better to break a rule in an emergency (such as withdrawing stocks from stores), rather than stick to the rules and risk the possible death of a patient.

Annex 2 has some examples of useful reference materials. To bring about such changes, you will require skills in:

- managing change
- staff motivation
- effective communication
- encouragement, and
- supportive training with demonstrations.

All parties involved in the network of HTM Teams and HTM Working Groups need to participate in developing the HTM Service. This will encourage a sense of ownership of the Service and its responsibilities, and will lead to greater acceptance and motivation among staff. If you are short of skilled staff (such as technicians, managers, planners or policy-makers), you may need to obtain specialist support to assist with some of these tasks.

2.2 BACKGROUND CONDITIONS SPECIFIC TO THIS GUIDE

Your country and health service provider may have existing regulating principles and conditions which will affect, or can inform, aspects of your planning and budgeting work.

You will need to find out whether the regulations and policies discussed in this Section exist in your country and organization. If they do, it makes sense to follow them. If such regulations do not exist, you will need to highlight these issues at the central level of your organization, and continue to follow the advice provided in this Guide at your level.

Responsible Management Authorities

If you work for a health service provider organization, you must conform to:

- any existing regulations and guidelines concerning equipment planning and budgeting, which are produced by the central management body.

In addition, there may be professional bodies which provide guidance for their area of expertise. For example:

- the National Board of Survey, which has regulations and procedures on decommissioning and disposal of equipment. These cover the condemning, boarding, and auctioning of equipment at the end of its life.

Responsible Finance Authorities

If you work for a health service provider organization, you must work within the financial resources allocated to you. Thus you must conform to:

- the regulations and guidelines produced by the central Finance Office (for example, the treasury in the government system), such as:
  - any accounting policies and procedures covering budgetary processes
  - any budgetary limitations and criteria set by the central level of your health service provider (such as guidelines on maintenance expenditure as a percentage of health facility operational budgets)
  - any financial policies and procedures which govern stock management and expenditure accounting
  - any local regulations regarding co-financing schemes.

Central Plans for the Health Service

When making plans which will introduce changes to your work, your health facility, or your district/region, you must conform to:

- the overall central plans and aims of your health service provider.

Individual health facilities and district authorities should not work independently of the plan for the health service as a whole. In equipment terms, there are several key areas where this especially applies:

The 'Vision' for the Health Service

As explained in *Section 2.1*, every health service provider needs a realistic Vision of the services it can offer, so that it can decide what equipment it should own, and prioritize the actions to take to develop its stock of equipment. *Section 4.2* describes how to develop a Vision.

Your country and health service provider may already have developed central level guidance such as Essential Service Packages. But many countries and organizations may not have defined the functions for each level of healthcare delivery, or written them down in a policy document. This makes it very difficult to plan, since there is no framework on which to base decisions. Thus, you should conform to:

- any guidance from your health service provider on the direction of healthcare delivery for your level of facility.

When developing Essential Service Packages, be careful to ensure that you can afford the technology implications. For example, you may wish to improve equity of access and think it ideal to move a service, such as CT scanning, from central level to regional (provincial) level. But if there are five regions, you will require not only five times the pieces of equipment, but also five times the qualified staff, consumable items, support services and energy supplies. You may find instead that it is more cost-effective to transport patients to the central unit. Thus the money might be better spent on improving the central unit and the patient referral transport system.

There are many issues affecting service delivery in the future which are still being aired in international discussion documents. For example, the changing disease profile is likely to affect both care and equipment requirements. Also, controversies are being examined for lessons learnt, such as the need in some countries to re-centralize in order to be able to afford and manage services (see *Annex 2*).

Model Equipment Lists

Once you have drawn up a Vision for health service delivery, you can determine what types of healthcare interventions to offer at each service level. Next, you must define what equipment is required.

This is done by drawing up Model Equipment Lists, which describe what equipment is essential for providing each healthcare intervention. (The process of developing such lists is described in *Section 4.3*). When drawing up Model Equipment Lists, you should conform to:

- any guidance from your health service provider on equipping levels for your facility.

Since Model Equipment Lists are linked to the healthcare interventions you carry out, they will not necessarily be tied to specific rooms. However, when drawing up Model Equipment Lists, it is also important to consult with architects, to determine factors such as room size, accessibility and flow patterns, based on the function of the room. Such minimum room standards ensure that the furniture and equipment can fit into the space in an orderly and effective way. Your plans should include the number of square metres, the requirements for water, electricity, light levels and any other factors which could have an impact on equipment use and accessibility (see *Annex 2*). These building aspects are often forgotten. Thus, you should conform to:

- any guidance from your health architects on the space requirements for your Model Equipment Lists.

When planning equipment, it is also important to remember the other capital investments (outside the Model Equipment List), such as training requirements, and buildings and utilities (power, water, waste management). These investments are significant and often are a pre-condition, before you can start to make wise equipment investments. Thus, you should conform to:

- any guidance from your health service provider on the other capital investments arising from your equipment plans.

Purchasing, Donations, Replacement, and Disposal Policies

To avoid wastage, you need to ensure that equipment is acquired in a rational and planned way. Equipment should be obtained according to good policies and procedures, covering both the disposal and replacement of existing equipment, and the purchase and donation of additional items. (The development of such policies is described in *Section 4.4*). Thus, you should conform to:

- any policies of your health service provider which guide you on valid reasons for replacing equipment and obtaining new items.

Where possible, you should introduce an element of standardization when acquiring equipment in order to gain technical, financial, logistic, procedural, and training benefits (*Section 2.1*). However, government or institutional procurement guidelines often do not allow direct procurement, but stipulate procurement through tenders based on generic specifications (see *Guide 3*). In such cases, the only way to introduce a level of standardization is to procure for many health facilities at one time. For example, the whole country, region, or organization might replace all their suction pumps at the same time and a standard can evolve. Thus, you should conform to:

- any standardization policies of your health service provider.

Procurement on an individual facility basis will almost certainly produce many one-off examples of different types of equipment which are not economical to maintain. To avoid such issues, it is very important to combine forces with other facilities when planning and purchasing new equipment. In order to make the planning of such procurement possible, it is almost mandatory to have a computerized inventory and procurement system. Thus, you should conform to:

- any strategies introduced by your health service provider for collaboration between bodies during planning and procurement.

Generic Equipment Specifications

Once you have developed Model Equipment Lists, it will be necessary to describe the equipment required in detail. This is necessary to ensure that you acquire the types of equipment you want (this applies equally whether your equipment is received through procurement or via donations). *Section 4.5* gives further advice on how to write such Generic Equipment Specifications. Thus you should conform to:

- any equipment specifications developed by your health service provider.

Generic Equipment Specifications will also enable you to conform to the standards set by government, and to continue to meet the standardization policy of your health service provider.

Availability of Management Skills

This Guide presents a detailed and complete description of the planning and budgeting process. To carry out the procedures outlined here, you will require a reasonable number of well trained staff. In many countries, this level of management skills may be available at national level or in large hospitals, but will be a problem at district level.

The current decentralization efforts in the health sector will bring about significant changes in the management and procurement of healthcare technology. District managers may be asked to quantify and specify all future procurement activities. This task is large and complex and the present skills of district managers in some countries will be inadequate.

For these reasons, it may be necessary to:

- encourage planning, budgeting, and procurement tasks to be carried out at central level for those facilities and service levels which cannot undertake the whole management process themselves
- encourage district managers to understand the process and be aware of what they are able to manage, and where they need help.

Economies of Scale

With an improved management system, decentralization can promote accurate and timely decision-making. However, there will still be a need for central policy guidance on equipment levels and technical specifications, because it will not be economical to develop such knowledge at district level. This is an example of how the economy of scale for technical knowledge will challenge the decentralization process.

A second example of a challenge to decentralization is the economy of scale required in procurement. Procurement of small quantities increases the initial cost and the life-cycle costs of equipment (*Section 3.3*), because you cannot benefit from the savings that bulk-buying offers. More details of procurement options are provided in *Guide 3*.

When making a needs assessment for one hospital, you are likely to arrive at low quantities of a broad variety of equipment. So undertaking calculations at facility level will not enable you to benefit from economies of scale. Instead, by combining procurement for several facilities at the same time, and gaining the resulting standardization, you can obtain significant advantages. These include better prices for new equipment and spare parts, shared training costs and improved after-sales commitment from the supplier.

Thus it is preferable to:

- undertake equipment management and needs assessment at district or regional level, and merge procurement needs for a number of facilities or districts. This will result in the ideal combination of accurate management and procurement advantages, proportional to the economy of scale.

You may face problems with this rationalization and savings strategy when donors target funds at individual facilities or districts. Thus it is preferable to:

- ensure donors follow your Model Equipment Lists, Generic Equipment Specifications, and standardization policy, in order to overcome the drawbacks.

Box 4 contains a summary of the issues covered in this Section.

BOX 4: Summary of Issues in Section 2 on Framework Requirements

Quality Health Services	**Government**	◆ actively regulates health services, whether they are delivered by public providers, private providers, or a mixture of the two ◆ develops checking systems and legal sanctions for infringement of health regulations ◆ adopts suitable standards for quality health services, in general ◆ specifically for healthcare technology, adopts standards for: - design, development, and manufacturing - performance and safety - use and training - waste disposal ◆ develops donor regulations to ensure all equipment received through foreign aid and donations also comply with the standards ◆ establishes public or quasi-public supervisory bodies to enforce regulations and standards.

Continued opposite

BOX 4: Summary of Issues in Section 2 on Framework Requirements (continued)

Quality Health Services	**Ministry of Health**	◆ develops national policies for health services ◆ specifically develops a Healthcare Technology Policy to cover all healthcare technology management activities including: - a Vision - an element of standardization - the provision of maintenance - provision of finances for all HTM activities - the organizational structure for an HTM Service ◆ regulates on these issues (if required) ◆ develops an HTM Service made up of a network of teams and working groups ◆ uses the central level of the HTMS as the national regulatory body, if necessary, and to ensure that HTM policies are implemented ◆ provides sufficient inputs to ensure the HTMS is effective ◆ uses strategies to manage the changes involved carefully, so that they can be successful.
	All Health Service Providers in general	◆ conform to regulations and guidelines provided by government ◆ conform to the standards set by government ◆ follow the policies of the Ministry of Health if regulated to do so ◆ develop their own internal Healthcare Technology Policy and expand strategies ◆ develop their own HTM Service made up of a network of teams and working groups, with sufficient inputs to ensure it is effective, in order to ensure that HTM policies are implemented ◆ follow MOH regulations on the HTMS if regulated to do so ◆ implement strategies to develop skills in managing change, staff motivation, effective communication, encouragement, and supportive training with demonstrations ◆ introduce rules and procedures using discussion, working groups, training workshops, etc. with the staff that will implement them ◆ include all parties involved in the network of HTM teams and working groups in the development of the HTMS ◆ introduce changes to HTM step-by-step, with a careful review process.

Continued overleaf

BOX 4: Summary of Issues in Section 2 on Framework Requirements (continued)

Planning and Budgeting	**All health staff and managers**	◆ Conform to regulations and guidelines provided by relevant bodies on: - equipment planning and budgeting - decommissioning and disposal of equipment - accounting policies and procedures - budgetary limitations and criteria set for different activities - financial policies and procedures that govern stock management and expenditure accounting - co-financing schemes.
	Health Service Providers	◆ Provide central guidance on: - the Vision for the health service and Essential Service Packages - equipping levels for your facility (Model Equipment Lists) - purchasing, donations, replacement, and disposal policies - the development of Generic Equipment Specifications.
	Managers (at each level of your organization)	◆ only undertake planning and budgeting at suitable decentralized levels in your organization where sufficient management skills are present ◆ use economies of scale to your advantage by: - making use of technical skills and guidance from levels where the knowledge exists - combining forces with other levels to undertake needs assessment, and bulk-buy equipment and supplies in order to gain from procurement savings and standardization.

3. HOW TO DISCOVER YOUR STARTING POINT – PLANNING TOOLS I

Why is This Important?

In order to manage your equipment effectively, you need to have a clear picture of your current stock and supplies – it is very difficult to manage an unknown.

You need to know the value (quantity and cost) of your equipment, so that financial planning is not guesswork. You also need to understand your likely expenditure on equipment-related activities such as training and maintenance.

Finally, to help you budget effectively, you also need to determine your rate of use of equipment. In this way, you can draw up a realistic estimate of the inputs you need.

Before you can carry out any planning or budgeting, it is necessary to know where you are starting from. Thus you need some *baseline data* which will help you to understand your present equipment situation.

To analyze your equipment situation effectively, you need to draw upon some important 'planning tools'. This Section covers four such tools, and discusses how to determine your starting point by:

- keeping an up-to-date Equipment Inventory (*Section 3.1*)
- knowing the value of your stock of equipment (*Section 3.2*)
- having budget lines that are sensitive enough to show equipment expenditures (*Section 3.3*)
- discovering your rate of use of equipment-related consumable items (*Section 3.4*).

Some health providers may already know a great deal about their equipment. This will vary, depending on how much planning and budgeting of equipment has already been carried out. Your level of equipment knowledge will depend upon:

- your country
- your health service provider
- which level of the health service you work at
- the degree of autonomy of your health facility.

This Section describes how to undertake one-off exercises to establish the tools needed to plan and budget for your equipment. Different activities are described for the different health service levels. This work will help you to analyze your own present situation.

How to use these tools in the planning and budgeting process is described in *Section 7*. *Section 8* discusses how to monitor and review these tools.

3.1 THE EQUIPMENT INVENTORY

3.1.1 Understanding Inventories

One planning tool you need is an **Equipment Inventory**. This provides you with all the details of the equipment that you currently own.

Usefulness of Having an Inventory

It is very important to know all about your current stock of equipment, so that:

- any allocation of resources is an objective assessment, and not guesswork; (therefore budgets are based upon the actual quantity of equipment owned)
- you can manage equipment effectively, because you are not dealing with unknown quantities; (for example, the HTM Manager knows how many suction pumps to include in the planned preventive maintenance programme)
- you can calculate what you can afford to operate or run; (therefore you do not overestimate or underestimate the consumables required, and set your recurrent budgets accurately)
- you can develop realistic plans for the future, because you know your current equipment situation; (therefore you do not waste funds procuring new equipment while neglecting the replacement of existing essential items).

As an example, we can consider the importance of an inventory for planning maintenance activities:

- if you want your equipment to function, you must maintain it
- if you want to maintain your equipment stock, you must budget for maintenance
- to be able to budget adequately, you must have an idea of the value of what you own.

Did you know?

Knowing what you own means:

knowing	-	what there is	*type/sorts*
	-	how much of it there is	*quantity*
	-	where it is	*location*
	-	what condition it is in	*status*
	-	how far it is in its life-cycle	*age/expected* life
having	-	some way of updating the information	*accuracy*

The method for doing this is to keep an **Inventory** of your equipment.

An Equipment Inventory is an important tool because it enables you to:

- identify the shortfalls in your equipment stock (once you have developed a Model Equipment List to compare it to – *Section 4.3*)
- implement your equipment replacement and disposal policies (*Section 4.4*)
- implement your equipment purchasing and donations policies (*Section 4.4*)
- calculate the new value of your equipment stock (using up-to-date prices) which will be used for calculating your budgets (*Sections 3.2, 5 and 6*).

What is an Inventory?

An inventory can consist of several separate lists of specific types of equipment (such as medical equipment, plant, furniture or workshop tools), or a combined list of all equipment types.

Box 5 (overleaf) shows the sort of information to gather when taking the equipment inventory as a minimum. Additional information can be gathered and either kept with the inventory or separately (see *Box 6*). Your inventory can be:

- simply a compilation of these record sheets, containing lists of the equipment found in each department
- or you can enter the information gathered onto an Inventory Form for each piece of equipment
- or you can enter the information into a computer program.

Such a listing can then be organized and sorted in many ways. This is easiest if you have a computerized inventory, although sorting information is possible with a card index system. You can sort the information in ways which are of use to you, such as:

- alphabetically by product (for example, defibrillator, microscope)
- by location
- by manufacturer
- by use/function
- by age
- by your inventory code number.

If your Equipment Inventory covers a wide range of facilities or many items, you may have to prioritize what to include on the listing. For example, are you going to list every scalpel and stethoscope? Or can you simply list the number of different surgical sets (so long as the contents have been agreed), or only list items above a certain value?

BOX 5: Record Sheet for taking the Equipment Inventory (showing the basic essential data to gather)

Description:

			Date Inventory Taken:						
Facility:			**Department:**			**Section:**			
Location/ Room	Type of equipment	Inventory code number	Name of manufacturer	Model name and/or number	Manufacturer's serial number	Year made or bought	Supplier bought from	Status/ Condition	Your property or leased?
		(your own number)			*(factory number)*				

Example 1:

			Date Inventory Taken:						
Facility: Green Rural Hospital			**Department:** Maternity			**Section:** Labour Ward			
Location/ Room	Type of equipment	Inventory code number	Name of manufacturer	Model name and/or number	Manufacturer's serial number	Year made or bought	Supplier bought from	Status/ Condition	Your property or leased?
Examination	Foetal doppler	GR 123456	HNE Diagnostics	FD II	HNE-863b	2000	AB & Sons	working OK	Leased
Delivery	suction pump	GR 123029	Eschmann	VP35	760-819-MN	1999	BCD Company	working OK	Own

Example 2:

			Date Inventory Taken:						
Facility: Blue District Hospital			**Department:** Kitchen/Canteen			**Section:** Kitchen			
Location/ Room	Type of equipment	Inventory code number	Name of manufacturer	Model name and/or number	Manufacturer's serial number	Year made or bought	Supplier bought from	Status/ Condition	Your property or leased?
Cooking area	stove	BD 198765	Vulcan	model 6	435R/Z6	1995	Vulcan Ltd	replace 1 plate	Own
Food prep	refrigerator	BD 198123	GEC	MCC 660	1357-2468C	1990	Vulcan Ltd	OK but old	Own

Experience in Kenya

The Aga Khan Foundation (private) hospital found that if they listed everything, the contents of their Equipment Inventory would be quite comprehensive. Thus they decided to agree on an accounting definition of what should be called a 'capital item'. For equipment, they chose a 'capital item' to be anything which:

- *has a cost of US$250 or more*
- *has a life of at least one year; and*
- *is a distinct tangible object.*

Other information about the equipment should also be kept on file, but does not necessarily have to form part of the inventory. *Box 6* shows the types of other data that need to be kept. You may choose whether to keep this information on the inventory itself, or to enter it into the maintenance Service Histories for the equipment (see *Guide 5*).

One factor which will help you in deciding what data to include in the columns of the record sheet, is the level of knowledge of those filling in the sheet. If there is data which is kept by a different department (such as the purchasing department), or is only known by specialists (such as HTM Managers), this information could be kept in a separate record system.

BOX 6: Other Types of Equipment Information to Keep

- the address of the manufacturer and local agents
- the address of the supplier and local representative
- technical ratings
- date when the warranty expires
- the price paid
- any external funding agency involved
- stocks of consumables, accessories, and spare parts received
- results of inspection tests undertaken on commissioning
- the frequency of planned preventive maintenance required
- details of any maintenance contract and maintenance contractor
- maintenance history.

An initial exercise will be required to establish both the Equipment Inventory and the inventory code numbering system. However, decisions on code numbers should not delay the establishment of the Equipment Inventory. Specialist support may be required to assist with these processes.

After the initial exercise, the upkeep of the Equipment Inventory and the inventory code numbering system is part of the routine work of the HTM Teams, as part of their equipment management activities (*Section 8.1*).

3.1.2 Establishing the Equipment Inventory

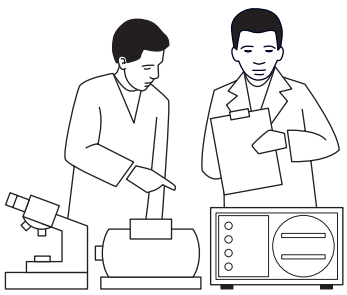
Who is Responsible for the Equipment Inventory?

Many health service provider organizations have a General Inventory for their facilities kept by Stores personnel. This covers **everything** found in each department (including such items as furniture, plastic and glassware, waste bins, notice boards, wall clocks). A record of the contents of each room is kept on a card (often found on the back of the door), and a paper copy is held in the Stores. Items are often painted with their Stores code number.

However, the details contained within this General Inventory are generally insufficient to enable equipment or maintenance plans to be made. Also, the data is not easily updated or manipulated on a computer. For this reason, a separate record is required, which is known as the **Equipment Inventory**. This covers technical details and is restricted to items of **equipment** – in other words, those items which require maintenance throughout their lives.

Preference

You should aim to introduce an equipment inventory system that is uniform across the whole of your health service organization. This is preferable to allowing each facility to collect different details and use different forms (though even that is better than having no inventory at all). If all facilities collect the same type of information, the data can be compiled at some point to form an inventory for the whole organization, and can more easily be entered into a computer system using common software.



Who?		Takes what action?
HTM Teams (*Section 1.1*)	→	Manage the equipment inventory
Which level?		**Takes what action?**
Central HTM Team	→	- Ideally, designs the inventory system (the forms plus the data collection process). - Probably computerizes the system as the team must be able to manipulate data for the whole health service. - Shares a paper or computer version of the inventory with each facility and district/region.
Facility and/or District HTM Teams	→	Gather the data, keep a paper copy of their inventory, update the information annually, and feed back any changes to the centre.

Tip

- Your health service provider might not have developed a service-wide inventory. Do **not** let this prevent you from having an Equipment Inventory at your health facility. You can encourage your central HTM Service to establish an inventory system, but in the meantime you can gather your own inventory data and use it for planning purposes.

How to Create the Inventory

An initial inventory should take place, in which a team of staff (including technical personnel) visits each department, physically checking each piece of equipment, and writing down all the details. *Box 5* shows an example of a record sheet which can be used for taking an inventory. A list of tasks involved is highlighted in *Box 7*. The amount of work involved in undertaking such an exercise should not be underestimated. This is a large task, since every room, cupboard, drawer, worktop, shelf, and store room must be investigated. If you are undertaking an inventory for the first time for a whole district or country, you may need to hire specialist support to help you with the task.

The inventory can consist of a manual paper record or a computerized file. It does not matter which, because the sort of data that you must record is the same whether you are designing the layout of a card or the fields on your computer screen. The master copy of the Equipment Inventory can be stored on computer, so that data manipulation and updating is easy. However, for daily referral to the inventory, hard copy print-outs can be used.

Annex 2 provides references which discuss the possibility of computerizing your inventory, and provides details of some inventory software products that are available.

To ease the workload for the small HTM Teams, support from secretarial and computing staff can be used to assist with data entry.

BOX 7: Taking the inventory

Body	Responsibility	Activity	People involved
HTM Service	Creates and updates the Equipment Inventory	Organizes the gathering of inventory data.	Either by: ◆ facility staff for their own facility ◆ district/regional staff for the facilities in their district/region ◆ central staff for the health service as a whole ◆ using specialist help.
Inventory Team	Carries out the Equipment Inventory at each facility	Visits each department in the health facility, and: ◆ looks in all rooms, cupboards, etc. ◆ physically checks all equipment for the details required (see *Box 5*) ◆ fills in the Equipment Inventory Record Sheets (see *Box 5*). If existing records are available: ◆ modifies or expands the information as necessary to cover new items ◆ fills in any gaps ◆ corrects entries ◆ updates data in order to make the Equipment Inventory as accurate as possible.	Due to the workload and knowledge required, it is useful for the team to be made up of: ◆ two maintenance staff (from the relevant HTM Team) ◆ a senior equipment user from the facility ◆ a member of staff from the department being studied (who changes as you move from department to department). As a bare minimum you could try using one member of maintenance staff and one member of departmental staff (who changes as you move from department to department).
HTM Teams	Compile the Equipment Inventory. Make hard copies.	◆ Enter the data gathered, either onto an inventory card or a computer screen, for each individual machine. ◆ Create summaries, prepare and print out hard copies ◆ Provide a copy of the Equipment Inventory to the Stores Controller for inclusion in the General Inventory held by Stores.	Make use of trained technical staff and secretarial/computing support to assist with data entry.

Continued opposite

BOX 7: Taking the inventory (continued)

Body	Responsibility	Activity	People involved
Central-level HTM Team	Develops the Equipment Inventory as an active (regularly updated) computer file, as well as a hard copy print-out. Analyzes the Equipment Inventory for planning purposes (*Section 7.1*).	◆ Uses the computer software packages required for this purpose (for example, word-processing spreadsheets or specific commercial inventory products – see *Annex 2*), which staff have been trained on.	Makes use of support from staff trained in keeping computerized records.

Periodic Updating of the Inventory

An inventory is an active record – in other words, it must be kept up-to-date if it is to be of any use. Data used for planning purposes is of little use if it is out of date. You should update your inventory periodically throughout the year, whenever new data is received which is relevant to the inventory. There should also be a formal annual updating process (*Section 8.1*).

The HTM Teams should use the many opportunities during their work throughout the year to regularly gather data for updating the Equipment Inventory, such as:

- when new equipment purchases and donations arrive, information will be entered onto the Equipment Inventory when the equipment is commissioned and the 'Acceptance Test Logsheet' is completed (see *Guide 3* on procurement and commissioning)
- whenever equipment is serviced or repaired throughout its life (see *Guide 5* on maintenance management)
- whenever equipment is taken out of service (see *Guide 4* on operation and safety).

Possibly every month or quarter, HTM Managers should oversee the inventory updating process and make sure the following happens:

- A record of any changes is kept on the hard-copy print-out of the Equipment Inventory.
- The computer inventory file is regularly updated by entering into the computer any comments from the hard-copy print-out, as well as removing from the inventory any 'written-off' (condemned) items (see *Guide 4*).
- A formal annual inventory update is organized (*Section 8.1*).

3.1.3 Establishing Inventory Code Numbers

What is an Inventory Code Numbering System?

Inventory codes are numbers that the HTM Service uses to label each separate piece of equipment, so that individual machines can be identified from among many similar items. It is important to be able to do this so that, for example, you could consider the service history (see *Guide 5*) of a specific suction pump, for example, compared to the performance of all suction pumps in general.

Various types of inventory code numbering systems can be used, and *Box 8* shows the advantages and disadvantages of the various options. It is possible to make your system as sophisticated (complicated and informative) or as basic (simple but less informative) as you like.

BOX 8: Types of Inventory Code Numbering Systems

Options	Advantages	Disadvantages
Basic Sequence Number The inventory code numbers simply start at 'one' and continue endlessly into the thousands. Each new item is simply allocated the next number on the list, whatever type of equipment it is or wherever it is going to be located.	Ideal for computerized inventories. The number is used to search the computer database to reveal all the data stored about that particular machine.	By looking at the number you cannot tell anything about the machine. You need to have a centralized master list to see which is the next number to be allocated.
'Speaking' Numbers This is a system where a code number is used, which tells you something about the equipment. Different parts of the code are used to mean certain things. For example, the code could be T1 199 02. In this case, the first part of the code (T1) tells you about the location (Theatre 1). The second part tells you the equipment type (199 being your code for suction pumps), and the third part identifies the individual machine (i.e. your second suction pump in Theatre 1).	From the code number you can identify the location of the equipment, the equipment type, and which specific machine you are dealing with. Speaking numbers can be made with as many parts as you like which tell you additional things about the equipment (such as the facility or the region)	The list of numbers which make up different parts of the code (e.g. 199 = suction pumps) has to be agreed, allocated, and understood by the HTM Teams. If the location of the equipment changes, the number will also have to be altered.
A Barcode Commercial barcode stickers are purchased, which can be read by barcode readers. The information is then transferred to a computer. Software programming is required to link the reading from the barcode to details about the equipment.	You don't need to paint large sequences of numbers onto the equipment. This is a computer-based system.	By looking at the barcode, you cannot tell anything about the machine. It can only be used with a computerized system. You need a regular supply of barcode stickers, barcode readers, and a software program.

Country Experiences

The central health ministry in Malawi uses a basic six-digit sequence number that refers to the equipment record kept in a computerized database. Whenever work is undertaken on a piece of equipment, typing in the basic number into the computer means that the inventory details and maintenance history of that item are displayed on the screen.

The Central Maintenance Department of the public health service in El Salvador developed a sophisticated 13-digit inventory code numbering system, which contained details of the type of equipment and its location. This required a great deal of knowledge (technical, medical, and administrative) among the staff responsible for allocating the numbers. However, using the skills of the knowledgeable personnel, they were able to develop a small code booklet, which is now used by technicians to look up the correct numbers.

The central health ministry in Namibia decided to stick barcodes onto their equipment, instead of having an inventory code number painted onto each item. They acquired a commercial barcoding system to program and install on their computers, and scanners with which the technical staff can read the codes.

Who is Responsible for Inventory Code Numbers?

Preference

You should aim to introduce an inventory code system that is uniform across the whole of your health service organization. This is preferable to allowing each facility to use a different code system (though that is better than having no system for identifying equipment at all).

Who?		Takes what action?
HTM Teams	→	Manage the inventory code numbering system
Which level?		**Takes what action?**
Central HTM Team	→	Ideally, designs the inventory code numbering system, and shares it with each facility and district/region.
Facility and/or District HTM Teams	→	Implement the system, and put the numbers on the

Tip

- Your health service provider might not have developed a inventory code numbering system. Do not let this prevent you from using some method of identifying equipment at your health facility. You can encourage your central HTM Service to establish an inventory code numbering system, but in the meantime you can label your own equipment.

How to Create the Inventory Code Numbering System

The HTM Service should undertake an exercise to develop an inventory code numbering system, and should consider the options available as shown in *Box 8*. Specialist support may be required to assist with these processes. Once a system has been set up:

- Existing machines and maintenance records (see *Guide 5*) must be labelled with their inventory codes (stickers or marker pen can be used).
- New equipment must be allocated a code during the commissioning and acceptance testing process (see *Guide 3*).

Tip • Never label your surgical instruments by scratching or etching letters onto them (such as the name of the facility). This removes the protective layer and causes dirt and water to collect in the grooves, which results in corrosion, staining, or rusting. Rust weakens instruments and will eventually cause them to break. Also the grooves make it very difficult to decontaminate the instruments adequately (see *Guide 4*).

3.2 STOCK VALUE ESTIMATES

It is preferable to have a planned approach to the financing of healthcare technology. Many calculations which can help you to decide the finances required for equipment are based on a percentage of the equipment stock value. For example, in *Section 6.1* when calculating maintenance costs for your equipment you will use an internationally recognized percentage of your equipment stock value. This is necessary because your maintenance budget must be based on the capital value of your equipment.

If you do not know the value (quantity and cost) of the equipment you own, any planning is likely to be purely guesswork. Therefore it is necessary to calculate your **Equipment Stock Value** (your second planning 'tool'). Once you have worked out this figure, any other calculations you make will be directed towards providing the resources needed to sustain your existing stock.

In many countries no equipment stock values have been estimated, usually because no equipment inventories exist. This means that all equipment budget allocations are based largely on guesswork, rather than being based on calculations of the real finances required to keep equipment functioning.

Tip • When calculating stock values, it is best to use **current and up-to-date** prices for the equipment. It is much more difficult to calculate the actual present value of the stock because you will have to allow for depreciation in value over time, and decide which of the many depreciation methods to use. Also, by basing your calculations on the price you originally paid for the equipment, you will always be out-of-date. By calculating Equipment Stock Values 'as new', your replacement and maintenance estimates will always be linked to current prices.

Who is Responsible for Stock Value Estimates?

Who?		Takes what action?
The HTM Working Group, or possibly a smaller pricing sub-group (*Section 1.2*)	→	Is responsible for developing equipment price lists and stock values.

Which level?		Takes what action?
Any level of the health service (central, region/district, facility)	→	Can develop stock value estimates.

How to Make Stock Value Calculations

Anyone can develop stock value estimates if they have access to two things:

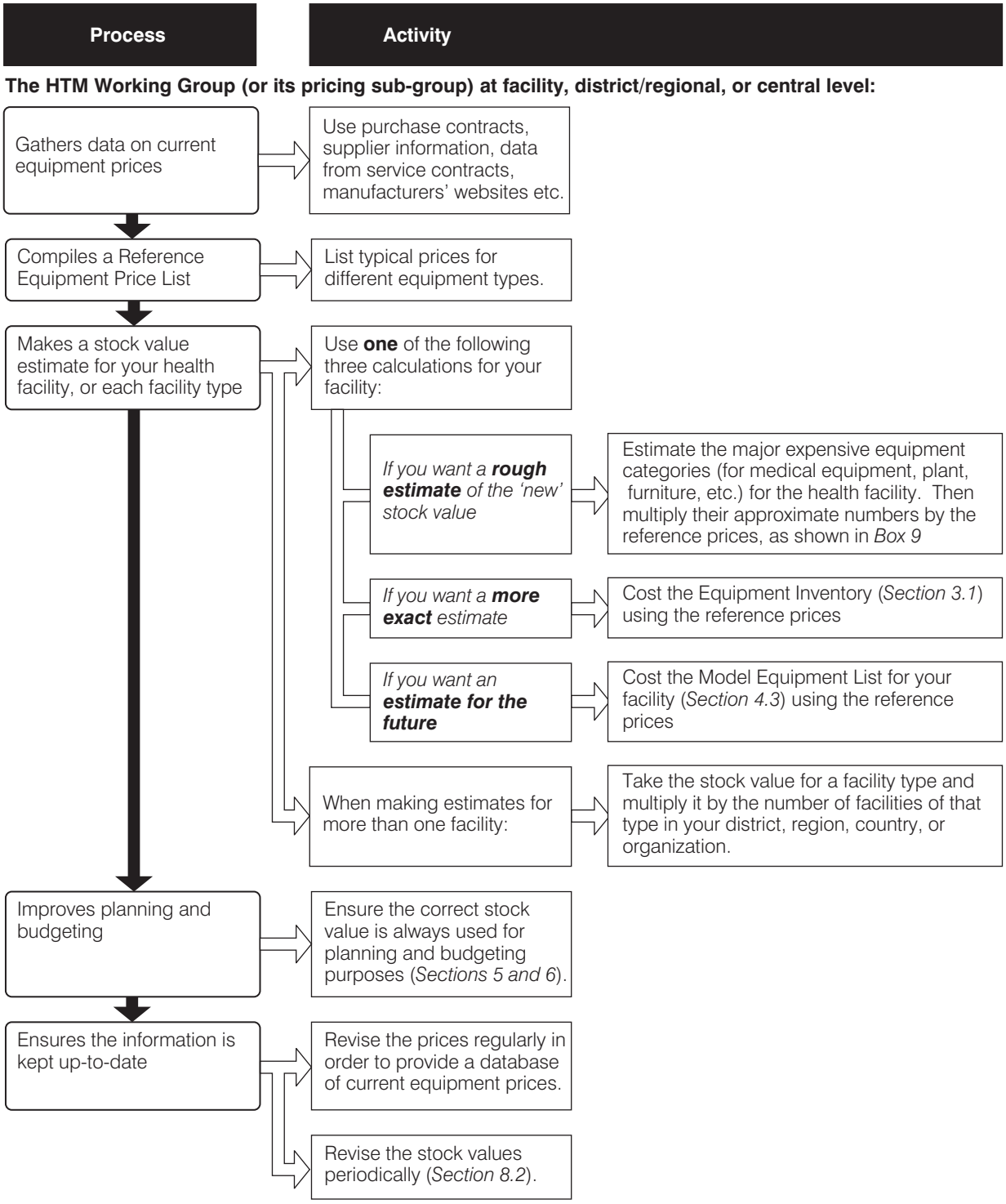
- the Equipment Inventory (*Section 3.1*)
- a Reference Equipment Price List.

A Reference Equipment Price List is useful as you can look up the typical approximate prices for any type of equipment. A list of possible types of equipment, together with their expected product lifetimes, is given in *Annex 3*. In the same way, you can also develop a list of typical prices against different equipment types. You can develop this by:

- starting slowly with the prices of recent and known purchases
- building it up over time as you get further quotes
- researching current prices over time, for example on the internet (see *Annex 2*).

The next step is to calculate equipment stock values. Details of how to do this are given in *Figure 8*.

Figure 8: How To Estimate Total Equipment Stock Values



Box 9 shows a rough estimate of equipment stock values by equipment category, for an imaginary 120-bed district hospital. We recognize that, in some countries, the contents listed would be for a larger hospital, or for a hospital offering secondary level healthcare services.

BOX 9: Example of Equipment Stock Values for a 120-bed District Hospital (in 2003)

Medical Equipment	**US$**
X-ray machines (one suite, one mobile) and film processors	250,000
Anaesthetic machines with vaporizers, and anaesthetic ventilators (three theatres)	110,000
Laboratory equipment, assorted	120,000
Operating tables (one each for three operating theatre suites)	90,000
Operating lights (one each for three operating theatre suites)	50,000
Infant incubators (six)	40,000
Transport incubators (one)	15,000
Monitors (one each for three operating theatre suites)	60,000
Defibrillators (one)	20,000
Diathermy units (one each for three operating theatre suites)	45,000
Ultrasound scanner (one for maternity cases)	15,000
Beds (120) and hospital furniture	200,000
All other medium to low technology medical equipment and instruments	200,000
Plant	
Autoclaves (two large units)	25,000
Laundry equipment (one small set)	165,000
Incinerator (one)	70,000
Kitchen equipment (one small set)	45,000
Air-conditioning (10 individual units)	25,000
Mortuary (nine-body capacity)	20,000
Refrigeration (eight individual units, one cold room)	10,000
Electrical generator (one small set covering the whole facility)	50,000
Electrode boiler (one small set)	45,000
Water storage and treatment tanks	20,000
All other various plant items such as geysers, pumps, compressors	100,000
Assorted	
All other furniture and office equipment	250,000
Vehicles (three)	90,000
Communication equipment (telephones or radios)	10,000
Total	**2,140,000**

There will also be the buildings, and service installations such as the plumbing, sewage, and electrical distribution routes.

3.3 BUDGET LINES FOR EQUIPMENT EXPENDITURES

If you want to plan the finances for your equipment correctly, you must have:

- a clear idea of what you currently spend, and
- a realistic estimate of what you need.

To do this, it is necessary to have expenditure records of sufficient detail to enable you to identify equipment-related costs.

By introducing **Budget Lines for Equipment Expenditures**, you can record and monitor the many different ways in which money is spent on equipment. This planning tool means that you will be able to analyze the financing required adequately.

In many countries it is very difficult to identify what is spent on equipment, as there are no specific equipment expenditure records. Nor is it possible to analyze in any detail how funds are being spent, because of the ill-defined structure of health budgets (both centrally and at facility level).

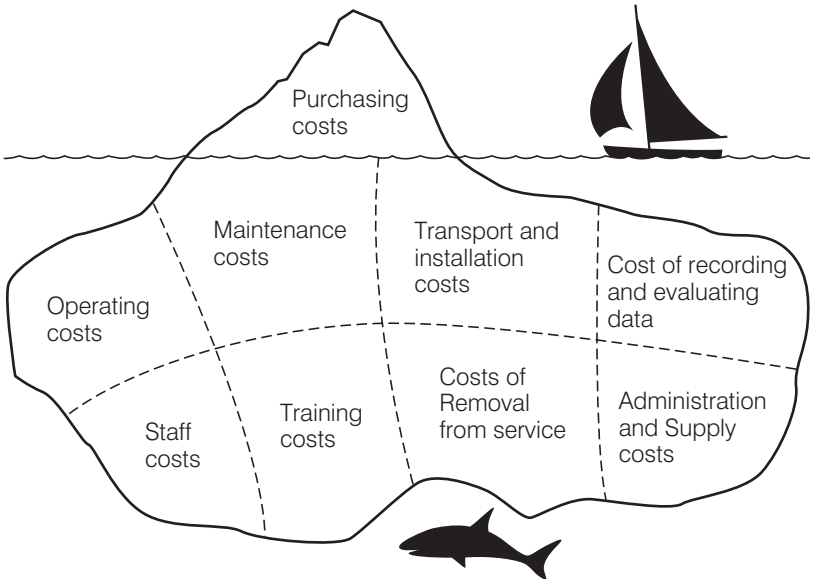
Country Experiences

Many countries face the following problems with analyzing their equipment expenditure:

- *Running costs of equipment (i.e. consumable costs) cannot be identified as they fall under a recurrent budget code covering all general and medical supplies.*
- *Maintenance costs for medical equipment cannot be identified as they fall under a budget code which covers maintenance of everything – buildings, vehicles, office, plant and general equipment.*
- *Planned development expenditure on plant and large installed items of medical equipment (such as X-ray machines) cannot be identified as they are rolled into total budget allocations for construction costs.*
- *Budgets for the replacement and maintenance of the buildings and plant of the government health service are allocated to the Ministry of Works, but they cannot be identified for the Ministry of Health as the budgets are not divided by facility or even by client ministry.*

There are a variety of costs related to healthcare technology, and most of them are hidden. This can be illustrated by using the image of an iceberg as shown in *Figure 9*. An iceberg is known for only having a small portion of its bulk showing above water, with the vast majority of its bulk hidden dangerously below the surface. All of these expenses together are known as the 'life-cycle costs' for healthcare technology.

Figure 9: The Iceberg Syndrome of Life-Cycle Costs for Healthcare Technology



Source: Damann, V. and H. Pfeiff (eds), 1986, 'Hospital engineering in developing countries', GTZ, Eschborn, Germany

As we have illustrated, there are many different equipment-related costs, and it is common for only the purchasing costs to be remembered and allocated. It is difficult to plan if:

- the various spending allocations cannot be specifically identified or monitored within a facility's budget, and are lost among other expenditures
- central budgets do not show how these funds for equipment are allocated to individual cost centres (facilities, districts or health service providers).

Therefore, it is important to have budget lines (or sub-divisions) for each type of equipment expenditure, at each service level.

Different Types of Expenditure

It is important to recognize the different types of expenditure for equipment and what they are used for:

- **Capital Funds** are required to cover large one-off expenses. They are normally planned for annually. The sorts of expenses covered by capital funds depend on the size of the task and whether it is linked to the purchase of new equipment.

They usually include:
- replacing existing equipment
- buying additional equipment
- pre-installation work (site preparation and associated lifting and warehousing expenses)
- support activities so you can start to use your purchases and donations (installation, commissioning, and initial training)
- rehabilitation of equipment and the fabric of buildings which will be major works and require large sums of money.

- **Recurrent Funds** are required to cover smaller regular expenses in order to keep equipment functioning and running. They are normally planned for on a weekly or monthly basis. The sorts of expenses covered by recurrent funds depend on the size of the task and whether it takes place at times other than the purchase of new equipment. They usually include:
  - buying consumables for equipment operation
  - buying spare parts and technical support for equipment maintenance, repair, and minor works
  - administrative expenses for equipment operation and maintenance services, including energy costs
  -training expenses for ongoing skill-development requirements.

In order to be able to monitor the different allocations and expenditures for these equipment requirements, you will need to develop a variety of different budget elements (or sub-divisions). These will need to be presented for each cost centre (facility, region/district, or health service provider)

Tip

- Whenever equipment is purchased it is essential to budget for its running costs. Therefore, there must be a link between the budget lines for planned capital expenditure and recurrent budget estimates for maintenance, consumable items, and training.

We recognize that many poor countries find it difficult to set aside funds for equipment needs from the small recurrent budgets available, as they are continually re-allocated to meet other prioritized needs. This is especially the case if primary healthcare is the priority of health services, and public health programmes take precedence over institutional care services.

Experience in Ghana

Seventy per cent of the capital budget for the Ministry of Health (MOH) is funded from external sources, and these capital funds are more readily available than funds from the recurrent budget. Thus the MOH has adopted a strategy that links more of the 'life-cycle cost' of equipment (daily operation, maintenance, and administrative needs for running the equipment) into the capital budget over a number of years.

It has achieved this by considering these running costs as part of the 'total cost of ownership' (purchasing cost) of the equipment which can be covered by the capital budget. In this way, Ghana ensures that the cost of using equipment is covered for a few years after commissioning. In the meantime, the recipient facility accumulates enough monies from their internally generated funds so that they can support the equipment after this initial grace period is over.

Who is Responsible for Creating Budget Lines?

Preference

Your health service provider should develop a budgetary system containing a variety of budget elements for different equipment expenditures, which can be used across the whole of the health service.

Who?		Takes what action?
Finance Officers	→	Develop the new budget lines.
Which level?		**Takes what action?**
Any level of the health service (central, region/district, facility)	→	Can develop budget elements that will show how money is being spent on the different equipment expenditures.

Tip

- Your health service provider might not have developed a budgetary system with various equipment-related budget elements. Do not let this prevent you from doing so at your health facility or district level. You can encourage your health service provider to do this centrally, but in the meantime you can start analyzing how you are spending your money.

How to Create Budget Lines for Equipment Expenditure

It is possible to develop budget elements that will show how money is being spent on the different equipment expenditures. *Box 10* provides some strategies necessary to do this.

BOX 10: Strategies for Developing Budget Lines for Equipment Expenditure

People Responsible	Action
Finance Officers, at all levels of the health service (central, region/district, facility)	Establish different budget lines (sub-divisions) as itemized below: a. capital funds to cover equipment replacement (depreciation) b. capital funds to cover additional new equipment requirements c. capital funds to cover support activities which ensure equipment purchases can be used (installation, commissioning, and initial training) d. capital funds to cover pre-installation work for equipment purchases e. capital funds to cover major rehabilitation projects f. recurrent funds to cover equipment maintenance costs, including spare parts, service contracts, and minor works g. recurrent funds to cover equipment operational costs, including consumable items and worn out accessories h. recurrent funds to cover equipment-related administration, including energy requirements i. recurrent funds to cover ongoing training requirements.
HTM Working Groups	Start using these budget lines to analyze how money is allocated and spent for equipment purposes.
Health service providers	Ensure that budgets are presented by cost centre so that it is clear what allocations are made between central, region/district, and facility level. In this way, you can see what money is spent on equipment activities at each level of the health service. Lobby other bodies involved (such as Ministry of Finance, Works) to also show equipment expenditures by cost centre, so that you can see what is allocated by other agencies for equipment activities in the health service.

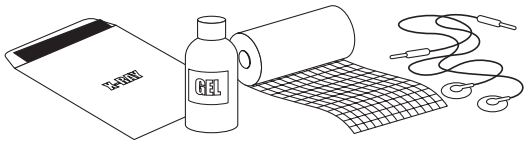
3.4 USAGE RATES FOR EQUIPMENT-RELATED CONSUMABLE ITEMS

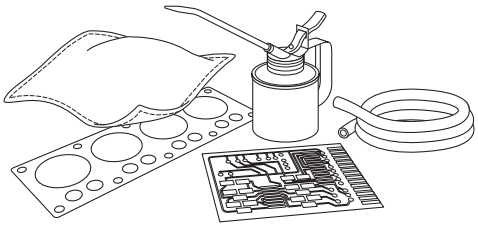
If equipment is to keep functioning, you must ensure that reasonable stocks of consumable items are held at all times, and that these form part of recurrent budgets. You therefore need to calculate the **Usage Rates for Equipment-related Consumable Items**. By doing this, you can base your recurrent budgets on the actual 'lifetime costs' (daily operational, maintenance and administrative requirements) of the items in your Equipment Inventory.

Recurrent budgets covering equipment-related consumable items are required to ensure that equipment continues to function. Equipment-related consumable items are:

- equipment consumables (for example, electrodes, gels, paper)
- replacement accessories (for example, handpieces, probes, lenses)
- spare parts (for example, filters, o-rings, bearings)

- maintenance materials (for example, lengths of pipe, paint, paper for the record system)
- equipment cleaning materials (for example, cotton wool, detergents, disinfectants)
- safety materials (for example, protective clothing, refilling fire extinguishers, calibrating test instruments)
- energy supplies (for example, fuel, oil, gas, electricity).





If recurrent budgets for equipment are too small, it will not be possible to use or maintain many pieces of equipment because you will have run out of the necessary consumable items.

It may be the case that, in the past, equipment-related consumable items have not been 'stockable' items in the Stores system, in other words items which, when stocks run low, are automatically replenished and therefore always 'in stock'. (Details of how to implement such a system are contained in *Guides 4 and 5*).

If this is the case, you are unlikely to have sufficient information available on which to base estimates concerning requirements and rates of use of equipment-related consumable items. To rectify this, you need to carry out assessments of their requirements and rates of use. Based on these assessments, you can then estimate adequate recurrent budgets for the operation and maintenance of equipment, and calculate correct stock reordering times. This information is useful for:

- improving budget allocations
- planning the correct timing for the procurement of supplies
- providing feedback on the choice of equipment.

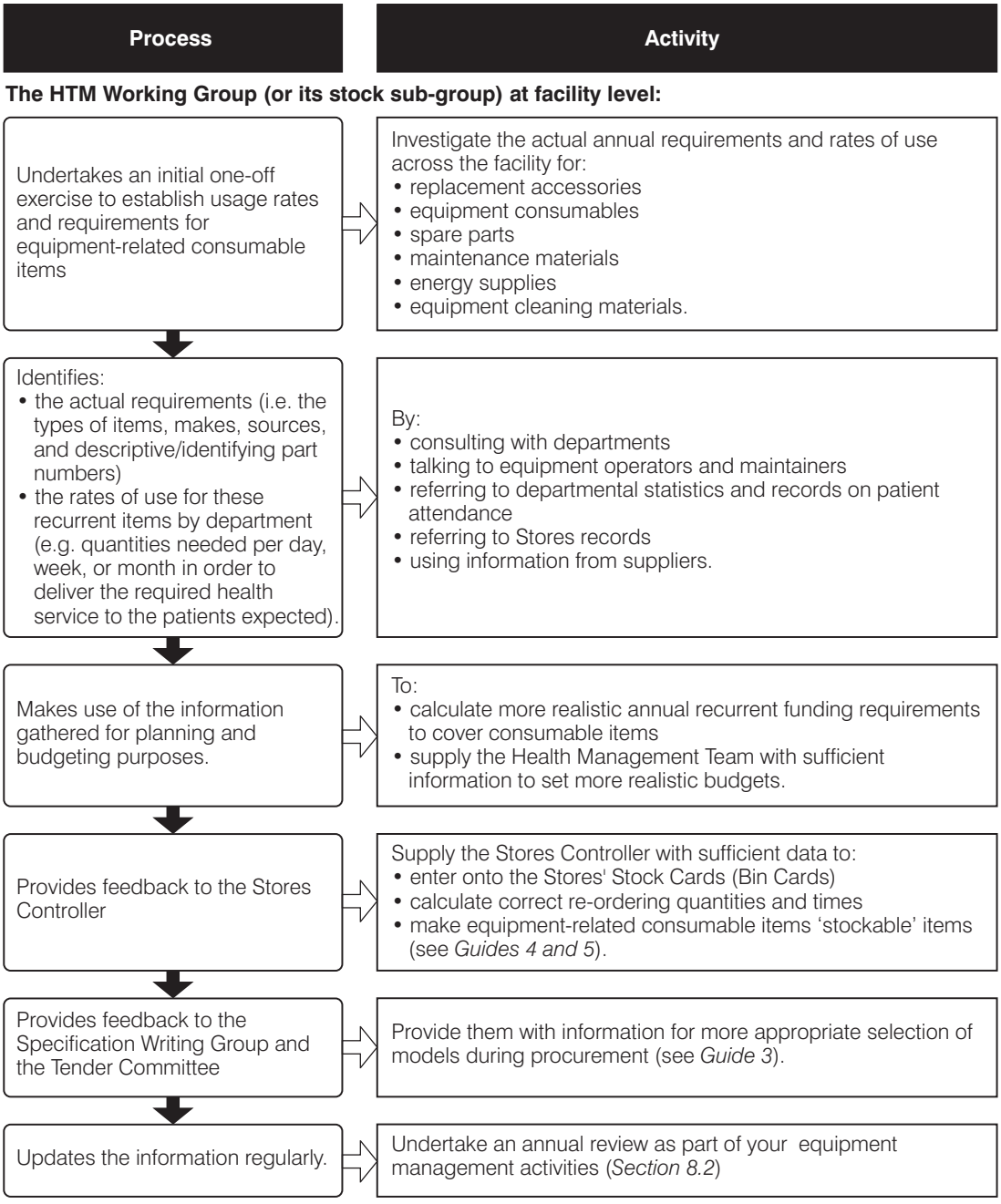
Who is Responsible for Determining Usage Rates?

Who?		Takes what action?
The HTM Working Group, or a smaller stock sub-group (*Section 1.2*)	→	Is responsible for establishing usage rates
Which level?		**Takes what action?**
Facility level	→	Make these calculations, use the information for planning and budgeting purposes, and share it with higher administrative bodies within the health service.
District/regional and central health authorities	→	Use the information to ensure more appropriate budget allocations are provided to the facilities.

How to Discover your Usage Rates

An initial exercise will be required to establish the usage rates and requirements of equipment-related consumable items, as described in *Figure 10*.

Figure 10: Exercise to Establish your Usage Rates and Requirements for Equipment-related Consumable Items



Once you have undertaken the one-off exercises to establish the planning tools, as described in this Section, you can use them to make your long-term plans (*Section 7*) and to undertake annual planning (*Section 8.1*). You will also need to update the tools. This is described in *Section 8.2*.

Box 11 contains a summary of the issues covered in this Section.

BOX 11: Summary of Procedures in Section 3 on Discovering your Starting Point

Inventory	**HTM Service (at central level)**	◆ designs the inventory system, and the code-numbering system ◆ computerizes it
	Facility and District/ Regional HTM Teams	◆ gather inventory data, keep it, update it, and pass it onto the centre ◆ use the inventory code-numbering system
Stock Values	**HTM Working Groups (or pricing sub-group)**	◆ develop a Reference Equipment Price List, and calculate the equipment stock values ◆ revise the prices regularly in order to ensure that an up-to-date database of current equipment prices is available ◆ revise the stock values periodically
	Health Management Teams	◆ use the information for planning and budgeting purposes
Budget Lines	**Finance Officers (at each level of your organization)**	◆ establish a variety of different budget elements (see *Box 10*), so that it is possible to see how money is allocated and spent for equipment purposes
	Health Service Provider	◆ ensures that health allocations are presented for central, region/district, and facility levels, clearly showing what is spent on equipment activities ◆ lobbies other bodies involved (such as Ministry of Finance, Works) to clearly show what is allocated for equipment activities in the health service
Usage Rates	**HTM Working Groups (or stock sub-group)**	◆ undertake an exercise to discover more realistic usage rates and requirements for all equipment-related consumable items (see *Figure 10*)
	Health Management Teams	◆ use the information for planning and budgeting purposes

4. HOW TO DISCOVER WHERE YOU ARE HEADED – PLANNING TOOLS II

Why is This Important?

To manage your healthcare technology effectively, you need to have a clear idea of your goals and targets, and the context in which you are operating. It is very difficult to manage without knowing what you are trying to achieve. Equipment, for example, should not be viewed in isolation – it is there for a purpose, and must be managed according to set objectives.

To plan effectively, you require access to a wide range of information and reference materials. You also need a clear vision of the direction your health service is going in, plus a definition of what equipment is required to help you achieve the health service goals.

To ensure any equipment purchasing is planned and rational, you will need to have good policies and procedures in place. These will provide guidance on the valid reasons for buying equipment, as well helping you to decide what equipment to buy.

It is better to plan and budget with specific goals in mind. You therefore need to gather information which will help you to understand the goals and objectives for your equipment.

To help you analyze your future equipment needs, you need some further 'planning tools'. This Section covers five additional tools, and discusses how to discover the direction you are going in, by:

- having access to information and reference materials (*Section 4.1*)
- developing a Vision for health service delivery (*Section 4.2*)
- translating that Vision into Model Equipment Lists (*Section 4.3*)
- agreeing what your equipment purchasing, donations, replacement, and disposal policies are going to be (*Section 4.4*)
- writing Generic Equipment Specifications (*Section 4.5*).

Different health service providers will have reached different stages in deciding on the direction to go in, depending on the amount of planning they have already carried out. The direction you take will depend on:

- your country
- your health service provider
- which level of the health service you work at
- the degree of autonomy of your health facility.

This Section describes how to undertake one-off exercises to establish these tools. Different activities are described for the different health service levels. This work will help you to discover where you are headed.

The use of these tools in the planning and budgeting process is provided in *Section 7*, and *Section 8* discusses how to monitor and update the tools.

4.1 REFERENCE MATERIALS

To increase their skills in planning and budgeting for the equipment stock, health service providers need to expand their information and knowledge base concerning equipment and its management. Therefore it is useful to develop a library of equipment literature, covering a broad range of types of documents. These are known collectively as **reference materials**, and provide background advice for equipment planning and budgeting.

To keep up-to-date, it may be useful to subscribe to regular equipment information sources, such as hazard reports and monthly journals. Due to the cost, you may need to ask for assistance from external support agencies. Information regarding the sources of some useful literature is given in *Annex 2*.

It is advisable for some data to be kept in every health facility and maintenance workshop, so that staff can be encouraged to read and learn from reference material which is available close at hand.

Who is Responsible for Gathering Reference Material?

Preference

For information to be available at all levels of the health service.

Who?		Takes what action?
Health Management Teams	→	Organize the gathering of reference material
Which level?		**Takes what action?**
The Central Health Management Team	→	Is in a much better position to finance subscriptions, to ask for assistance from external support agencies, and to share information around all levels of the health service.
Health Management Teams at individual facilities and districts	→	Should pursue strategies to gain more information, and develop their own equipment libraries.

How to Obtain Reference Materials

There are several ways of obtaining reference materials. *Box 12* provides a variety of strategies for trying to get hold of different types of data and expand your library.

Some data which costs a lot of money to obtain may only be collected by the central-level HTM Team, and they should pursue the strategies listed for sharing this information around the HTM Service network.

BOX 12: Strategies For Sourcing Useful Literature and Advice (see *Annex 2*), and Expanding your Library

Strategy	Type of Material/Information	Action
Obtain literature which is usually available free of charge.	◆ manufacturers' brochures (from manufacturers and their representatives) ◆ procurement catalogues from bulk suppliers ◆ lists of the manufacturers registered nationally with the central Ministry of Health.	For existing equipment, find as many of these as possible.
Obtain literature from neighbours which, with negotiation, may be available for the cost of photocopying and postage.	◆ Model Equipment Lists ◆ equipment specifications ◆ copies of manufacturers' operator and service manuals for older machines ◆ lists of registered manufacturers.	Contact as many other health facilities and health service provider organizations in your country and neighbouring countries as possible, to obtain existing resources.
Obtain information available internationally which can be paid for as one-off items, or by annual subscription (depending on the material type and source). This material may come as a hard copy or as part of a software package.	◆ text books on a variety of subjects (including advice on planning and budgeting) ◆ manufacturers' operator and service manuals ◆ Equipment Evaluation Reports and Product Comparison data ◆ technology assessment literature ◆ Equipment Hazard Reports and safety literature ◆ journals ◆ internationally available advice on equipment issues.	Try to get hold of these resources, perhaps subscribe to them, and look for help to pay for them.

Continued overleaf

BOX 12: Strategies For Sourcing Useful Literature and Advice (see *Annex 2*), and Expanding your Library (continued)

Strategy	Type of Material/Information	Action
Make sure you order relevant literature when purchasing all your new equipment (see *Guide 3*).	◆ operator manual ◆ service manual.	◆ when the manuals arrive, store the original copies in a safe place (such as the HTMS library, the facility library, the workshop library) ◆ make photocopies of the operator manuals, and give one copy to the relevant user department, and one copy to the HTM Team or relevant workshop ◆ make photocopies of the service manuals, and give one copy to the HTM Team or relevant workshop.
Investigate other sources for getting literature/ information which you do not have.	◆ suppliers ◆ manufacturers' local representatives ◆ international agencies ◆ links with health facilities abroad.	Make use of internet (world wide web) contacts where possible, as this method will become more and more important in future.
If material is no longer available on paper, find a more accessible format.	◆ CD-Rom ◆ video ◆ DVD.	Investigate these alternative sources of information. Make copies and print-outs of the material and make it available to other facilities.
Scan single copies of printed documents into a computer and keep them as electronic copies.	◆ user manuals ◆ service manuals	Scan these documents into your computer system and make them more easily available to maintenance technicians at many locations.

4.2 DEVELOPING THE VISION OF SERVICE DELIVERY FOR EACH FACILITY TYPE

As *Section 2.1* explains, the **Vision** for your health facility tells you the direction of healthcare delivery (in terms of the interventions and procedures to be carried out). By referring to the Vision, you can determine what type of equipment you require.

When developing the Vision for a certain level of health facility, it is very important to be reasonable and realistic in your goals. As *Section 2.2* explains, you need to be aware of the cost implications associated with any of your proposed goals (such as developing Essential Service Packages).

For example, you might decide that decentralizing your services provides a fairer level of access for the surrounding population. However, great care must be taken to ensure that any such move is affordable. If not, you run the risk of putting funding for existing services in danger.

Experience in South Asia

The Ministry of Health in a Southern Asian country felt pressured by manufacturers, professional staff, and the example set by private health service providers to develop public services in a certain direction. Such a development was dependent on the purchase of sophisticated technologies, such as CT scanners, MRI scanners, cardiac-angiography machines and video endoscopes.

However, in a recent survey they discovered that the utilization of these items is less than 10 per cent due to the lack of available manpower and recurrent budgets. This shows how important it is not to allow realistic decision-making to be undermined by outside pressures.

Who is Responsible for Developing the Vision?

The body or organization responsible for developing the Vision will vary from country to country. This will depend upon:

- your health service provider
- which level of the health service you work at
- the degree of autonomy of your health facility.

Preference

It is unhelpful to have lots of individual facilities pulling in different directions, and no coordinated plan for the health service as a whole. It is easiest for all concerned if your health service provider at central level considers what sort of healthcare will be provided at each level of your health service. They should collaborate with the Ministry of Health and follow MOH guidance.

Tip

- Your health service provider at central level might not be undertaking a Vision exercise. Do **not** let this prevent you from working on the Vision for your health facility, as long as you stay within sensible goals for your level of the health service.

Who?		Takes what action?
Health Management Teams at each level	→	Organize special meetings of different types of staff at each level to discuss the Vision.
HTM Working Group (*Section 1.1*)	→	Advises the Health Management Team on all technology issues during this process.
Which level?		**Takes what action?**
Central Level	→	Takes the **first step** and develops the overall Vision for the direction of the health service as a whole.
Regional/District Level	→	Once this Vision has been completed or updated, takes the **second step** and defines the services to be provided by individual health facilities. By: - studying the map of facilities for their area - considering how their region/district varies from the norm described by the centre.
Facility Level	→	Once the services have been defined for the district, takes the **third step** and looks at the possibilities they have for providing the defined services.

How to Develop your Vision

The Health Management Team at each level should organize a series of meetings to discuss the development of the Vision. These meetings should include a cross-section of different types of staff from their level (facility, district/region, or service as a whole). As well as involving staff, it is also important to ask questions of your customers (as far as is possible), especially when they contribute to covering the cost of the health service provided.

At these meetings you should discuss:

- the direction that the service should be taking
- the sort of care that should be provided now and in the future
- the sort of interventions and procedures that will be carried out; and
- the type of healthcare technology required.

These meetings should take into account:

- healthcare trends
- demographic data
- epidemiological profiles
- priority health problems
- the clinical and referral features of the target area
- the infrastructure, finances, and human resources available
- local strengths and weaknesses
- the support available from external support agencies.

To inform the technology part of the debate, the HTM Working Group (at each level) should consider the equipment implications of the healthcare interventions suggested, and then offer technical advice to their Health Management Team.

Box 13 shows some of the issues that the Central Level HTM Working Group should consider.

BOX 13: Equipment Considerations for the Vision at Central Level

Issues	Examples
What expansion of services is necessary or feasible?	◆ What should be the role of a hospital (central, referral, district, or rural), in terms of the interventions and procedures to be carried out? What does this mean in terms of equipment availability? ◆ What type of care can be offered by rural, district or town health centres? Can any types of care be transferred over to them? What does this mean in terms of equipment availability? ◆ It may be best to locate certain specialized services (such as intensive care units) only at certain hospitals. Some specialized services, such as radiotherapy, may only ever be offered at national/central level. With pressures to reduce costs, improve efficiencies, and possibly to reduce staff numbers, can service provision be rationalized? Is expansion based only on needs that can be realistically met?
What are the implications in terms of staff, skills, resources, patient referral networks?	◆ Introducing a new service has knock-on implications for human, material, and financial resources. Why buy eye instruments for a facility if there is no eye surgeon, or prospects of one becoming available? ◆ If the referral system is such that dialysis is only undertaken and supported at a central facility, think carefully before placing dialysis machines at, for example, 10 further locations. Such a move would have major and costly knock-on effects. For example, at each of the 10 locations you would need to: - recruit or train renal doctors and surgeons - finance and supply dialysis machines, water treatment systems, specialized laboratory services and equipment - provide renal nurses and after care services - provide regular supplies of consumables and maintenance support, as well as recurrent budgets.
Are desired expansions financially affordable?	◆ Although many hospitals may ideally wish to have fluoroscopy facilities (for example), at a cost of approximately $500,000 per suite is this a feature each hospital can necessarily invest in?
Do the services suggested fit into the overall Health Service in the country?	◆ Is it possible to develop a Vision which fits in with the other health service provider organizations?

Box 14 shows some of the issues that the Regional/District Level HTM Working Group should consider.

BOX 14: Equipment Considerations for the Vision at Regional/District/Diocesan Level

Issues	Examples
Are some services duplicated in facilities near to each other and therefore over-provided?	◆ Each facility may wish to offer all services, but this may not be practicable. In many cases, it may be necessary and important to share service provision. Which healthcare interventions can be shared with other types of facility in the neighbouring area (such as the referral hospital, the town clinic, rural outreach services)? Can you reduce your equipment requirements by sharing services? ◆ Are there neighbouring facilities or health services (such as a flying doctor service) which are better able to offer certain interventions – for example services for Ear Nose and Throat, eye specialists, sophisticated imaging? If they are better equipped to provide such services, you might agree that they will be the source of those services and limit your equipment requirements in those areas.
Are there alternative ways to provide healthcare interventions?	◆ Are there other providers who could supply you with services you require, such as hot meals, clean linen, incineration? If so, would the reduction in equipment capital and recurrent costs outweigh the cost of buying in those services?
Do the services suggested fit into the overall health service in the surrounding area?	◆ Is it possible to develop a Vision which fits in with the neighbouring regions/districts and other health service provider organizations?

Box 15 shows some of the issues that Facility Level HTM Working Groups should consider.

BOX 15: Equipment Considerations for the Vision at Facility Level

Issues	Examples
Are some services duplicated within the facility itself?	◆ Perhaps your facility was built with three operating theatres, but are they all in use all of the time? Can the use of the theatres be rationalized and operating times maximized, so that new theatre equipment does not need to be purchased three times (in this example) for many separate theatres? ◆ Some countries have introduced fee-paying systems. This can result in a difference between fee-paying (high cost) and non-fee-paying (low cost) services, causing duplication of services. Can the difference between high and low cost be based on factors such as more prompt service, more experienced staff, better food? In this way, can you avoid two physically separate sets of facilities which lead to duplication of expensive equipment, especially in areas such as intensive care, labour, or dental units?
Are there alternative technology strategies for providing the services required?	◆ Does your geographical area lend itself to different ways of providing services which may be more cost-effective or reliable? For example, can you use solar energy for your electricity, a biogas plant for your sewage system, a borehole water supply, radio communication, oxygen concentrators?
Do the services suggested fit into the overall health service in the surrounding area?	◆ Is it possible to develop a Vision which fits in with the neighbouring facilities and other health service provider organizations?

Following these considerations, the Health Management Teams should:

- develop a reasonable and realistic Vision for the health service in terms of the procedures and interventions to carry out, and produce it as a formal document; and
- ensure the approved written Vision is used as the basis of subsequent equipment planning and budgeting decisions.

4.3 MODEL LISTS OF EQUIPMENT PER INTERVENTION

Once the Vision for the direction of health service delivery for a facility has been developed (*Section 4.2*), you will know the healthcare interventions and procedures you will be offering. Based on this information, you can then develop Essential Service Packages, which should translate the Vision into:

- human resource requirements, and training needs
- space requirements, and facility and service installation needs
- equipment requirements.

This Section concentrates upon equipment requirements, and considers the process of defining what equipment is needed for each healthcare intervention. The planning 'tool' used to do this is the **Model Equipment List**.

What is a Model Equipment List?

A Model Equipment List is:

- a list of equipment typically required for each healthcare intervention (such as a healthcare function, activity, or procedure). For example, health service providers might list all equipment required for eye-testing, delivering twins, undertaking fluoroscopic examinations, or for testing blood for malaria
- organized by activity space or room (such as reception area or treatment room), and by department
- developed for every different level of healthcare delivery (such as district, regional and central), since the equipment needs will differ depending on the Vision for each level
- usually made up of **everything** including furniture, fittings and fixtures, in order to be useful for planners, architects, engineers and purchasers
- a tool which allows you to see if your Vision is economically viable.

The Model Equipment List must reflect the level of technology of the equipment. It should describe only technology that the facility can sustain (in other words, equipment which can be operated and maintained by existing staff, and for which there are adequate resources for its use). For example a department could have:

- an electric suction pump or a foot-operated one
- a hydraulic operating table or an electrically controlled one
- a computerized laundry system or electro-mechanical machines
- disposable syringes or re-usable/sterilizable ones.

As *Section 2.2* explains, it is important that any equipment suggested:

- can fit into the rooms and space available. You should therefore refer to any building norms which define room sizes, flow patterns, and requirements for water, electricity, light levels and so on
- has the necessary utilities and associated plant (such as the power, water, waste management systems) available for it on each site. If such utilities are not available, it is pointless planning to invest in equipment which requires these utilities in order to work
- can be operated and maintained by existing staff and skill-levels, or for which the necessary training is available and affordable.

Due to these factors, Model Equipment Lists will vary from country to country.

Usefulness of the Model Equipment Lists

A Model Equipment List is an aid to the planning process. In order to plan what equipment to purchase, you will need to be aware of any shortfall in equipment. To determine such shortfalls, you will need to compare your Equipment Inventory (*Section 3.1*) with your Model Equipment List. This will enable you to determine whether any equipment is currently missing or needs to be purchased.

Thus, the Model Equipment List will help you determine what equipment is:

- necessary
- surplus
- extravagant
- missing

in relation to the Vision for your facility.

Who is Responsible for Developing Model Equipment Lists?

Who has responsibility for developing the Model Equipment Lists will vary from country to country. It will depend on:

- your health service provider
- which level of the health service you work at
- the degree of autonomy of your health facility.

Although at district or hospital level there may be sufficient medics, often there are limited economists and technical personnel with management skills for the facilities and districts to complete the task of developing Model Equipment Lists alone (*Section 2.2*). It is very important that this task is undertaken by a multi-disciplinary team, so that decisions benefit from the skills and views of all disciplines, not just one or two.

Preference

Your health service provider at central level should consider developing Model Equipment Lists in collaboration with staff from each level of the service. It is not helpful to have lots of individual facilities pulling in different directions, with no coordinated plan for the health service as a whole.

Who?		Takes what action?
HTM Working Group at each level	→	Organizes special meetings of different types of staff to work on the Model Equipment List. Then reports back to the Health Management Team.

Which level?		Takes what action?
Central Level	→	Takes the **first step** and runs specific exercises to establish the Model Lists of Equipment for each clinical and support area, at each operational level.
Regional/District Level	→	Takes the **second step** and adjusts the list on a regional/district basis to cover local variations.
Facility Level	→	Takes the **third step** and assesses: - how they can provide the healthcare interventions - what numbers of equipment they require depending on how they organize their work. Organizational decisions influence the quantity of equipment. For example, the timing of clinics can reduce or increase the workload in the laboratory. Before ordering new equipment, you will need to assess its level of use. (For example, as a microscope is used for a number of tests, the work pressure upon it must first be established, before deciding whether there is a need for additional microscopes).

Tip

- Your health service provider at Central level might not be undertaking an equipment list development exercise. Do **not** let this prevent you from working on the Model Equipment List for your health facility, as long as you stay within sensible goals for your level of the health service.

How to Create Model Equipment Lists

When each level works on the Model Equipment List, the HTM Working Group should organize a consultation exercise for staff. The best way to do this is by arranging a series of meetings. A cross-section of different types of staff should be brought together, from across all the various levels the HTM Working Group is responsible for (such as facility, district/region, or service as a whole). In these meetings, each discipline needs to decide the types of equipment required to provide the healthcare interventions described in the written Vision (*Section 4.2*).

During these meetings, it is important **not** to simply look at the space available and draw up a list of equipment to fill it. The idea is to consider:

- the disease burden that the facility faces
- the healthcare interventions that are required at that level of facility
- the equipment needed to provide those interventions and the technology level that can be sustained
- the quantities of each type of equipment required. Factors to consider include:
  - which interventions can share equipment (for instance, could several surgical procedures share an operating table?)
  - whether the location of activities requires duplication of equipment (for example, the number of resuscitations per year may only call for one resuscitation bag, but clinically it is safer to have a resuscitation bag available at several locations).

Tip

- To begin with, the task of creating Model Equipment Lists may appear to be overwhelming. A simple way to start might be to take a critical look through the equipment lists of neighbouring countries. Disease patterns do not fluctuate that much between neighbouring developing countries, and financial and technological capacity are likely to be largely similar. (Further information on Model Equipment Lists developed by a variety of agencies and countries is given in *Annex 2*). You could simply adapt existing Model Equipment Lists for your own situation, if you do not have the resources or central support for a full exercise

For HTM Working Groups at Regional/ District and Facility Level where there may be limited management skills (*Section 2.2*), making comparisons with other countries' Model Equipment Lists may be the most effective way of working.

At Central level you may require some computer software to assist you when undertaking the clinical, technical, and economic analysis. This would also be beneficial if the centre is responsible for compiling and overseeing lists for the rest of the health service. *Annex 2* provides further information on how to computerize your Model Equipment Lists, together with some equipment analysis software products that are available.

Tip

- The WHO recommends the use of the 'Essential Healthcare Technology Package' (EHTP) approach for determining equipment lists. *Annex 2* provides details of EHTP software which would usually be applied at central level.

Box 16 describes an exercise for consulting staff that can be undertaken to develop Model Equipment Lists.

BOX 16: Exercise to Develop your Model Equipment Lists

People and Steps	Example Activities
The **HTM Working Group** gathers useful reference materials from various sources which can stimulate discussions, and can be modified according to local needs.	◆ uses the Equipment Inventory as a starting point, in order to develop a list for each department ◆ draws upon any existing Equipment Development Plan for the facility (*Section 7.1*) ◆ uses Model Equipment Lists from neighbouring countries as a reference point, which can be modified to suit the health service's own working practices (see *Annex 2*) ◆ seeks guidance from the central health service provider organization on the Vision for the health service ◆ refers to any international guidance available ◆ uses any computer software programs available (if you have access to them).
The **HTM Working Group** sets up a series of small working groups of different types of staff for different working areas, until all departments have been covered.	◆ surgeons, theatre nurses, CSSD staff, and medical equipment technicians to discuss equipment required for theatre interventions ◆ different grades of laboratory staff, maintenance staff and doctors to discuss the needs for laboratory services ◆ doctors, physiotherapy staff, maintenance personnel to discuss physiotherapy needs ◆ the Support Services Manager, a range of kitchen staff, ward managers, maintenance staff, and employee representatives to discuss kitchen and canteen requirements, and so on.
Each **working group** undertakes a series of tasks so that they can develop an Equipment List for their working area.	◆ considers the reference materials obtained ◆ discusses what equipment is required for each of the healthcare interventions offered in the written Vision for the facility/service level, for their department or area ◆ provides a realistic estimate of the type of equipment required to provide the service to be offered, being careful not to create a wishlist which can never be attained ◆ provides a realistic estimate of the level of technology which can be sustained ◆ determines the numbers of each item required for the existing patient throughput, staffing levels, and work organization ◆ considers all the items required to work effectively, including – equipment, furniture, hardware (clocks, waste bins, kidney bowls), instruments and utensils ◆ creates a departmental list of all items and their quantities, on an 'activity by activity' and 'room by room' basis.

Continued opposite

BOX 16: Exercise to Develop your Model Equipment Lists (continued)

People and Steps	Example Activities
The **HTM Working Group** prepares and reviews the final list.	◆ compiles the clinical/support area lists ◆ determines quantities, by identifying where several interventions can share an item of equipment, and highlights areas where the location of activities means that duplication of equipment is necessary ◆ finalizes the Model Equipment List for that facility ◆ develops a mechanism for updating the lists over time.
The **Health Management Team** gives overall approval for the proposals.	◆ approves the Model Equipment List ◆ ensures it is used as the basis of equipment planning and budgeting decisions.

4.4 PURCHASING, DONATIONS, REPLACEMENT, AND DISPOSAL POLICIES

4.4.1 General Issues

Having gone through a detailed planning and budgeting process, you will then be in a position to acquire equipment, either through procurement or donations. In order to ensure you obtain **only** what you need, you must undertake an acquisition process which is both rational and planned.

Any new or additional equipment must be acquired according to good policies and procedures. When planning, you should consider both the costs of replacement and disposal of existing equipment, and also the costs of purchase and donation of additional items. A useful planning tool is the **Purchasing, Donations, Replacement, and Disposal Policies**. These are a series of policies which guide you on the process of decision-making for new acquisitions and help you to determine **what equipment you should obtain**.

Ideally the Ministry of Health will have developed a Healthcare Technology Policy which other health service providers can use as guidance, or follow if regulated to do so (*Section 2*). Central authorities of all health service providers should be actively involved in expanding these details and developing policies of their own, which cover all aspects of the life of equipment. The Purchasing, Donations, Replacement, and Disposal Policies will thus form one part of a wider Healthcare Technology Policy.

Alongside the policies for internal use, health service providers also need to develop donor regulations (see *Guides 1 and 3*) to ensure that all equipment received through foreign aid and donations complies with existing standards and policies. Guidance on developing and implementing such regulations is provided in *Annex 2*.

Who is Responsible for Developing Purchasing/Replacement Policies?

Who?		Takes what action?
Health Management Teams, with advice from their HTM Service on technical issues.	→	Approve the equipment policies

Which level?		Takes what action?
The central HTM Service	→	Should develop Purchasing, Donations, Replacement, and Disposal Policies for equipment, and share them with each facility and district/region.
Any health service level (central, region/district, facility) with the help of their HTM Service	→	Can develop and implement policies.

Tip

- Your health service provider may not have developed such policies. Do **not** let this prevent you from doing so for your health facility.

4.4.2 Purchasing and Donations Policies

To make the best use of your finances, you should only acquire equipment according to rational, reasonable arguments and not according to random or wild demands. Therefore it is useful to develop policy statements for purchasing and donations of equipment. These will fall into two parts:

i. when to purchase

ii. what to purchase.

When to Purchase

Each facility should acquire equipment for valid reasons only and according to an order of priority, both of which should be defined. *Box 17* provides an example of suggested valid reasons and an order of priority.

If there is a shortage of funds, acquisition should then take place in the same order of priority as shown in *Box 17*. This will:

- protect acquisitions which cover equipment as it fails at the end of its life; and
- ensure that, as a bare minimum, the existing status quo is maintained.

Otherwise, the existing health service provided will start to **deteriorate**.

BOX 17: Example of Valid Reasons and Order of Priority for Purchasing and Donations of Equipment

There are four reasons for procuring/donating equipment, each of which provides a different goal which will dictate when to acquire equipment. These can be placed in the following order of priority:

1. **To cover depreciation of equipment.** Equipment is replaced as it reaches the end of its life and is taken out of service. This is necessary in order for the level of healthcare you currently deliver to be sustained.

   Note: This means that the size of your existing equipment stock remains the same, and does not imply an expansion of the health service.

2. **To obtain additional equipment items which are missing from the basic standard requirements.** Additional equipment may be required in order to provide a basic standard level of care.

   Note: Missing items are identified by comparing the Equipment Inventory with the Model Equipment List for the facility.

3. **To obtain additional equipment items beyond the basic standard.** This is done in order to upgrade the level of health service provided by the hospital. For example, new equipment may be needed to provide a new service, build a new special unit, or increase the level of care offered.

4. **To obtain additional equipment items outside the facility's own plans.** This will only be applicable if the additional items have been called for by directives from the central health service provider organization or a national body and cannot be stopped/refused for political reasons, such as 'out of the ordinary', high profile, or political projects.

Within each of the four categories shown, priorities will have to be set. The priorities can be based on indicators which measure your progress with attaining the goals. These are discussed in *Section 7.1* on Equipment Development Planning.

Experience in South Asia

The public health sector of a Southern Asian country does not have a Healthcare Technology Policy or standards. It finds it difficult to control the purchase of equipment. Ministry of Health officials face the following problems:

- *Requests from influential clinicians or politicians to buy inappropriate equipment, which need to be challenged.*
- *When funds are refused for such items, use of the mass media to override the official decision and appeal to the public for donations.*
- *The high turnover rate of the Minister and Permanent Secretary of Health means the new incumbents continually want to make gestures for their electorate of new and sophisticated equipment projects.*
- *Often, the MOH may be forced to succumb to such public and political pressures and fund such projects.*

Equipment acquisition should only occur under the umbrella of an Equipment Development Planning Process, so that it is rational and planned (*Section 7.1*). Any acquisition should also be guided by the priorities laid out in any annual development plans (*Section 8.1*).

What to Purchase

To help you to obtain **only** equipment which is appropriate to your needs, your purchasing and donations policies should clearly specify the 'good selection criteria' to employ. All equipment should:

- be appropriate to your setting
- be of assured quality and safety
- be affordable and cost-effective
- be easily used and maintained
- conform to your existing policies, plans, and guidelines.

Tip

- Only select equipment that is suited to your needs. For example:

There is little point in acquiring an expensive piece of equipment which:
- has capabilities that are hardly ever utilized
- is almost impossible to keep in running order
- is difficult to operate safely and effectively.

There is little point in acquiring a cheap or poor-quality piece of equipment which:
- does not have the capabilities that your staff require
- falls apart easily and must be replaced quickly
- is of poor design and cannot be operated safely.

The selection process is described in full in *Guide 3* on procurement and commissioning.

Box 18 summarizes good selection criteria.

BOX 18: Example of Good Selection Criteria for Purchasing and Donations of Equipment

Indicators of appropriateness	Criteria
Appropriate to setting	Equipment should be: ◆ suitable for the level of facility and service provided ◆ acceptable to staff and patients ◆ suitable for operator skills available ◆ suitable for the local maintenance support capabilities ◆ compatible with existing equipment and consumable supplies ◆ compatible with existing utilities and energy supplies ◆ suited to the local climate, geography and conditions ◆ able to be run economically with local resources.

Continued opposite

BOX 18: Example of Good Selection Criteria for Purchasing and Donations of Equipment (continued)

Indicators of appropriateness	Criteria
Assured quality and safety	Equipment should be: ◆ of sufficient quality to meet your requirements and last a reasonable length of time ◆ made of materials that are durable and hard-wearing (for example, aluminium bends easily compared to iron or stainless steel) ◆ made from material that can be easily cleaned, disinfected, or sterilized without rusting (for example, a polymerized finish or an epoxy coating) ◆ made of materials that do not easily break (for example, polycarbonate rather than glass) ◆ manufactured to meet internationally recognized safety and performance standards (see *Guides 1 and 3*) ◆ suitably packaged and labelled so that it is not damaged in transit or during storage ◆ provided by reputable, reliable, licensed manufacturers, or registered suppliers.
Affordable and cost-effective	Equipment should be: ◆ available at a price that is cost-effective. Quality and cost often go together (for example, the cheaper option may be of poor quality and ultimately prove to be a false economy) ◆ affordable in terms of costs for freight, insurance, import tax, etc. ◆ affordable in terms of installation, commissioning, and training of staff to use and maintain them ◆ affordable to run (for example, cover the costs of consumables, accessories, spare parts and fuel over its life-time) ◆ affordable to maintain and service ◆ affordable to dispose of safely ◆ affordable in terms of the procurement process (for example the cost of a procurement agent or foreign exchange) ◆ affordable in terms of staffing costs (for example, costs of any additional staff or specialization training required).

Continued overleaf

BOX 18: Example of Good Selection Criteria for Purchasing and Donations of Equipment (continued)

Indicators of appropriateness	Criteria
Ease of use and maintenance	You should choose equipment: ◆ for which you have the necessary skills in terms of operating, cleaning, and maintenance ◆ for which instructions and manuals are available to you in a suitable language ◆ for which staff training is offered by the supplier ◆ for which local after-sales support is available with real technical skills ◆ which offers the possibility of additional technical assistance through service contracts ◆ which comes with a warranty/guarantee, covering a reasonable length of time, for which you understand the terms. (For example, does it cover parts, labour, travel, refunds or replacements?) ◆ which offers a supply route for equipment-related supplies (for example, consumables, accessories, spare parts) ◆ which offers assured availability of these supplies for a reasonable period (up to 10 years).
Conforms to existing policies, plans and guidelines	You should choose equipment: ◆ according to your purchasing and donations policy ◆ according to your standardization policy ◆ according to the technology level described in the Model Equipment Lists and Generic Equipment Specifications (*Sections 4.3 and 4.5*) ◆ which is deemed to be suitable, having studied available literature and compared products (see *Box 12* and *Annex 2*) ◆ which is deemed to be suitable, having received feedback regarding previous purchases (*Section 8.2*).

If the equipment fails to meet these 'good selection criteria' (*Box 18*), you will have to find ways around all the drawbacks that will arise. Alternatively, you could decide not to acquire equipment which does not meet the selection criteria, and choose another type, make, or model.

Introducing an element of standardization in the equipment purchased will help you to limit the wide range of makes and models of equipment found in your stock (*Section 2.1*). By introducing standardization, your technical, procedural and training skills will increase, and your costs and logistical requirements will decrease (see *Guide 1*). If procurement is carried out on an individual facility basis, you will almost certainly be left with items of equipment which are uneconomic to maintain. For this reason, it is extremely important to try to collaborate and procure equipment at a central or regional level (*Section 2.2*).

Tip

- When you, or an external support agency, acquire equipment, it is important to conform to any standardization policies or strategies that your health service provider has introduced.

Equipment purchases and donations should be costed according to the principles provided in *Section 5.2* of this Guide, in order to determine which items can be afforded over their life-cycles.

4.4.3 Replacement and Disposal Policies

The majority of equipment acquisitions should be carried out for the purpose of replacing existing stocks as they reach the end of their lives (see the order of priority for purchasing and donations in *Box 17*).

Replacement is necessary because all equipment has a finite life expectancy. This lifespan will depend upon the type of equipment, and the types of technology contained within it. For example, five years might be the typical life for an ECG monitor, 10 years for a suction pump, 15 years for an operating table, and 20 years for an electricity generator. Once the equipment reaches the end of its life no amount of intervention (such as maintenance) will be effective, and the only option will be to replace it. International guidance on equipment lifetimes is available in *Annex 3*.

If replacement of equipment is not planned for, the health service delivered to the public will simply deteriorate. If you do not replace equipment at the end of its life, there will be:

- an uneven standard of reliability among your equipment
- a general deterioration in:
  - performance
  - safety
  - dependability
  - availability for use.

Each facility should replace equipment **for valid reasons only**, which should be defined. *Box 19* provides an example of suggested valid reasons, and criteria for condemning equipment.

BOX 19: Example of Valid Reasons for Condemning and Replacing Equipment

Valid Replacement Criteria

i. Equipment will **only** be replaced when one of the following valid reasons has been fulfilled:

   a. it is worn out beyond repair (has reached the end of its natural life)
   b. it is damaged beyond repair
   c. it is unreliable – faulty, old, unsafe
   d. it is clinically or technically obsolete
   e. spare parts are no longer available
   f. it is no longer economical to repair.

   and one of the following valid reasons has also been fulfilled:

   g. utilization statistics are available to show that it is still required
   h. a demonstrated clinical or operational need still exists.

ii. Equipment will not be replaced simply because:

   - it is old
   - staff do not like it
   - a newer model has arrived on the market.

Judging When it is Time to Condemn Equipment

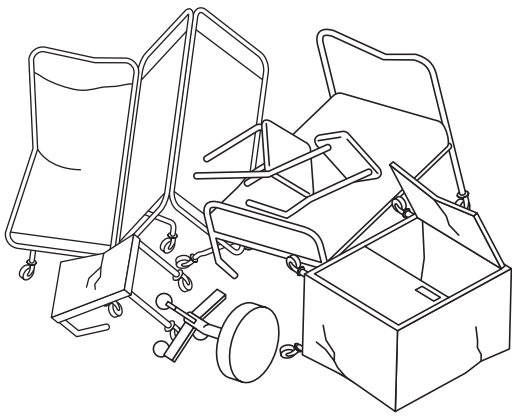
Senior maintenance staff need to study the equipment, and judge:

- whether the equipment fulfils any of the valid replacement criteria (see above)
- whether the equipment has outlived its (internationally/locally) advised typical 'lifetime' (see *Annex 3*)
- the equipment's track record and state of health, as documented in its service history records (see *Guide 5*)
- whether it will be necessary to override the average expected lifespan and condemn the equipment early, or even to extend the lifespan of the equipment.

For expensive equipment, it may be helpful to obtain an evaluation from the supplier.

Formal procedures must exist for condemning and disposal of equipment. Failure to dispose of equipment properly could result in the following:

- graveyards of abandoned equipment piling up around health facilities
- departments, store rooms, cupboards, and workshops full of old equipment
- previously condemned equipment ending up back on the wards and being re-used.



Once equipment has been condemned, you need a formal policy to oversee its disposal. This should cover:

- how it should be disposed of safely
- how it can be disposed of as promptly as possible
- how it can be disposed of in an environmentally sound way according to your 'Waste Management and Hygiene Plan'
- how you can strip off the useful spare parts before the equipment is disposed of.

These issues are discussed in *Guide 4* on operation and safety.

The condemning and disposal of equipment should trigger the purchase of a replacement piece of equipment. It is preferable to plan for replacements before they are needed and, where possible, you should identify likely replacement needs within your annual Equipment Inventory update and annual plans (*Section 8.1*). These activities should be timed to take place ahead of the next procurement cycle, which usually takes place annually (see *Guide 3*).

In summary, to replace and dispose of equipment it is necessary to have the following:

- technical skills to identify those items ready for replacement
- good procurement practices which enable you to finance and purchase replacement items **in good time**
- courage and determination to take equipment out of service when necessary, even if the users want to keep using it
- a formal method for condemning equipment
- a formal method for disposing of the equipment, safely and in an environmentally sound way
- a formal method so that the disposal of equipment triggers the purchase of a replacement item.

All these formal methods are described in *Guide 4* of this Series.

4.5 GENERIC EQUIPMENT SPECIFICATIONS AND TECHNICAL DATA

Having drawn up Model Equipment Lists (*Section 4.3*) and Purchase/Replacement Policies (*Section 4.4*), you are ready to begin the process of acquisition. Whether you are carrying out procurement on your own behalf, or have enlisted the help of an external support agency to do it for you, purchase orders or requests for tenders/quotations have to be prepared. All such purchase documents should include:

- **Item information**, describing what you want to purchase (equipment specifications, quantities, technical and environmental data)
- **Order information**, describing the terms and conditions for supplying the goods (qualification and evaluation criteria, delivery and payment terms, etc.)

The compilation and use of such purchase documents for acquiring your equipment is described in *Guide 3* on procurement and commissioning. However, establishing the item information is a specialist technical task and requires advanced planning.

Ideally, you should write your own equipment specifications, so that whoever is procuring/providing the goods can conform to your requirements. Useful planning tools to help you are **Generic Equipment Specifications** and **Technical Data**. These should be written by in-house technical staff, so that they can be used by procurement staff from any organization.

The specifications provide the detailed technical description of each type of equipment on your Model Equipment List. You may require specialist help with writing such specifications.

What are Generic Equipment Specifications?

A clear specification includes:

- a detailed description of the equipment
- the 'package of inputs' needed to keep the equipment going through its lifetime (including consumables, installation, training and after-sales support)
- the quantities required.

The specification is the **most important document** for both the purchaser and for the potential supplier, since it sets out precisely what characteristics are required of the products or services sought. Often, this is your only chance to detail your selection criteria (see *Box 18*, *Section 4.4.2*), including requirements for certain levels of technology, quality, safety, appropriateness, consumable inputs, training, and technical support. This is especially the case if you are using a tendering process (see *Guide 3*), when it is not legal to introduce additional terms and conditions after the tender bids have been received. Therefore any preferences you have in these areas must be highlighted within the initial specification.

When drawing up a product specification, it is best to describe equipment according to its type or class – in other words to describe its function. The advantages of this approach are:

Generic
means a 'type' of thing, or a 'class' of item or object.

- it describes exactly what the equipment will be required to do
- it enables any supplier to offer any products which will perform that function
- it does not limit the product only to one brand name or make of product.

Although many variations exist, unfortunately many common problems arise as a result of poor specification-writing. Some examples of this can be seen in the 'Country Experiences' box opposite.

Country Experiences

Examples of the kinds of problems which have arisen in various countries due to poor specifications are:

Equipment that is incompletely procured	◆ *Equipment arrives without the necessary accessories* ◆ *There is a lack of consumables such as chemicals or fuel* ◆ *Instruction manuals are not received or are written in a foreign language* ◆ *No local after-sales support is available*
Equipment that does not fit medical and technical requirements	◆ *Equipment is technically and/or economically obsolete upon arrival, or soon after its arrival* ◆ *Transport incubators are not transportable* ◆ *Generators have insufficient capacity to supply the hospital's power requirements* ◆ *Taps in the theatre scrub-up rooms are not elbow or foot operated* ◆ *Beds cannot be tilted* ◆ *Gas gauges are not compatible with local gas fittings* ◆ *There are items which no-one knows how to use*
Poor quality equipment	◆ *Quality is so poor that a few years after commissioning, much of the equipment falls apart and is hazardous* ◆ *Suction machines do not suck* ◆ *Heavy workload areas receive lightweight equipment* ◆ *Filing cabinets for X-ray film cannot bear the weight of films* ◆ *Trolleys are so narrow that the patients fall off them*
Equipment that cannot be installed	◆ *The site is not suitably built or provided with service supplies* ◆ *No expertise is available to install or commission the equipment* ◆ *Requirements and responsibilities for installation and commissioning are not defined.*

Properly written generic equipment specifications also enable you to conform to the standards set by government, and to continue to meet the standardization policy of your health service provider (Section 2.1).

Who Is Responsible for Developing Generic Equipment Specifications and Technical Data?

In some countries, health service providers have already developed specifications and technical data for equipment at most, if not all, levels of the health system. If no such specifications and data exist, your HTM Working Group or a smaller Specification Writing Group needs to develop specifications plus technical data for equipment which is commonly used. Since this is a skilled technical task, staff may require extra training or consultancy support.

Did you know?

Many countries suffer from using poor equipment specifications. Common mistakes include:

- **the product description is too short**, providing an insufficient description of what is required. For example, a specification which says: 'Please supply one autoclave' is useless. It gives no details at all about the type of unit, what needs to be autoclaved, its size, or how it will be powered (by electricity or kerosene). Many different sorts of autoclaves could be supplied, most of which will be unsuitable.
- **the product description is too rigid**. If the description provided is not general enough, this can be very limiting. For example, a specification which states: 'Please supply one X-ray machine like a Siemens model Unistat 11' is so specific that most suppliers (other than Siemens) cannot help. The only exception to this rule would be if you actually wanted to buy a particular make and model of machine (for example, if you have standardized to it – *Section 4.4*).
- **the product description reduces your options**, by providing a description of particular equipment rather than the function you require. For example, a specification which states: 'Please supply one peristaltic pump for diffusion' means that all you will be offered is peristaltic pumps. If instead you say you want to undertake infusion with the best available pump, you widen the choice of different available pumps that suppliers can offer.

Preference

To have a central library of generic equipment specifications that are used across the whole of your health service organization. This is preferable to allowing each facility to write their own specifications (though even this is better than having no specifications at all).

Who?		Takes what action?
HTM Working Groups (or the smaller Specification Writing Group)	→	Write the specifications and technical data and develop a library of such resources.

Which level?		Takes what action?
Central Level	→	Ideally, develop generic equipment specifications and technical data for the health service organization as a whole. This is sensible, since the Central Level is far more likely to have the necessary technical skills, and access to technical information and support.
Facility and District/Regional Levels	→	Can develop generic specifications and technical data suited to their own equipment levels.

Tip

- Your health service provider might not have developed generic equipment specifications for all equipment types suitable for different health service levels. Do not let this prevent you from developing the specifications you need at your health facility for your own purchases and donations.

How to Write Generic Equipment Specifications and Technical Data

Ideally, you should develop equipment specifications and technical data for all equipment purchases. This will help ensure that you buy the right equipment for your needs, and will minimize your risk of experiencing problems later on.

Tip

- To begin with, the task of writing Generic Equipment Specifications may appear overwhelming. A simple way to start might be to take a critical look through the specifications of neighbouring countries. (Information on specifications developed by a variety of agencies and countries is provided in *Annex 2*). You could simply adapt existing specifications for your own country's situation, if you do not have the resources or central support for a full exercise.

For HTM Working Groups at Regional/ District and Facility Level where there may be limited management skills (*Section 2.2*), making comparisons with other specifications may be the simplest way forward.

At central level you may require some computer software to assist you in undertaking the clinical and technical research and writing. If the centre is also compiling and overseeing specifications for the whole health service, computers and software will make the task easier. For further details on available software products, see *Annex 2*.

Contents of the Specification

The length of the specification will vary, depending on the item being purchased. For a simple item, the specification may consist simply of a brief description, with few details. For a more complex item, it will be necessary to itemize the product requirements, so that the specification may run to several pages (see *Annex 4* for an example).

When drawing up specifications, you will need to conform to the aims of your Model Equipment List (*Section 4.3*). Take care not to specify a performance higher than you need, (though you should also bear in mind any future medical developments that may take place during the lifetime of the equipment). Equipment that is more complex than actually required is needlessly expensive, more difficult to use, and more costly to maintain. You can avoid the model being obsolete by asking the manufacturer for the latest technology or latest model **that meets your specifications** (be aware that simply asking for the latest model may provide you with the most advanced model).

When writing the specification:

- Describe precisely and clearly what **function** you want the equipment to be able to perform, together with its technical and operational criteria. You can then look for suppliers who can provide equipment to meet your needs, at the most attractive terms.

- Where possible, avoid limiting yourself only to the brand names you can remember at the time. Often, other brands could be equally suitable.
- Occasionally, you may have a standardization policy that requires a particular make or model to be provided (for example, you may decide that some of your machines should be a particular model in order to save money on accessories or consumables, or to ensure it can be used and maintained). In this case, you should purposely describe the equipment by its make and model. Bear in mind, though, this can present difficulties with some donor and funding agencies (see *Guide 3*).

Box 20 describes the sorts of information that you should include in your specifications.

BOX 20: Contents of a Typical Equipment Specification

Element	Examples
Description of the equipment, and quantities	◆ Describe what the equipment should be used for. ◆ Describe what the equipment should do – its purpose, scope, function and capabilities (that is, the output required). ◆ Describe the design and features you want, taking into account factors such as performance to be achieved, and technical characteristics as follows: - operational requirements - versatility of the equipment - safety requirements (in other words, the manufacturing standards equipment should comply with). Where you cannot provide a standard, specify that the equipment should match the authoritative standards appropriate to the country of origin (for example, DIN – German Industrial Norms, BS – British Standard, or others) - quality expected - durability - energy saving features - physical characteristics (for example, construction/material requirements, colour and finish, unit or pack size, power-type, whether or not it is portable). ◆ Describe what preferences you have when there are alternatives (for example, whether you want wheels, handles, a drying cycle, extra facilities, whether it must be made of plastic). ◆ Include any restrictions on country of origin. ◆ Include the expected performance or output, but do not necessarily define how this should be achieved. ◆ Try to use common titles for equipment that are widely understood by various countries. For example, the United States uses a United Medical Devices Nomenclature System (UMDNS). Other manufacturing countries have developed their own systems, and the European Commission is trying to combine these as a Global Medical Devices Nomenclature (see *Annex 2*). ◆ If the goods you are purchasing are not whole pieces of equipment, but are simply accessories, consumables, and spare parts for existing equipment, you must provide technical details of each item. You must also specify the make, model and year of manufacturer of the equipment that they are used with (see *Guides 4 and 5*).

Continued opposite

BOX 20: Contents of a Typical Equipment Specification (continued)

Element	Examples
'Package of inputs' required, with quantities. This must cover everything else you need to use the equipment over its entire lifetime.	The 'package of inputs' may include any or all of the following: ◆ **Accessories** (for example, shelves, mains lead, patient cables, hand-pieces). Outline all the accessories you need to last a specified length of time (at least two years), together with sizes, types and quantities. Usually, it will be necessary to purchase at least three sets of accessories – one 'in use', one 'being cleaned', one 'as spare'. ◆ **Consumables** (for example, electrodes, breathing circuits, gel). You will require a stock to last a specified period of time (at least two years), although you should also take into account expiry dates and short-life items. You must detail the exact type and number of consumables. (It may be advisable to make them conform to the types and sources of existing supplies, so that existing stocks can be rationalized). Remember that, while some equipment uses standard supplies, other equipment requires specific supplies and you will need to order accordingly. ◆ **Spare parts** (for example, bottles, switches, o-rings, gaskets). You will require a stock to last a specified period of time (at least two years). You must detail your requirements for both planned preventive maintenance and typical repairs. This should be based on your experience, knowledge of the technology, and the manufacturer's recommended list. ◆ **Manuals** – you will require **both** Operator and Service Manuals including circuit diagrams. It is advisable to obtain two copies of each. ◆ **Warranty** – you must specify that the guarantee should last for at least 12 months from delivery or the end of commissioning, **not** 12 months from the shipping date (since if the goods spend six months getting to you, you will have lost half the guarantee period). If the equipment is not going to be used for some time after delivery, special arrangements must be made with the supplier to re-define the warranty period. ◆ **Delivery** – you must specify the freighting arrangements, by air, sea, or road. Also include details for the packing and crating for freight, the destination, and the delivery date or delivery period (number of weeks). Try to use common INCO terms (for trade transportations). These can be found on the internet (world wide web) with good explanations, and should be checked before use as they are occasionally updated (see *Guide 3*). ◆ **Insurance** – you must specify whether you want the goods to be insured during the delivery period. Some countries require all imports to be insured locally. Make sure you specify any rules that apply. ◆ **After-sales support** (the supplier's general capacity to deliver technical and commercial know how after delivery) – specify whether you require this to be available locally, and outline the sort of support required. In addition, ask for a price for a maintenance contract (for reference, in case it is needed).

Continued overleaf

BOX 20: Contents of a Typical Equipment Specification (continued)

Element	Examples
For some equipment, such as sophisticated or imported items, or equipment which is new to you, you may also need to specify the following item lines:	◆ **Site preparation details** – you must ask for the technical instructions and details from the suppliers so that you can plan for this work, either in-house or by contracting out. ◆ **Installation** – you must ask for help with this if it is required. ◆ **Commissioning** – you must ask for help with this if it is required. ◆ **Acceptance** – you must clearly detail the responsibility of both the purchaser and supplier with respect to testing and/or acceptance of the goods. ◆ **Training** of **both** users and technicians – you must ask for help with this if it is required, **and** for written training resources. ◆ **Maintenance contract** (an important part of after-sales support) – you must ask for one of these if it is required. It will be necessary to agree and stipulate the duration and whether it should extend beyond the warranty period, the cost and whether it includes the price of labour and spare parts, and the responsibilities of the owner and supplier.

Layout of the Specification

The layout of the specification is important, since details must be clear for the bidding suppliers. Also, it should ensure that the manufacturer's replies (his specification) can easily be compared with your requirements (your specification). This helps when you are evaluating bids (see *Guide 3*). The layout should ensure that:

- the specification is split into sections which describe different aspects of the item to be purchased, and the different elements of the specification
- each section lists features of the equipment that the supplier must comply with. Try to ensure that each feature is listed on a separate line
- equipment features are tabulated, together with columns where the supplier is obliged to state whether their machine complies with each point, and the price of each element
- the supplier is required to provide a breakdown of costs for each item/charge, as well as a summary total cost for the overall bid.

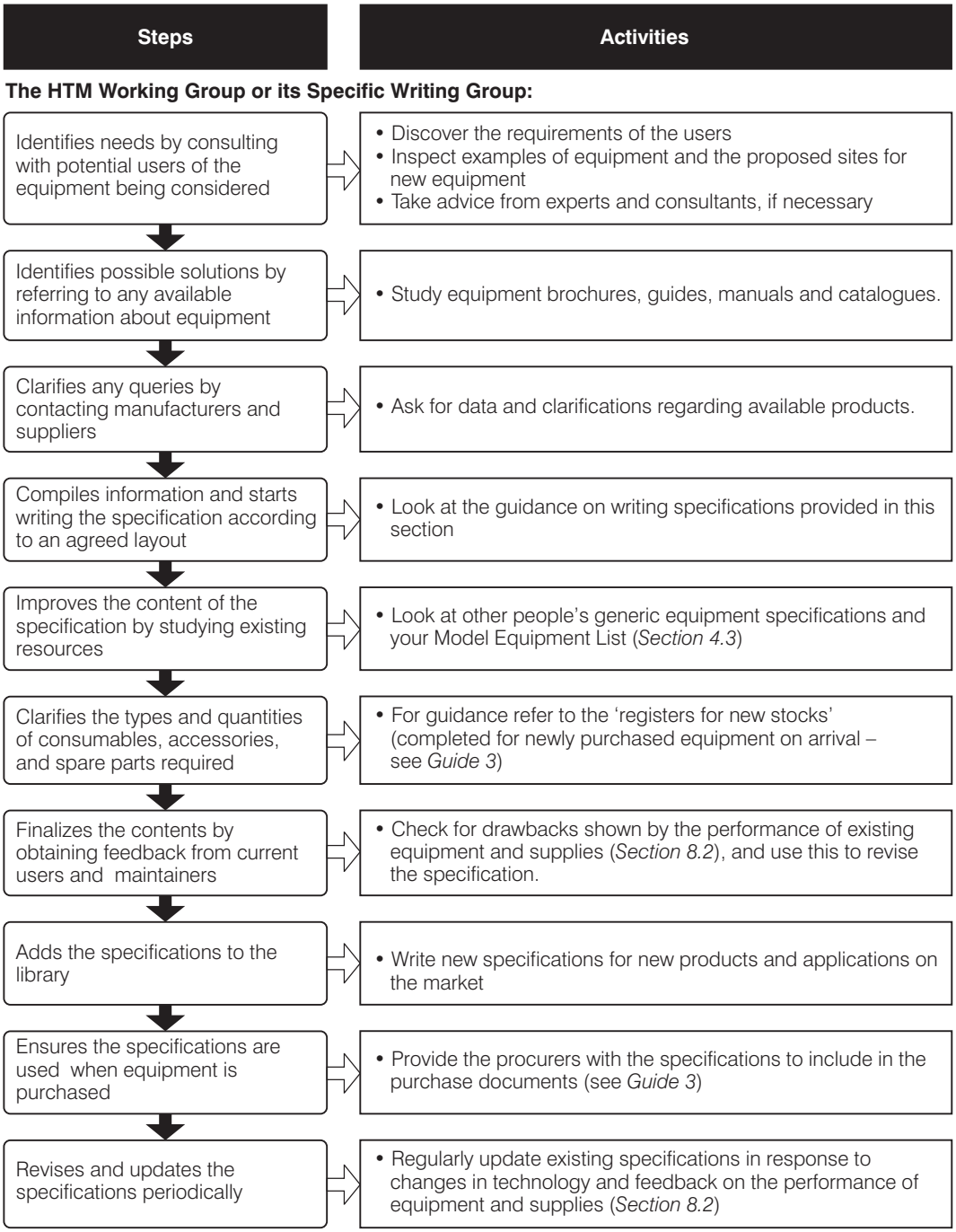
Tip

- When listing the 'package of inputs', it is important that you do not simply ask the supplier to state whether or not they can supply the various services listed. If so, you may just receive a 'yes' or 'no' answer. Instead, you must specify that they should provide a quote for each of the services listed. This way, when it comes to awarding the contract, you will be able to decide whether to omit certain services if they are too costly.

An example of a layout for a long specification is shown in *Annex 4*.

Figure 11 provides advice on how to write your specifications, and how to update them over time.

Figure 11: Steps for Writing Specifications



Technical and Environmental Information

As well as providing details of the types of equipment and support services required, your purchase documents also need to include technical and environmental data. Such data describes the types of environment and surroundings in which the equipment will be used, and enables the supplier to offer the most suitable product for your needs.

There are a number of technical and environmental factors which you will need to take into account. For example:

- If you have an unstable power supply, is your supplier able to offer technical solutions (such as voltage stabilizers, uninterruptible power supply)?
- Will your geographical location (such as height above sea-level) affect the operation of equipment (such as motors, pressure vessels)? If so, can the manufacturer adjust the item for your particular needs?
- Extremes of temperature, humidity, and dust may adversely affect equipment operation, and may require solutions provided by either you or the manufacturer, such as air-conditioning, silica gel, polymerized coatings for printed circuit boards, and filters.

You may include this information within the generic equipment specifications. However, since much of the information is common to many pieces of equipment, some health service providers have found it simpler to develop a separate summary **Technical and Environmental Data Sheet**, which can be referred to in the purchase documents. This data sheet can be distributed to all suppliers, interested parties, trade delegations and other relevant bodies. Such a data sheet can be provided regardless of the length of specification or the procurement method used, ensuring that all parties are kept informed of prevailing national conditions which could affect the operation of equipment.

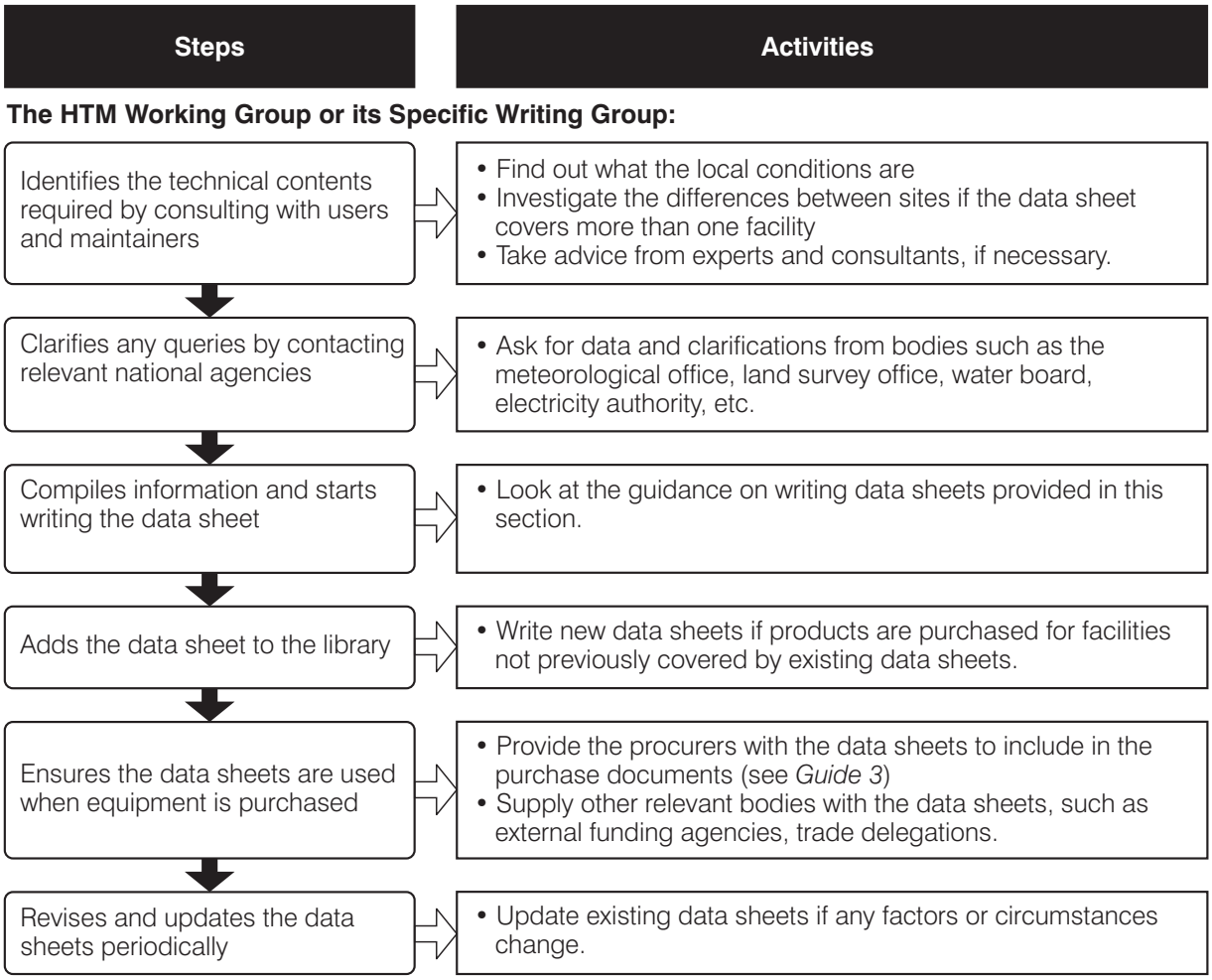
When compiling a Technical and Environmental Data Sheet, you should include details of:

- Electricity supply – mains or other supply, voltage and frequency values and fluctuations
- Water supply – mains or other supply, quality and pressure
- Environment – height above sea-level
  - mean temperature and fluctuations
  - humidity
  - dust level
  - vermin problems
- Manufacturing quality – international or local standards required
- Language required – main and secondary
- Technology level required – manual, electro-mechanical or micro-processor controlled.

You can develop a general data sheet for your country, or make more specific ones for your region, or your health facility. A sample of a Technical and Environmental Data Sheet is given in *Annex 5*, and its use is discussed further in *Guide 3* on procurement and commissioning.

Figure 12 provides advice on how to write your technical and environmental data sheet, and update it over time.

Figure 12: Steps for Writing Technical and Environmental Data Sheets



Once you have gone through the one-off exercises to establish the planning tools, as described in this Section, you can use them to make your long-term plans (*Section 7*) and to undertake annual planning (*Section 8.1*). You will also need to update the tools on a regular basis. This process is described in *Section 8.2*.

Box 21 contains a summary of the issues covered in this Section.

BOX 21: Summary of Procedures in Section 4 on Discovering Where You are Headed

Resources	**HTM Working Groups (at all levels)**	◆ use the strategies in *Box 12* to obtain as much literature as possible ◆ develop a reference library, and ensure the resource materials that staff require are available
	Health Management Teams	◆ investigate the cost of subscriptions, and other resources which must be purchased ◆ compile lists of resources to present to external support agencies for assistance ◆ use the reference materials for equipment planning and budgeting purposes

Continued overleaf

BOX 21: Summary of Procedures in Section 4 on Discovering Where You are Headed (continued)

Vision	**Health Service Provider and Health Management Teams**	◆ take responsibility for defining the Vision for the health services which are to be provided ◆ use the Vision for equipment planning and budgeting purposes
	HTM Working Groups (at every level)	◆ consider the technology implications of the Vision, and feed back to the Health Management Team at your level, in order to inform the debate
	Equipment Users and Section Heads	◆ participate in a series of meetings held at each level to develop the Vision (see *Boxes 13–15*)
Model Lists	**Health Service Provider and Health Management Teams**	◆ take responsibility for developing the Model Equipment Lists, and computerizing them ◆ use the Model Equipment Lists for equipment planning and budgeting purposes
	HTM Working Groups (at every level)	◆ organize a series of consultation meetings with staff from different disciplines, and develop the Model Equipment Lists (see *Box 16*)
	Equipment Users and Section Heads	◆ participate in a series of meetings held at each level to develop the Model Equipment Lists
Buy/Replace Policies	**Health Service Provider and Health Management Teams**	◆ address the practical issues involved in implementing the equipment purchase, donations, replacement, and disposal policies, and introduce them and their implications to the Heads of Section ◆ ensure replacement equipment is purchased when equipment is condemned at the end of its life (see *Guide 4*)
	HTM Working Groups (at each level) and Section Heads	◆ use these policies for equipment planning and budgeting purposes
Specs and Data	**HTM Working Groups (or Specification Writing Groups)**	◆ take responsibility for developing generic equipment specifications (see *Figure 11*) ◆ take responsibility for developing technical and environmental data sheets (see *Figure 12*)
	Procurement Officers (in the health services, and external support agencies)	◆ use generic equipment specifications and technical and environmental data sheets during procurement negotiations with suppliers (see *Guide 3*).

5. HOW TO MAKE CAPITAL BUDGET CALCULATIONS – BUDGETING TOOLS I

Why is This Important?

Capital funds are required annually to cover large one-off expenses. These may include such expenses as replacing existing equipment, buying additional (new) equipment, getting new acquisitions to work, and undertaking major equipment rehabilitation projects.

Failure to allocate sufficient funds for these items could result in insufficient equipment for your needs, or new items which cannot be utilized for several months because there is nobody to install or test them.

This Section provides advice on how you can learn to budget for all these costs.

The planning tools (*Sections 3 and 4*) will help you to identify what you want to replace, purchase, or rehabilitate. However, you should only introduce changes if you can afford them. This is determined by budgeting for equipment, according to the principles and budget calculations outlined in this Section.

In this Section, we outline some 'budgeting tools', which will help you to understand how to make various calculations for capital costs. Different calculations are described for the different health service levels. These calculations can then be used to make your plans and budgets, as described in *Sections 7 and 8.1*.

As *Section 3.3* explains, one reason why capital expenditure is required each year is to cover the need to purchase equipment. All capital allocations should be made in accordance with the priorities given in your Purchasing and Donations Policy (*Section 4.4.2*). In other words, funds should be spent on equipment for the following reasons and in the following order of priority (see *Box 17*):

1. for replacement
2. to obtain a basic standard level of care
3. to upgrade the level of health service provided by the facility
4. to provide items outside your plan only if forced to because of directives from higher authorities.

The capital funds must also cover:

- All other expenses that are associated with acquiring equipment, such as:
  - pre-installation work
  - support activities which ensure that you can use the equipment (installation, commissioning and initial training).
- The cost of major equipment rehabilitation work which cannot be covered by your usual annual recurrent allocation.

Therefore, in order to be able to make adequate allocations, you need to be familiar with various budgeting tools. This Section covers five budget calculations for capital allocations:

- replacing equipment (*Section 5.1*)
- purchasing new equipment (*Section 5.2*)
- pre-installation work (*Section 5.3*)
- support activities so you can use your purchases (*Section 5.4*)
- large-scale major rehabilitation projects (*Section 5.5*).

In this Section, different ways of calculating budget elements are given. They are used for different purposes, as follows:

a. Rough Estimations
- – used for long-term plans, business purposes, and bulk purchasing
- – most often used at central or regional levels which cover the needs of many facilities and cannot go into specific details.

b. Exact Detailed Estimates
- – used for annual requirements and specific single purchases
- – most often used at facility or district level.

Tip

- Whenever new equipment is acquired, it is vital to budget for its running costs. Therefore, there must be a link between planned capital expenditure and recurrent budget estimates for things like maintenance and consumables. The recurrent budget calculations are described in *Section 6*.

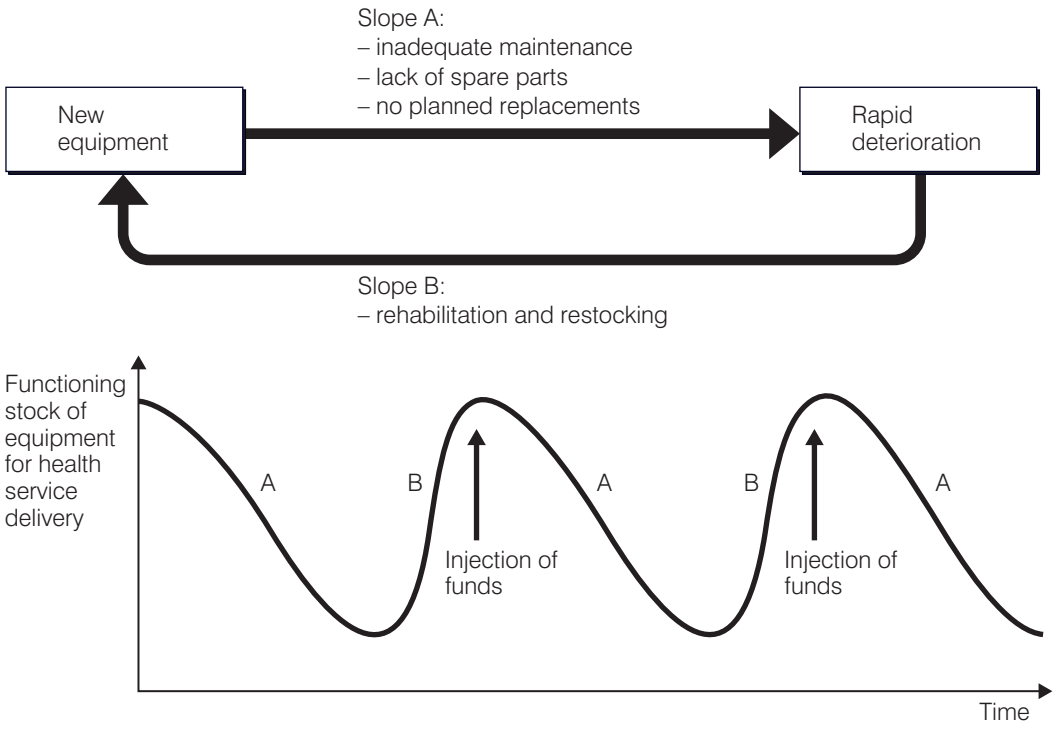
In many developing countries there is a recurring cycle:

- capital budgets are only allocated when funding is available from external support agencies
- health facilities are often funded through foreign aid and constructed as turnkey projects
- the useful lifetime of these facilities can be less than 10–15 years (if not well maintained)
- rehabilitation thus becomes a huge burden on the health service provider.

As *Figure 13* shows, such a cyclical approach to funding is costly and provides little benefit to patients. If such an approach is followed, the quality of the health service delivered will not be constant and will undergo frequent periods of deterioration.

It is important for budget estimates to reflect this danger. Therefore, you should plan the replacement of your equipment and facilities in gradual stages, in order to secure annual capital budget requirements.

Figure 13: The Danger of a Cyclical Approach to Funding Equipment



5.1 REPLACING EQUIPMENT

Budgeting for replacement is necessary, since all equipment has a life expectancy. Once equipment has reached the end of its life, no amount of intervention will be effective. Instead, you will simply have to replace the equipment if you want to carry on delivering a quality health service.

Different types of equipment have varying life expectancies, depending on the type of technology contained within them. For example, five years might be the typical life for an oxygen tent, 10 years for a respiratory ventilator, 15 years for a dental chair, and 20 years for a lift. It has been necessary to develop estimates for equipment lifetimes, although it must be recognized that these lifetimes will vary for different users. This will depend on a number of factors, such as:

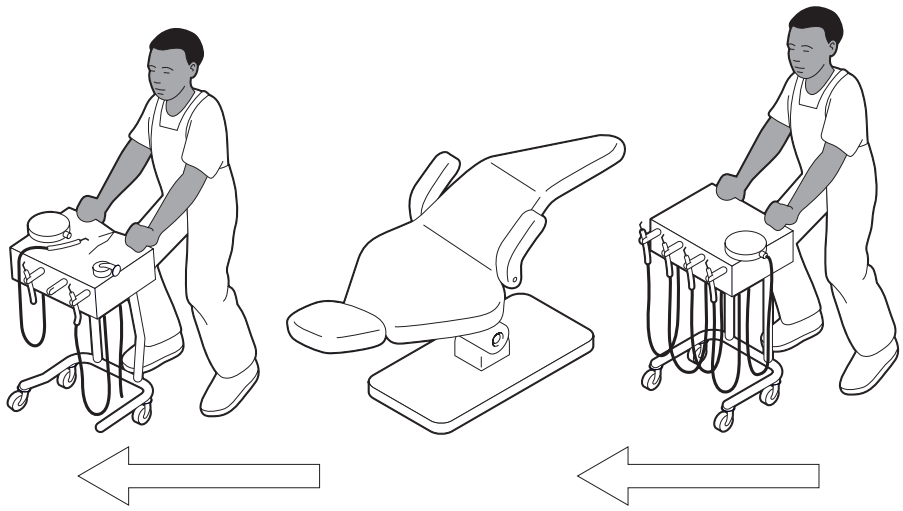
- the rate of use of the equipment (how many tests per month, how many patients per year, etc.)
- how many back-up units there are – whether a machine is used to its limit, overworked or overloaded
- how the equipment is handled or whether it is abused
- how well the equipment is cared for and cleaned
- how well the equipment is maintained and how often
- the initial quality of the equipment
- the physical environment and climate that the equipment is used in.

Annex 3 contains some typical lifetimes for equipment which have been developed by various organizations. Over time, and based on your experiences, you can modify these figures to suit your circumstances. But you need to start somewhere and these figures provide a basis for planning purposes.

An annual replacement budget covers the needs of equipment likely to reach the end of its life in any given year. This simply covers the normal demise/death of the proportion of existing stock which reaches the end of its life in that year.

By providing the finance for this replacement equipment, the health service provider is simply sustaining existing services and is not financing expansion.

For example, if a health facility wishes to continuously provide a dental service, the dental drilling unit needs to be replaced at the end of its life so that the existing service can continue. The purchase of a replacement drilling unit is not an expansion in dental services, but is merely a continuation of the existing provision.



Thus replacement funds need to be provided routinely, and are required for **different reasons** than funds allocated for the purchase of additions to the equipment stock under facility expansions and upgrading projects.

Failure to replace equipment will result in soaring maintenance bills as the equipment ages (see *Figure 19* in *Section 6.1*). Also, if many years go by without an annual replacement budget, your health service provider will face a critical reduction in the healthcare they can deliver. You will accumulate an increasing backlog of expired equipment. This means you will ultimately face the major capital investment implications of having to undertake bulk replacement of equipment stock all at once. This is not usually affordable or manageable.

What Budgeting for Replacement Implies

If replacement is not planned for, the health service delivered to the public will simply deteriorate. As a quick estimate, you need to make the following calculation, using the stock value estimates developed in *Section 3.2*:

$$\frac{\text{equipment stock value in new (current) prices}}{\text{equipment lifetime}} = \text{replacement budget required each year}$$

BOX 22: Principles Behind Replacement Cost Calculations

A. Basic Principle

Assuming – your equipment stock value (*Section 3.2*) is, for example, US$2,500,000 (Note: this is not based on what you buy each year, but upon the value of all the items you already own)

And – all the equipment only had a 'life' of one year

Then – you would need $2,500,000 each year to replace your equipment!

B. Taking Equipment 'Life' Into Account

But – if the 'life' of the equipment is, in fact, five years

Assume – the equipment will **not** all reach the end of its life at the same time

Then – you can spread your replacement budget over the equipment lifetime, as follows:

$$\text{replacement budget } \textbf{each year} = \frac{\text{value of stock}}{\text{lifetime}}$$

For example: $\text{replacement budget per annum} = \frac{2{,}500{,}000}{5} = \$500{,}000 \text{ pa}$

C. Averaging Across All your Stock

In fact, your stock will actually be made up of different types of equipment with different lifetimes – some five years, some 10, some 15, and some 20 years. Based on such lifetimes, an **average** lifetime is often taken to be 10 years. Thus, a **rough estimate** of the replacement budget will need to be 10 per cent of the equipment stock value each year:

$$\text{replacement budget } \textbf{each year} = \frac{\text{total stock value}}{\text{average lifetime}}$$

For example: $\text{replacement budget per annum} = \frac{2{,}500{,}000}{10} = \$250{,}000 \text{ pa}$

D. Averaging Across Types of Equipment

To make **more exact** estimates, it will be necessary be more specific and undertake calculations for each different type of equipment that has a different lifetime (see *Annex 3*). For example, your stock of equipment may be made up of:

$750,000 worth of stock with a 'life' of 15 years

$1,300,000 worth of stock with a 'life' of 10 years

$450,000 worth of stock with a 'life' of five years

Therefore, **each year** you will need a replacement budget of:

$$\frac{750{,}000}{15} + \frac{1{,}300{,}000}{10} + \frac{450{,}000}{5} = 50{,}000 + 130{,}000 + 90{,}000 = \$270{,}000 \text{ pa}$$

In *Box 22*, Examples A and B explain the basic principles behind the calculations. Such calculations can be undertaken for all types of equipment clumped together to give an average estimate, as shown in Example C. Or calculations can be undertaken for different groups of equipment with different lifetimes to provide a more accurate estimate, as illustrated in Example D.

Tip

- If we consider that typical equipment lifetimes range from approximately five to 20 years, an average equipment lifetime can be taken to be 10 years. Thus, as a rough indicator, the replacement budget would need to be 10 per cent of the equipment stock value each year. This has a **significant implication** for health finances.

It is very common for health service providers to undertake no regular planned replacement budgeting, even though such a practice is commonly used in the business community. We recognize that adequate replacement budgets may work out to be a large percentage of the overall health budget. Thus replacement needs are often not covered regularly but are left to fall under occasional development projects, funded either by the health service provider or external support agencies.

Although it may be difficult to set aside the recommended amounts to cover all replacement needs, your health service provider must start somewhere. They should start with at least some percentage of the equipment stock value. If they do not, they face the long-term cost implication of deteriorating facilities, lost ability to function, and failure to deliver health services.

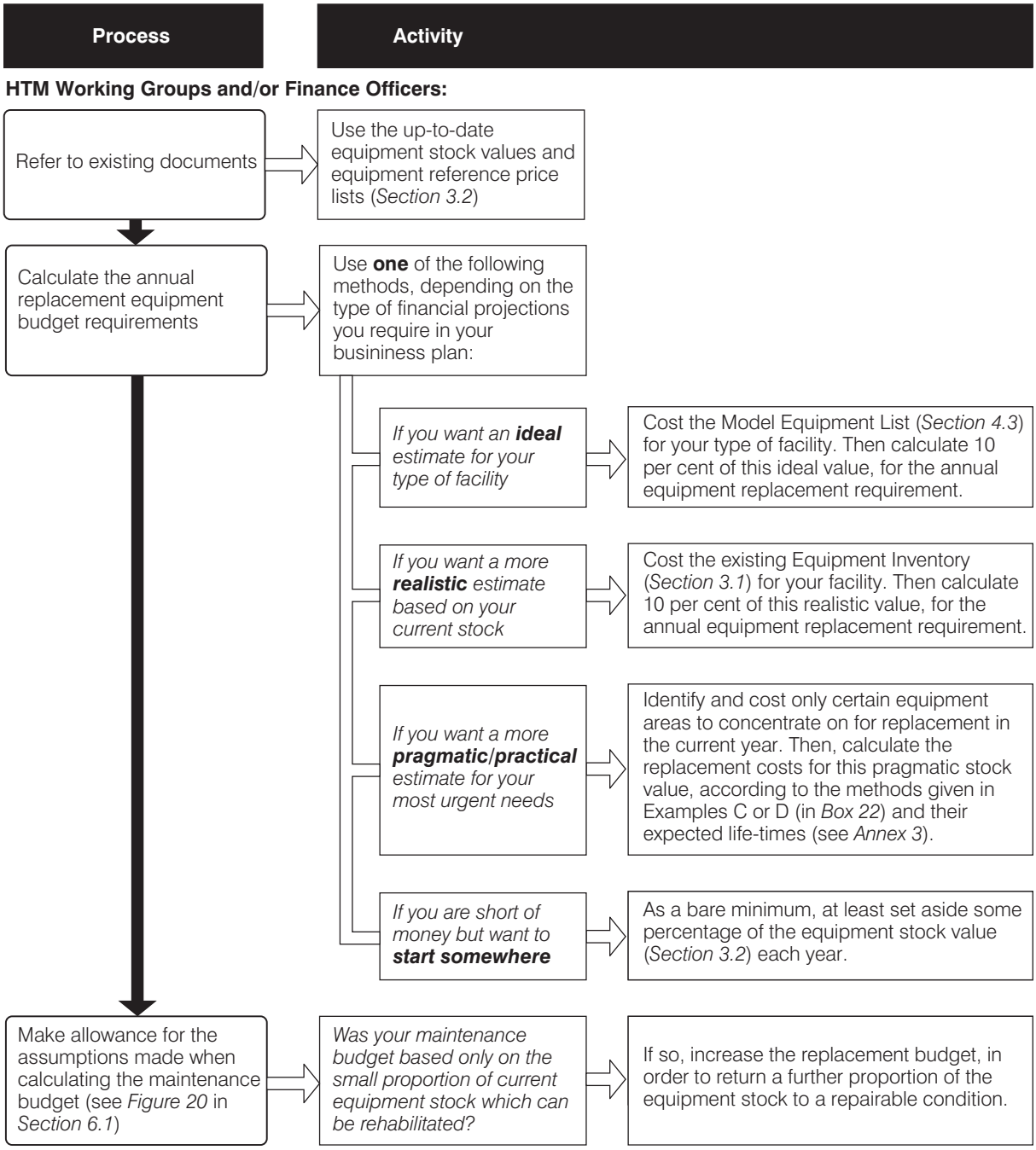
Who is Responsible for Replacement Budgeting?

Who?		Takes what action?
HTM Working Groups Finance Officers	→	Need to learn how to budget for equipment replacement.
Which level?		**Takes what action?**
Any health facility that: - makes its own plans - sets or requests its own budget allocations - runs its facility as a business.	→	Can make equipment replacement budget calculations.
Any service level that: - covers the needs of many facilities - develops business plans - wants a general idea of needs	→	Can use the **rough estimations** described here for long-term forward plans and budget allocations
Any service level that makes detailed estimates for: - specific single purchases. - annual requirements.	→	Can make **more exact detailed estimates** as described in *Section 5.2*

How to Budget for Replacement

When budgeting, you should aim to allocate sufficient funds for future needs. We recommend that you actually put aside money in your budget each year, to cover equipment replacement costs. This is **not** simply the book-keeping paper exercise of depreciation accounting. (Depreciation accounting is when you write off part of the value of your stock each year to show that your assets are worth less than they used to, and to reflect the revised value of your business).

Figure 14: How To Make Rough Estimations of Replacement Costs for Forward Planning



When budgeting for replacement costs, you should make:

- **rough estimations** for long-term forward planning purposes, as shown in *Figure 14*.

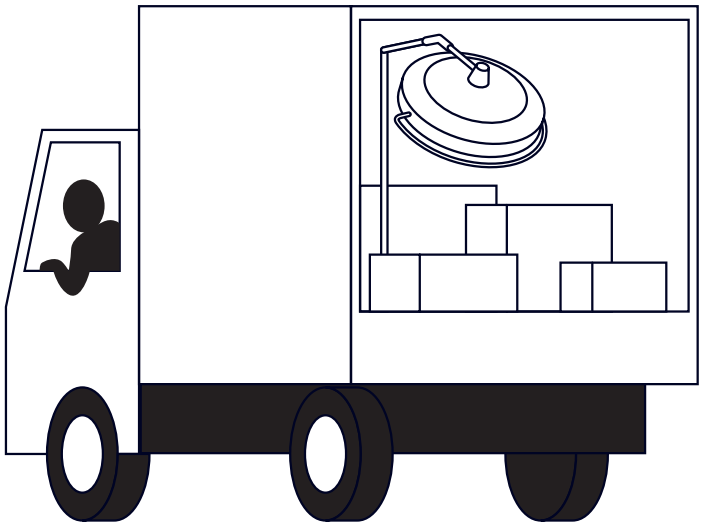
Then, once you are in a position to make the actual purchase of the replacement equipment, you can make:

- **exact estimates** for the specific equipment purchases, as shown in *Box 23* or *Boxes 24 and 25* in *Section 5.2*.

5.2 PURCHASING NEW EQUIPMENT

Whenever you purchase equipment, you need to budget for more than just the cost of the hardware. You must also budget for:

- the cost of the total 'package of inputs' (e.g. maintenance, training, consumables) required to keep the equipment functioning
- the costs of getting the equipment to your facility in a working condition.



A common mistake is to identify the supplier's price for the goods required, and assume that this is the total amount that you must budget for. In fact, there are many other expenses involved when procuring equipment which need to be included in order to identify what will be the total cost to you. You also need to take into account the following expenses:

- the price of the equipment
- the cost of a 'package of material inputs' required for you to use the equipment. This would include items such as accessories, manuals, stocks of consumables and stocks of spare parts

- the cost of a 'package of support inputs' required in order to get the equipment going. This would include items such as assistance with installation, commissioning and initial training
- the cost of freighting the goods to your facility (for example, crating, international shipment by sea or air, insurance, import duties, customs clearance and onward transport by road/rail to your facility)
- any procurement charges, if you are paying an agency to undertake the purchasing for you.

Also, there may well be additional costs that are often forgotten, such as:

- the cost of pre-installation work, such as site preparation, additional equipment needs (for example, air-conditioners or voltage stabilizers), hire of fork-lift trucks and storage costs (*Section 5.3*)
- the annual maintenance contract required (*Section 6.1*)
- the cost of employing extra staff. This implication needs to be identified and agreed in the planning stage, before the purchase goes ahead (*Section 4*).

All these costs will vary, depending on the purchase options you make (see *Guide 3*). This will depend on factors such as:

- the type of technology you purchase
- whether you import the equipment
- whether you buy in bulk
- whether someone else is undertaking the procurement for you.

It is also important to look for savings, such as negotiated discounts. For example, you may be able to lower your purchase costs by collaborating with other facilities or service levels, and buying equipment together in bulk. Using this method will also help you to standardize the makes and models purchased. *Section 2.2* discusses such issues of economies of scale.

Who is Responsible for Budgeting for Purchases?

Who?		Takes what action?
HTM Working Groups Purchasing and Supplies Officers	→	Need to learn how to budget for equipment purchases.
Which level?		**Takes what action?**
Any facility or service level that: - makes its own plans - sets or requests its own budget allocations - runs its facility as a business.	→	Can make equipment purchase calculations.

Which level?		Takes what action?
Central or regional service levels that: - cover the needs of many facilities - cannot go into specific details.	→	Are more likely to make **rough estimations** for long-term forward plans and budget allocations.
Facility or district service levels that make estimates for: - specific single purchases - annual requirements.	→	Are more likely to make more **exact detailed estimates**.

How to Cost New Equipment Purchases

If budgets are based solely upon the initial price of the equipment quoted by the supplier, it is likely that they will be inadequate.

Thus, for real purchase costs, you can make:

- either **rough estimations** for long-term forward planning purposes and bulk purchases, as shown in *Box 23*
- or **exact estimates** for specific or annual requirements, as shown in *Boxes 24 and 25*.

BOX 23: How To Make Rough Estimations of Equipment Purchase Costs for Forward Planning and Bulk Purchasing

HTM Working Groups and/or Purchasing and Supplies Officers:

1. When buying a consignment of assorted items, aim to make an estimate averaged over the whole range of the assorted equipment being purchased.
2. Start with the total bulk price of the equipment from the manufacturer (or see reference price lists in *Section 3.2*).
3. Make the following calculations to estimate what the real cost might be:

Calculation			Example
a. Take the (bulk) price of the equipment:	US$ price		= $20,000
b. Allow for the 'package of material inputs' by calculating:	110% of price	= package value	= $22,000
c. Allow for the 'package of support inputs' by calculating:	110% of package value	= working value	= $24,200
d. Allow for the freighting costs by calculating:	110% of working value	= delivered value	= $26,620
e. Allow for procurement charges by calculating:	110% of delivered value	= Total Cost	= $29,282

4. Consider whether any additional money is required for pre-installation work. Make these calculations according to *Box 26* in *Section 5.3*.

BOX 24: How To Make Exact Estimates for Specific Equipment Purchases

HTM Working Groups and/or Purchasing and Supplies Officers:

1. When buying single items or types of item, aim to consider each piece of equipment or similar types of equipment separately.
2. Contact the manufacturers or suppliers for the initial basic price of their available products (or see reference price lists in *Section 3.2*).
3. Make the following calculations to estimate what the real cost might be:
   - Imagine equipment falls into four categories which are dependent on how technically complicated it is, and therefore how many skills and resources are required for it (as shown in *Box 25*).
   - Choose the correct category for the equipment you are trying to purchase. Then look up that category in *Box 25* to find out the actual cost estimate required.
4. Use these total cost estimates (rather than the supplier's initial price) when budgeting for specific replacement and additional equipment purchases, which have been planned and agreed (*Sections 7* and *8.1*).

Box 25 helps you to see the impact of purchasing types of equipment of varying complexity and technology levels.

BOX 25: Total Purchase Cost[4] Estimates depending on Equipment Type

Price Category A: High technology sophisticated equipment requiring special spare parts. Most repair and preventive maintenance is undertaken by specialists. Normally comprehensive training of clinical and technical staff is required.

Price Category B: Medium technology equipment requiring special spare parts. Repair and preventive maintenance can usually be undertaken by local staff. Training of clinical and technical staff is required.

Price Category C: Low technology equipment requiring easily obtainable spare parts. Repair can be undertaken by local labour. Little or no training of staff is required.

Price Category D: Simple equipment and furniture requiring little or no spare parts. Repair can be undertaken by local labour. No training of staff required.

	Equipment Price Categories			
COSTS	**A**	**B**	**C**	**D**
1. Net Procurement price Free-On-Board (i.e. at the port of exit of the supplier's country)	100%[1]	100%	100%	100%
2. Package of inputs (accessories, consumables, manuals, etc.) for estimated one year of operation	7%[2]	5%	3%	2%
3. Installation, commissioning, plus initial training of key personnel	15%	10%	5%	0%
4. Spare parts for estimated two years of normal operation	20%[3]	10%	2.5%	0.5%

Continued overleaf

BOX 25:Total Purchase Cost[4] Estimates depending on Equipment Type (continued)

COSTS	Equipment Price Categories A	B	C	D
5. Freight charges, dependent on whether coming from neighbouring countries (eight per cent) or from overseas (15 per cent)	8–15%	8–15%	8–15%	8–15%
6. Insurance	1.5%	1.5%	1.5%	1.5%
7. Contingency	3%	3%	3%	3%
8. TOTAL[4] if freighting from neighbouring countries	154.5%	137.5%	123%	115%
TOTAL[4] if freighting from overseas	161.5%	144.5%	130%	122%
Possible Additional Costs				
9. Charges of a Procurement Agent	10%	7.5%	5%	5%
10. One year's service support	7%	5%	1.5%	0.5%
11. Unloading/lifting equipment and warehousing[5] – dependent on size and weight; if small/light (nought per cent), if large/heavy (one per cent)	0–1%	0–1%	0–1%	0–1%
12. Site preparation work[5] – dependent on size and portability; if small/portable (nought per cent), if large/fixed (10 per cent)	0–10%	0–10%	0–10%	0–10%

Notes:
1. The initial basic price for the equipment which you obtain from the manufacturer or supplier is the amount to appear in the first row (100 per cent).
2. These percentages are calculated from the basic price provided by the supplier (in row 1).
3. For sophisticated equipment you may not hold the spares yourself, but will budget to pay the manufacturer's representative to obtain them or hold them for you.
4. The real total cost that you will have to budget for will be greater than 100 per cent of the initial price, and will be the percentage shown in the Total row (row 8), with possibly the additional costs shown in rows 9–12.
5. See *Box 26* (in *Section 5.3*).

When negotiating with donors, it is very important to ensure that they finance this full 'package of inputs'. There are examples of good foreign aid projects where the whole package has been planned for. Unfortunately, however, there are also many examples of poorly planned projects, where equipment has failed to work from the beginning, due to the lack of consideration of these inputs.

5.3 PRE-INSTALLATION COSTS

Once equipment has been purchased, further work may be required, in order to prepare the facility for the arrival and commissioning of the equipment. If you do not allocate sufficient funds for this, your new equipment may sit for many months before you are able to use it. It is best to build the extra expense of pre-installation work into the capital allowance you set aside for equipment purchases, as this is when capital funds are available. If you discover you need money for pre-installation work after the equipment has arrived, it is then more difficult to find additional funds.

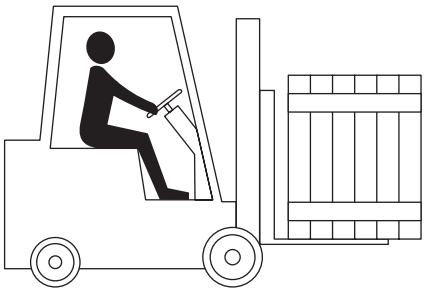
A variety of necessary work and tasks commonly fall under the category of 'pre-installation work'. These could include:

Site preparation tasks, such as:

- disposing of the existing obsolete item (disconnection, removal, cannibalizing for parts, transport, decontamination and disposal)
- extending pipelines and supply connections to the site (from the existing service installations)
- upgrading the type of supply (such as increasing the voltage, or the pipeline diameter)
- providing new surfaces (such as laying concrete, or providing new worktops)
- creating the correct installation site (for example, digging trenches, building a transformer house or a compressor housing).

Hiring lifting equipment (such as cranes, forklift trucks, stores trolleys, gangs of labourers):

- to help with lifting equipment for unloading/moving purposes
- to help with lifting equipment for installation/positioning purposes.



Paying for warehouse space:

- if goods are stored by Customs because you have delayed their clearance or have not paid the duty, then Customs will impose charges on you
- if equipment has to be stored when it arrives until you are ready to install it.

All of this 'pre-installation work' requires funding, if the equipment is to be usable once it arrives. Often, this work requires substantial amounts of money.

Experience in a West African Country

A donor agency financed large amounts of new equipment but assumed the central health service could finance the pre-installation work. However the cost of such work was found to be so large it required external support funding of its own.

Who is Responsible for Calculating Pre-Installation Costs?

Preference

Guide 3 of this Series covers in detail the activities involved during procurement and commissioning of equipment. We suggest that the HTM Working Group, or a smaller Commissioning Team (*Section 1.2*), is responsible for ensuring that pre-installation work is organized, financed and implemented.

Who?		Takes what action?
HTM Working Group, or a smaller Commissioning Team (*Section 1.2*)	→	Need to learn how to budget for pre-installation work
Which level?		**Takes what action?**
Any health facility or service level that: - makes its own plans - sets or requests its own budget allocations - runs its service as a business.	→	Can make pre-installation work calculations
A service level (such as facility or district) that makes detailed estimates for: - specific single purchases - annual requirements.	→	Will find the calculations for **exact estimates** most useful
Any service level that undertakes bulk purchasing, needs an exercise to estimate the pre-installation requirements at the variety of sites they purchase for.	→	Can use the calculations described for **exact estimates**

Which level?		Takes what action?
Service levels (such as central or regional/district levels) that: - cover the needs of many facilities - cannot go into specific details.	→	Only need to make **rough estimations** for their long-term forward plans and budget allocations

How To Calculate the Pre-Installation Costs

You can make:

- either **rough estimations** for long-term forward planning purposes, by referring to *Box 26*
- or **exact estimates** for specific equipment purchases, and investigate the needs for your bulk purchases, as shown in *Figure 15*.

It is difficult to make global rough estimates for the cost of site preparation work according to equipment price categories. However, *Box 26* provides some suggestions from various countries.

Box 26: Suggestions for Rough Estimations of Pre-installation Costs for Forward Planning

Different countries suggest a number of alternative approaches:

i. Advice can be obtained from:

- Manufacturers, who can usually provide information on site preparation and unloading/lifting needs. These can then be used to make estimates of local costs.
- Local freight forwarding companies, customs, and warehousing facilities, who can provide information on warehousing costs. Your commissioning team should be liaising with the freight forwarding company and any installation company concerning delivery dates and expected delays, which can be used to estimate warehousing needs (see *Guide 3*).

ii. Any estimates for site preparation depend on:

- the type of equipment involved
- whether site preparation involves new buildings or renovations/alterations of existing ones
- the state of the local construction industry
- local labour costs.

iii. Examples from Eastern and Southern African countries of site preparation costs are:

Equipment	Price (US$)	Site Preparation Needs	Cost (US$)	As percentage of price
MRI unit	1 million	new construction at US$1.500/sq.m	70,000	10%
Generating set for a facility	50,000	cabling, concrete base, shed	2,500	5%
ECG recorder	3,000	none	0	0%
Water heater	200	brackets, tubing, switch, circuit breaker	20	10%

Continued overleaf

Box 26: Suggestions for Rough Estimations of Pre-installation Costs for Forward Planning (continued)

Thus the site preparation cost does not always depend on the equipment sophistication, or on price category. Sometimes, it has more to do with:

- the size of the equipment
- whether it is portable
- whether it requires lots of service supply connections
- whether it requires a housing

Average costs as a percentage of equipment price are given in *Box 25*.

iv. Any estimates for unloading/lifting depend upon:

- the type of equipment involved
- its weight, size, and difficulty to handle
- local labour costs
- local hire costs for cranes and forklift trucks (for example, in parts of Southern Africa it costs US$50/hour for hiring a crane)
- whether the freight forwarding company has the means for unloading/lifting the equipment.

Average costs as a percentage of equipment price are given in *Box 25*.

v. Any estimates for warehousing depend on:

- the weight and volume of the equipment
- the length of the storage period.

Average costs as a percentage of equipment price are given in *Box 25*.

To make exact estimates, you need to know more specific details about the site, as shown in *Figure 15*.

Tip

- The service level which makes these calculations will have to visit the site, or know about the site, or have relevant site and engineering drawings.

Figure 15: How To Make Specific Estimates of Equipment Pre-installation Costs

Step/Process	Activity
1. The HTM Working Group or Commissioning Team:	
Liaises with the supplier	Whenever equipment is purchased, provide the supplier with details of the proposed equipment site and services, and officially request the necessary site preparation instructions and the size and weight of the crated goods.
Reviews administration needs and costs	Identify the needs and arrangements required for warehousing, hiring of lifting equipment, and safe disposal of existing items. Cost the requirements.
2. HTM Manager:	
Reviews technical needs	Study the manufacturers' site preparation instructions or, if these are not available, use experience and common sense.
Plans removal of existing equipment	• What work is involved in removing the existing item and cutting connections? • What work is involved in cannibalizing the existing item for parts?
Plans any construction or building alterations required	• Is special construction required, such as a transformer housing or lead screening? • Is the room large enough to accommodate the equipment? • Are any special modifications necessary, such as enlarging the doorway, or building a worktop? • Do any scrap or other items need to be removed from the room?
Plans the electrical requirements	• Does the new equipment require a new transformer? • Do you need a generator, or does the existing one need upgrading? • Is a single phase or three-phase supply required at the site of installation? • Is a special circuit breaker needed? • Is a special socket outlet required? • Has the existing electrical circuit sufficient capacity?
Ensures the existing electricity installation is safe	Organize an exercise to ensure that all relevant electrical installations are properly grounded and tested, and determine if any remedial works are required.
Plans the water and drainage requirements	• Is the water pressure available adequate? • Is water treatment required? • Does the pipeline diameter need increasing? • Is proper drainage provided?
Plans any steam supply requirements	• Is the necessary steam supply available at the proposed site? • Does the pipeline diameter need increasing? • Can the boiler accommodate the increased load?
Plans the gas supply requirements	Are the necessary gas supplies available at the proposed site?

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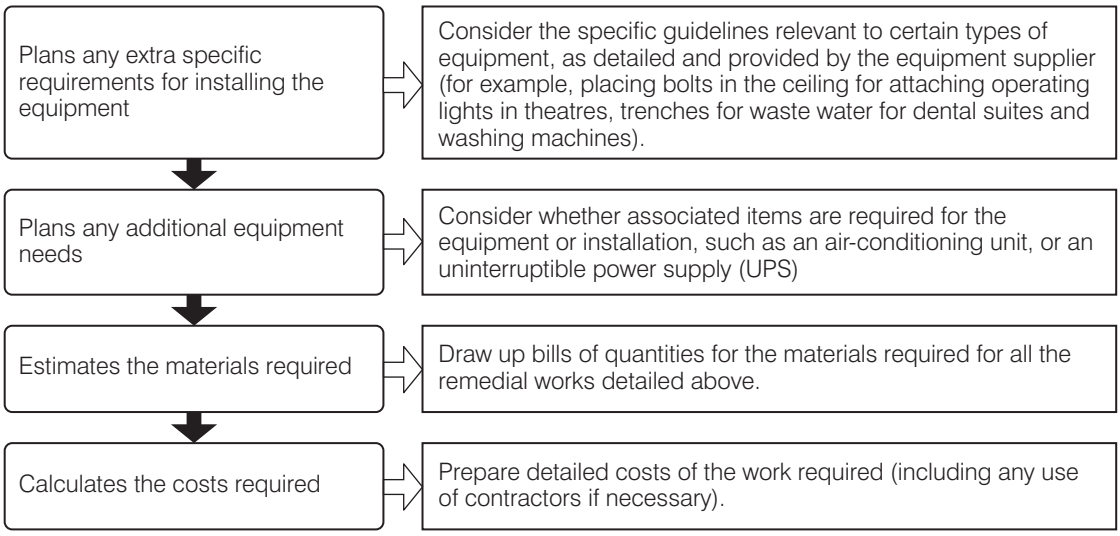
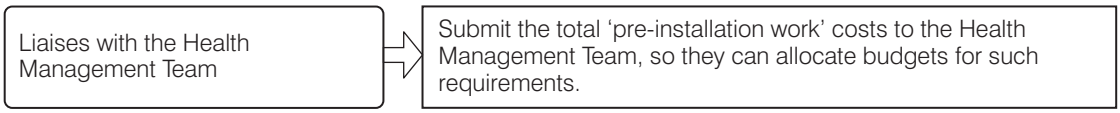
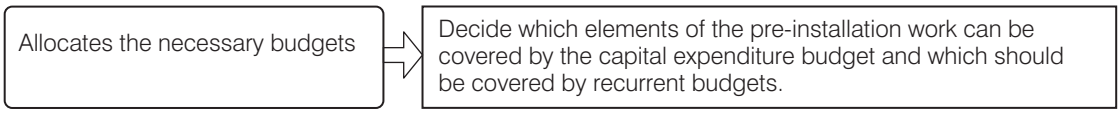
Figure 15: How To Make Specific Estimates of Equipment Pre-installation Costs (continued)



3. HTM Working Group or Commissioning Team:



4. Health Management Team or Finance Officer:



5.4 SUPPORT ACTIVITIES TO ENABLE YOU TO USE YOUR PURCHASES AND DONATIONS

There are a number of activities which must take place before you can start using equipment which has been purchased. These activities make up the official 'Acceptance Process' (see *Guide 3*) and include:

- receiving equipment on site
- unpacking
- installation (fixing equipment into place)
- commissioning (checking that equipment is performing correctly and safely)
- official acceptance
- initial training (for equipment users and maintainers)
- entering stocks into Stores and onto records
- payment
- complaints.

From this list of activities, health service staff must be responsible for receiving goods on site, official acceptance, entering stocks and information into existing record systems, and dealing with payment and complaints. These activities will not cost you anything to undertake.

However, unpacking, installation, commissioning and initial training can be undertaken either by health service staff or by paid external support. This 'package of support inputs' will have a cost attached. How much it costs depends on the type of technology and who undertakes the work.

Type of Technology

For common low-technology items of equipment that are simple to use, installation, commissioning, and initial training are not major activities and will happen all at once. For example, for a mobile examination lamp:

- installation is using a test meter to check the electricity supply of the socket outlet, and then simply plugging in the lamp
- commissioning is using a test meter to check the electrical safety of the lamp so that it will not give the operator an electric shock
- initial training is ensuring the operator knows where the on/off switch is, how to handle the light bulb, and how to alter the angle of the head without pulling the lamp over.

However for more complex items or for items you are not that familiar with installation, commissioning, and initial training can become major tasks. Such activities must be planned carefully if the equipment is to work properly from the start.

Who Should Undertake the Work?

Unpacking, installation, commissioning and initial training can be carried out either by representatives from the supplier company, staff from your health service provider, or another support organization.

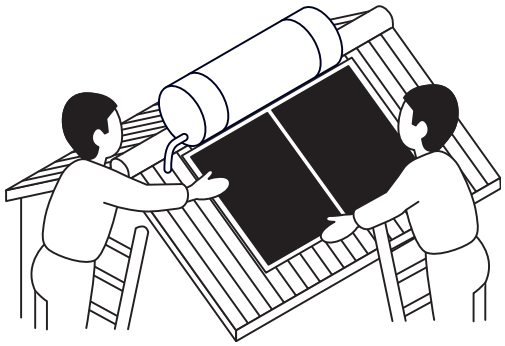
The factors which help you to decide which type of personnel should be involved are:

- The level of complexity of the equipment. For example, the more complex an item is, the more likely it is that you will need the help of the manufacturer or his representative.
- Whether the HTM Teams have the necessary skills. For example, if your staff cannot undertake the job it is useful to ask for assistance from a contractor.
- Whether you are buying one item or bulk buying. For example, if you are only buying one item, it may not be worth the expense of getting the manufacturer's help and your HTM Team can manage with sufficient written guidance from the manufacturer. But if you are buying large quantities of the same product it will be worthwhile contracting the manufacturer to undertake the installation, commissioning, and initial training at as many locations as necessary.

We recognize that for some equipment, installation, commissioning, and initial training will happen all at once, will be undertaken by the same people, and can be included in one quote. However, in the rest of this sub-section we consider the needs for installation and commissioning separately from initial training, since sometimes:

- you need installation and commissioning but no training
- you need initial training but minimal installation and commissioning work
- initial training takes place at a later date to installation and commissioning
- initial training is undertaken by different people than those doing the installation and commissioning
- the organization of training has different requirements than installation and commissioning.

5.4.1 Installation and Commissioning Costs



It is very important to ensure that new equipment is effectively installed and commissioned if you want it to work correctly and safely right from the start of your ownership. Even if the equipment is quite a common item, it is still necessary to install and commission it well.

Tip

- It is always best to address the need for installation and commissioning during the purchase or donation negotiations.

Provision of installation and commissioning should be linked to the procurement contract (see *Guide 3* on procurement and commissioning). In other words, when purchasing equipment from a company, you should request them to provide installation and commissioning at the same time if you cannot undertake it yourself. Provision of such support activities must be mentioned in your equipment specification (*Section 4.5*). If you are able to standardize your equipment and purchase in bulk in collaboration with other health facilities, it is more likely that equipment suppliers will be willing to travel to undertake this work, since they can cover several sites in one trip.

People Involved

If you have the skills, installation and commissioning should be undertaken by a combination of your HTM Team (or other teams from an appropriate level of the HTM Service) for the technical work, and the Commissioning Team (*Section 1.2*) for administrative work.

In the government system, plant may be installed and commissioned by staff from the Ministry of Works. If you need help, you could ask for support from other bodies such as another health service provider. However, for complex or unfamiliar items it is recommended to ask for assistance from the supplier company or its representative.

If you are using external support, it is useful to arrange for some of your in-house maintainers to accompany the external engineers for two reasons:

- to learn from watching the process
- to monitor that the work takes place (see *Guide 5*).

Requirements

Any outside contractor or organization assisting you will assume that you have made the site ready before the date they are due to arrive (*Section 5.3*). They will also expect you to provide a convenient nearby connection point on your service supply installations (such as a suitable tap, circuit breaker or drain outlet) and will only expect to provide materials to extend from the new equipment to this point. They will budget for materials accordingly.

The contractors/organization will bring what are known as 'start-up' consumable items with them – this is just enough to operate the equipment while checking that it is performing correctly and safely. They will not bring stocks of operating consumables for you to run the equipment with. You must ask for stocks of these in the procurement contract/specification (*Section 4.5)*.

You should provide a room for any visiting installation technician/engineer (whether in-house or contracted staff) to use as an office, as a base to work from, and a safe store for their materials and test equipment.

There will be a variety of other inputs required for the installation and commissioning work (for example, accommodation, fees, travel arrangements) as described in *Figure 16*.

Country Experiences

Examples of the kinds of problems that have arisen with installation and commissioning in many developing countries include:

No skills: *new items of equipment left rotting in their crates at health facility sites because there was no one with the skills to install it*

Poor work: *new equipment arrived on site but never worked properly, due to poor installation and commissioning procedures*

Poor planning: *installation engineers were assured by health facilities that the site was ready, but arrived to find that they could not start work, because there was not the correct electricity/water/gas supply.*

Who is Responsible for Calculating Installation and Commissioning Costs?

Preference

The HTM Working Group or its smaller Commissioning Team should be responsible for identifying installation and commissioning needs, and negotiating with the suppliers of equipment (see *Guide 3*).

Who?		Takes what action?
HTM Working Group or its Commissioning Team	→	Need to learn how to budget for installation and commissioning
Which level?		**Takes what action?**
Any health facility or service level that: - makes its own plans - sets or requests its own budget allocations - runs its service as a business.	→	Can make installation and commissioning calculations
A service level (such as facility or district) that makes detailed estimates for: - specific single purchases - annual requirements.	→	Will find the calculations here for **exact estimates** most useful
Any service level that undertakes bulk purchasing, needs an exercise to estimate installation and commissioning needs at the variety of sites they purchase for.	→	Can use the calculations described here for **exact estimates**

Which level?		Takes what action?
Service levels (such as central or regional/district levels) that: - cover the needs of many facilities - cannot go into specific details	→	Only need to make **rough estimations** for their long-term forward plans and budget allocations, and can use the calculations in *Section 5.2*.

How To Calculate the Installation and Commissioning Costs

You can make:

- either rough estimations for long-term forward planning purposes, by referring to *Boxes 23–25* (*Section 5.2*) and using a percentage estimate of the equipment price to cover installation and commissioning as well as initial training (the 'package of support inputs')
- or exact estimates for specific equipment purchases, and investigate the needs for your bulk purchases, as shown in *Figure 16*.

To make exact estimates, according to *Figure 16*, you need to know more specific details about the site.

Tip

- The service level responsible for making these calculations will have to visit the site, or know about the site, or have access to relevant site and engineering drawings.

Figure 16: How To Make Specific Estimates of Installation and Commissioning Costs

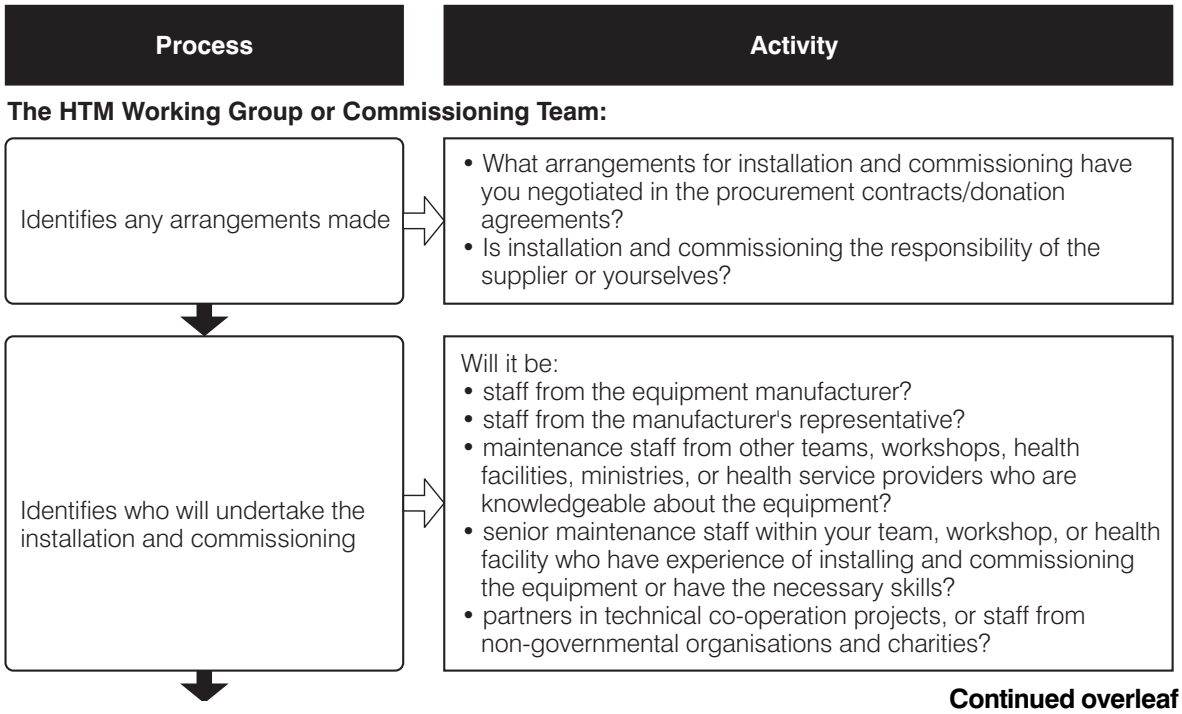


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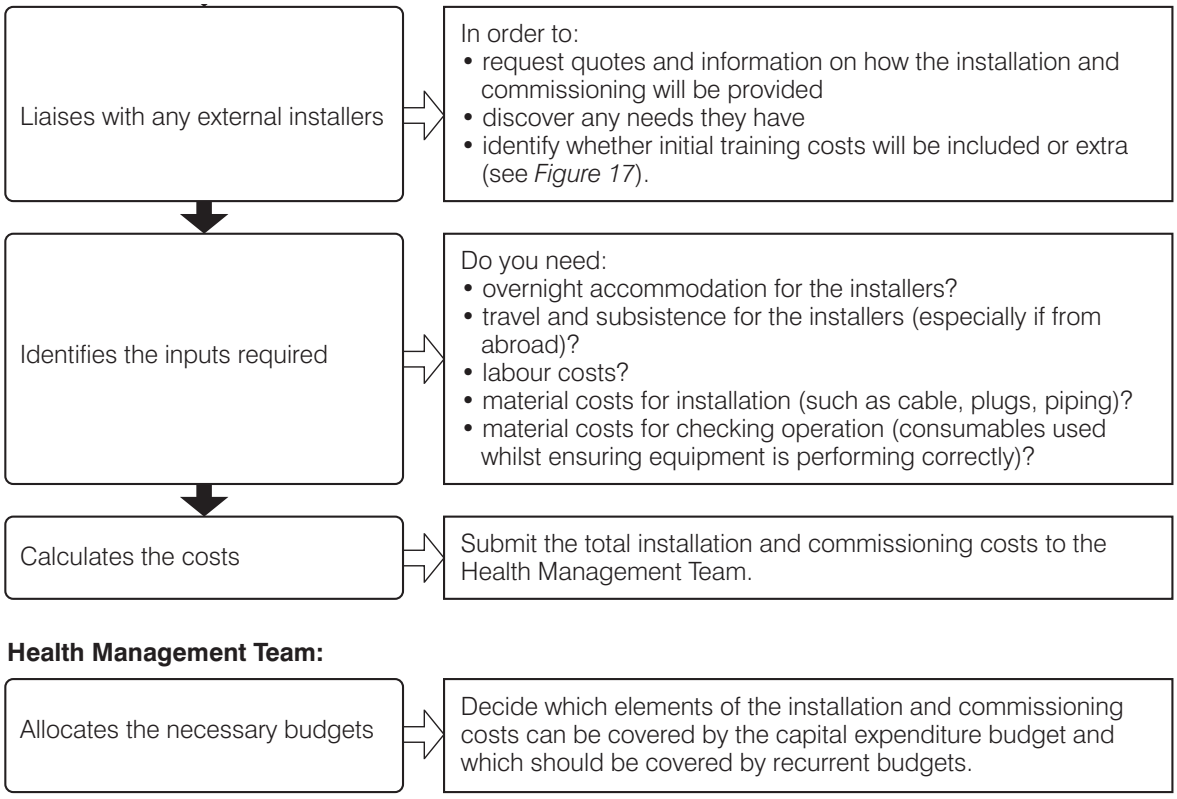
Figure 16: How To Make Specific Estimates of Installation and Commissioning Costs (continued)



5.4.2 Initial Training Costs

It is very important to obtain some 'initial' training for operator and maintenance staff on the new machines. Even if the type of equipment has been used before, staff need to understand the operating requirements of a new make and model.

Tip

- It is always best to address the need for application, operator, and maintenance training packages during the purchase or donation negotiations.

The provision of training should be linked to the procurement contract (see *Guide 3* on procurement and commissioning). In other words, when purchasing equipment from a company, you should also ask them to provide training. Such support activities must be mentioned in your equipment specification (*Section 4.5*). It is more likely that equipment suppliers will be willing to offer training packages if your equipment is standardized and purchased in bulk in collaboration with other health facilities.

The Needs

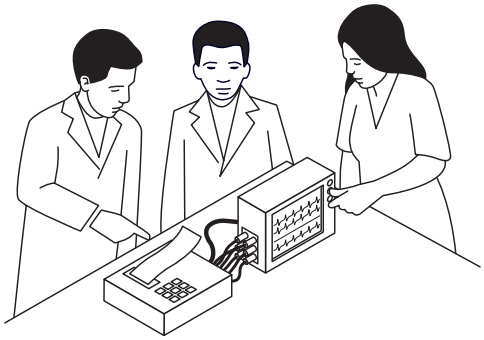
The cost of the training will depend upon whether you are buying single pieces of equipment or buying in bulk. It also depends upon a number of other issues (see *Annex 2* for further guidance), as follows:

Contractual Arrangements

As part of your procurement contract, you should negotiate who will pay for the training and where it will take place. The training arrangements may be dependent on the type and total cost of the equipment. If training is not provided by the supplier, you can run the training sessions yourselves.

The Training Required

Training will be required for a variety of different types of staff (for example, operators or maintenance staff), at different skill levels (such as doctors and nurses, engineers and technicians), and will need to cover a variety of topics (such as equipment operation, safety and maintenance).



The Trainers

The people who run the equipment training sessions can be representatives from the equipment supplier company, or staff from your health service provider, or another support organization. The cost of these trainers will vary, and you may have to identify in-house staff to be trained as trainers first.

Training Sites

You must consider whether:

- your staff will travel to the trainer (perhaps the manufacturer's factory, either locally, in a neighbouring country, or abroad – which, if well organized, can be useful for expensive equipment), or whether the trainers will come to you
- to repeat the training at many health facilities, or to bring the trainees to a central location for training
- to bring the (portable) equipment to a suitable training room, or conduct the training where the equipment is situated. For large items which are difficult to move (such as operating tables, blood-bank fridge) and installed equipment (dental suites, water still), the training sessions will have to be planned around the equipment while trying to cause the minimum disruption to the services provided by the department.

The Numbers to be Trained

Different quantities of staff will attend the training depending on the type of equipment and the department concerned. For example:

- for complex equipment in the theatre, the majority of theatre staff need to attend the training
- for some general equipment used on the ward, only a few representatives from each ward need to attend, who in turn should pass on their skills to the bulk of the ward staff
- technical staff should be chosen from the relevant engineering discipline (such as electrical or mechanical), and with varying skill levels (for example, engineer, technician, and artisan)
- check if other staff, such as cleaners, need special orientation
- for the skills to be spread among the wider workforce who did not attend, you must ensure you run extra courses so that the trained staff can teach their colleagues.

Inputs

There will be a variety of different administrative and material inputs required for running training sessions (for example, accommodation, fees, handouts) as summarized in *Figure 17* and detailed in *Box 33* of *Section 6.4*.

Who is Responsible for Calculating Initial Training Costs?

Preference

Various people can be involved in identifying training needs. We suggest that the HTM Working Group, or a smaller training sub-group (*Section 1.2*) should be responsible for developing all training needs for the overall Equipment Training Plan (*Section 7.2*). In addition, we suggest the Commissioning Team should be involved in negotiations with the suppliers for new purchases, including the training of staff (see *Guide 3*).

Who?		Takes what action?
- HTM Working Group or a smaller training sub-group - Commissioning Team	→	Need to learn how to budget for training which is linked to purchases

Which level?		Takes what action?
Any health facility or service level that: - makes its own plans - sets or requests its own budget allocations - runs its service as a business.	→	Can make training calculations for purchases

Which level?		Takes what action?
A service level (such as facility or district) that makes detailed estimates for: - specific single purchases - annual requirements.	→	Will find the calculations here for **exact estimates** most useful
Any service level that undertakes bulk purchasing, needs an exercise to estimate training requirements at the variety of sites they purchase for.	→	Can use the calculations described here for **exact estimates**
Service levels (such as central or regional/district levels) that: - cover the needs of many facilities - cannot go into specific details	→	Only need to make **rough estimations** for their long-term forward plans and budget allocations, and can use the calculations in *Section 5.2*.

How To Calculate the Initial Training Costs linked to Purchases

You can make:

- either **rough estimations** for long-term forward planning purposes, by referring to *Boxes 23–25* (*Section 5.2*) and using a percentage estimate of the equipment price to cover initial training as well as installation and commissioning (the 'package of support inputs')
- or **exact estimates** for specific equipment purchases, and investigate the needs for your bulk purchases, as shown in *Figure 17*.

To make exact estimates, according to *Figure 17*, you need to know more specific details about the staffing situation.

Tip

- The service level which makes these calculations will have to know about, or obtain information about, the staffing and training requirements at each site.

Figure 17: How To Make Specific Estimates of Costs for Initial Training Linked to Purchases

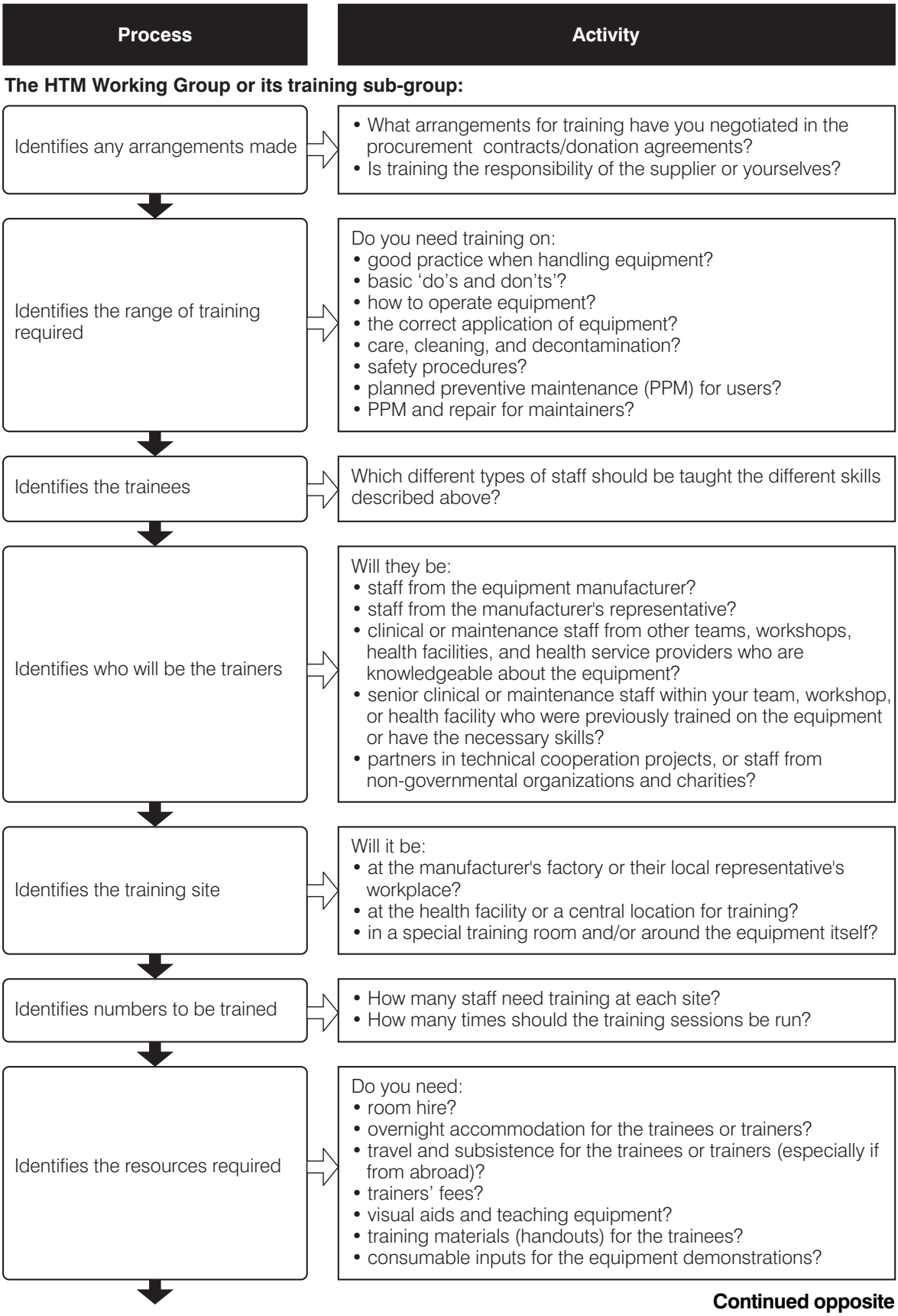


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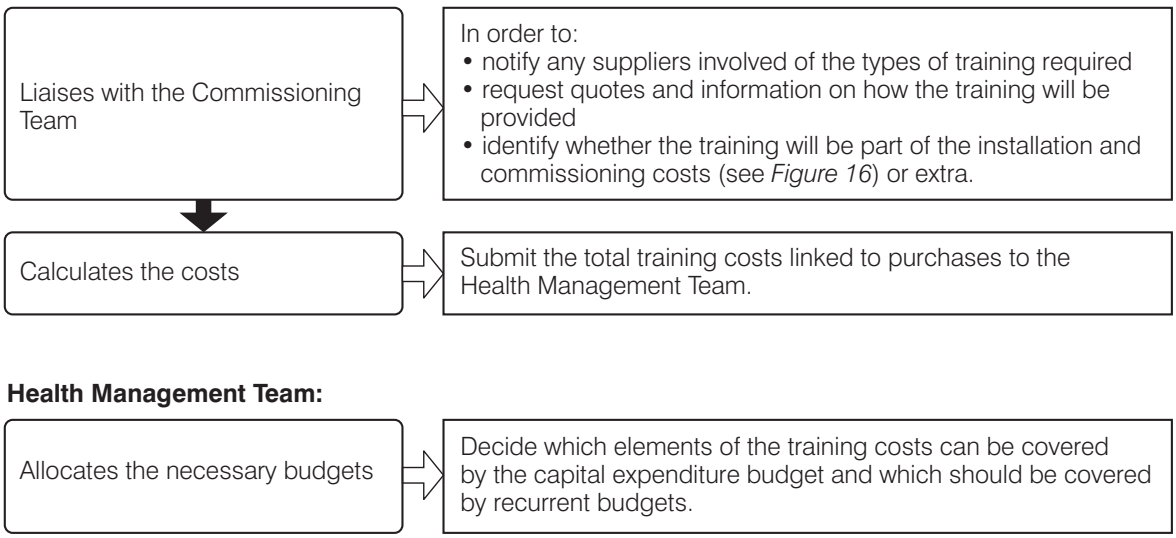
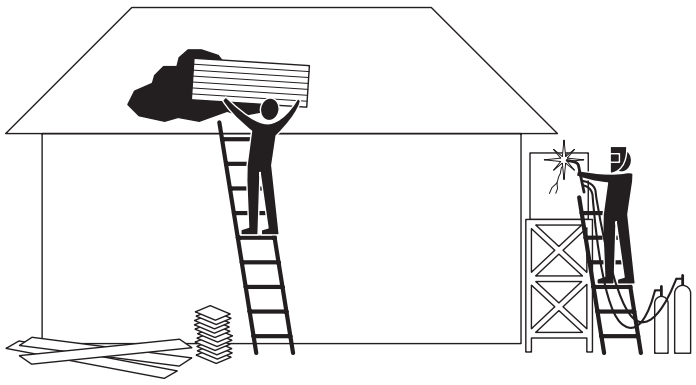
Figure 17: How To Make Specific Estimates of Costs for Initial Training Linked to Purchases (continued)



5.5 LARGE-SCALE MAJOR REHABILITATION PROJECTS

You may have parts of your facility or pieces of equipment which have not been functioning for a while, which you would like to bring back into working condition. Such a task would involve more work and more inputs than a simple repair and, as such, would require a specific rehabilitation (renovation) project. If such a job is cheaper than replacing the broken items with new ones, then funds are required so that you can get more of your stock working again.



Large-scale equipment rehabilitation projects may be too expensive to come out of annual maintenance recurrent allocations, due to the amount of materials or size of contracts required. These will have to be financed from the capital budget.

Who is Responsible for Calculating Rehabilitation Costs?

Who?		Takes what action?
HTM Managers with technical skills (those located at maintenance workshops – *Section 1.1*)	→	Need to learn how to cost large-scale major rehabilitation projects for equipment
Which level?		**Takes what action?**
Any health facility or service level that: - makes its own plans - sets or requests its own budget allocations - runs its service as a business.	→	Can make calculations for rehabilitation work
A service level (such as facility or district) that makes detailed estimates for: - specific projects - annual requirements.	→	Will find the calculations here for **exact estimates** most useful
Any service level that undertakes many rehabilitation projects and needs an exercise to estimate requirements at the variety of sites they cover.	→	Can use the calculations described for **exact estimates**
Service levels (such as central or regional/district levels) that: - cover the needs of many facilities - cannot go into specific details.	→	Only need to make the **rough estimations** described here for their long-term forward plans and budget allocations

How To Calculate the Cost of Major Rehabilitation Work

You can make:

- either **rough estimations** for long-term forward planning purposes, as shown in *Box 27*
- or **exact estimates** for specific rehabilitation projects, and investigate the needs for a number of projects at various sites, as shown in *Figure 18*.

It is difficult to make global rough estimates for the cost of major rehabilitation projects. However, *Box 27* provides some suggestions from various countries.

BOX 27: Suggestions for Rough Estimations of Large-scale Major Rehabilitation Costs for Forward Planning

Different countries suggest alternative approaches to determine whether it is worth carrying out the rehabilitation work:

i. The cost will depend upon the present status and condition of the equipment.

   In order for rehabilitation work to be worthwhile, it must add an extra five years to the life of the equipment.

ii. The cost of rehabilitation obviously must be less than the price of replacing the equipment.

   Some countries do not recommend continuing with rehabilitation if the cost will be more than 50 per cent of the new equipment value.

   Consider what is the maximum percentage of equipment value that you could spend that still makes the rehabilitation worthwhile (ask your health economist, accountants, or finance officer).

iii. If you bought separately all the parts that made up a piece of equipment, it would cost you three to four times the price of the equipment.

   Therefore if five to ten per cent of the equipment parts need replacing, you would have to budget for at least one-third of the new equipment value to buy the parts for the rehabilitation project.

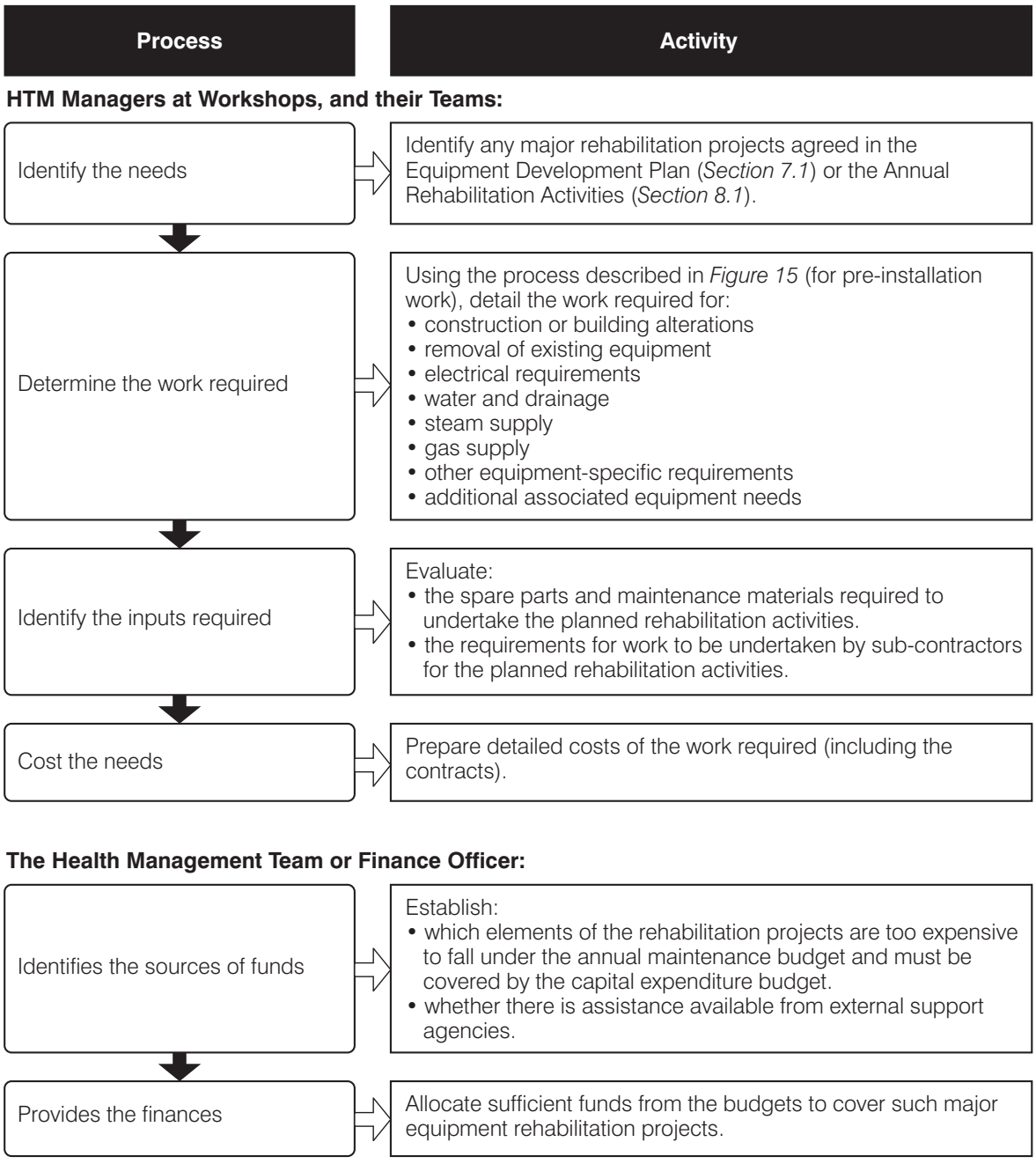
   Calculate the cost of the spare parts that you anticipate you will need and, if this is too large a proportion of the new equipment value, then consider replacing the equipment rather than rehabilitating it.

To make exact estimates, according to *Figure 18*, you need to know more specific details about the site.

Tip

- The service level responsible for making these calculations will have to visit the site, or must have sufficient knowledge or information about the equipment and site to make informed calculations.

Figure 18: How To Make Specific Estimates of Large-scale Major Rehabilitation Project Costs



Once you have learnt how to undertake these capital budget calculations, as described in this Section, you can use them to make your long-term Core Equipment Expenditure Plan (*Section 7.3*) and to undertake annual budgeting (*Section 8.1*). An example of a total capital budget plan is given in *Section 7.3*.

Box 28 contains a summary of the issues covered in this Section.

BOX 28: Summary of Procedures in Section 5 on Capital Budget Calculations

Replace	**HTM Working Groups and Finance Officers**	◆ make rough estimations of replacement costs for long-term forward plans and budget allocations, by using a percentage of the equipment stock value (see *Figure 14*) ◆ make exact estimates of replacement costs, by using detailed calculations for purchases as described below (see *Boxes 24–26*)
Purchases	**HTM Working Groups, and Purchasing and Supplies Officers**	◆ make rough estimations of equipment purchase costs for forward planning and bulk purchasing, by using a percentage of the equipment price (see *Box 23*) ◆ make detailed estimates for single purchases and annual needs, by considering the sophistication of the equipment and using a percentage of its price (see *Boxes 24–26*)
Pre-install	**HTM Working Group, or its Commissioning Team**	◆ makes rough estimations of pre-installation costs for forward planning and budget allocations, by considering the suggestions relating to equipment weight, size, portability, technology type, and price (see *Boxes 25 and 26*) ◆ makes detailed estimates for pre-installation work for single purchases, bulk purchases, and annual needs, by costing specific requirements (see *Figure 15*)
Support Activities	**HTM Working Group, or its Commissioning Team**	◆ makes rough estimations for installation, commissioning, and initial training costs for forward planning and budget allocations, by using a percentage of the equipment price (see *Boxes 23–25*) ◆ makes detailed estimates for installation and commissioning costs for single purchases, bulk purchases, and annual needs, by costing specific requirements (see *Figure 16*) ◆ makes detailed estimates for initial training costs for single purchases, bulk purchases, and annual needs, by costing specific requirements (see *Figure 17*)
Rehab	**HTM Managers at Workshops**	◆ make rough estimations for costs of large-scale major rehabilitation projects for forward planning and budget allocations, by considering the suggestions relating to a percentage of the equipment price (see *Box 27*) ◆ make detailed estimates for costs of large-scale rehabilitation work for single projects, multiple projects, and annual needs, by costing specific requirements (see *Figure 18*).

6. HOW TO MAKE RECURRENT BUDGET CALCULATIONS – BUDGETING TOOLS II

Why is This Important?

Recurrent funds are required to cover regular expenses which are necessary to keep equipment functioning and running. Such expenses could include buying consumables, maintenance support, training, or stationery required for record-keeping. These requirements can be planned for on a weekly, monthly, or annual basis.

If you do not allocate sufficient funds for these expenses, you may not have sufficient equipment that works, or you may wait for months before new items can be utilized.

This Section provides advice on how you can learn to budget for all these costs.

Although the planning tools (*Sections 3 and 4*) will help you to identify what equipment you want, you should only own those items that you can afford to keep functioning. This is determined by budgeting for equipment running costs according to the principles and budget calculations outlined in this Section.

This Section describes some further 'budgeting tools', which can help you to understand how to make various calculations for recurrent costs. Different calculations are described for the different health service levels. You can then use these calculations when making your plans and budgets, as described in *Sections 7 and 8.1*.

As *Section 3.3* explains, recurrent expenditure is required each year to enable you to keep your equipment going. You should calculate your recurrent expenditure allocations based on your existing stock of equipment. Please remember that whenever new equipment is purchased (*Section 5.2*), it is necessary to budget for its running costs. Therefore, there must be a link between planned capital expenditure and recurrent budget allocations.

In order to make adequate allocations, you need further budgeting tools. This Section covers four budget calculations for recurrent allocations:

- maintenance costs (*Section 6.1*)
- consumable operating costs (*Section 6.2*)
- administrative costs (*Section 6.3*)
- ongoing training costs (*Section 6.4*).

In this Section, different ways of calculating recurrent budget elements are given. They are used for different purposes, as follows:

a. Rough Estimations – used for long-term plans and business purposes
   – most often used at central or regional levels which cover the needs of many facilities and cannot go into specific details.

b. Exact Detailed Estimates – used for annual requirements
   – most often used at facility or district level.

It is important to remember that in many developing countries:

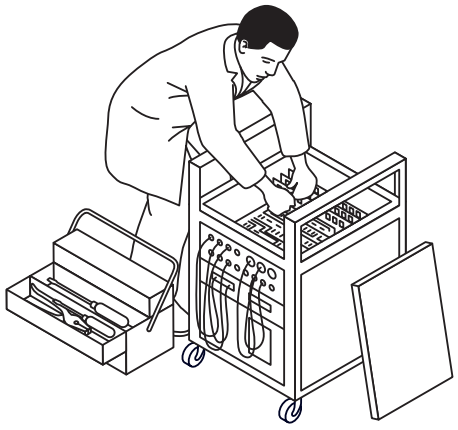
- equipment capital projects, often funded by external support agencies, can introduce considerable recurrent budget burdens
- many donors are hesitant to assist with recurrent costs and leave the recipient country to cope, even if they are not in a financial position to do so
- some donors provide maintenance contracts for a couple of years with the equipment, but do not usually offer more sustainable solutions.

For these reasons, experts in this field are calling upon the donor community to show more commitment by:

- assisting countries to develop adequate HTM systems
- contributing to recurrent expenditures for maintenance via a suitable national body
- setting aside 30 per cent of available project financing for recurrent needs.

6.1 MAINTENANCE COSTS

Equipment can only be used at its optimum performance level if it is regularly maintained. Therefore it is necessary to plan for the annual cost of maintenance and repair for the equipment stock, which will include any minor rehabilitation work required.



Some of this Section may appear similar to the discussion regarding consumable operating costs (*Section 6.2*). The key difference is that the calculations described here **are usually made by maintenance staff**, or planners.

The objective of drawing up maintenance budgets is to estimate the money required to maintain and repair the equipment, and thus ensure that the equipment remains functional for as much of the year as possible. This is known as reducing the 'mean-time between failures' (MTBF). It is important to make an estimate which is as realistic as possible, since:

- under-estimation will result in unsatisfactory maintenance for that year
- over-estimation will deprive other essential services in the facility of their necessary resources.

For long-term planning, international experts provide estimates of the amount which should be set aside **each year**. These amounts are expressed as a percentage of the stock value (*Section 3.2*). These estimates are based on an average, so some equipment in your stock will require much less money and some will require much more (the precise amount required will depend on the equipment type and age). Experts suggest that maintenance and repair costs ought to be approximately as follows:

- for medical equipment, each year five to six per cent of the 'new' stock value is required
- for buildings, each year one to two per cent of the construction costs is required
- for service supplies and plant, each year three to four per cent of purchase and installation costs is required.

Country Experience

Although the experts suggest five to six per cent of the new medical equipment stock value each year for maintenance, countries have found different estimates work better for them, depending on local conditions. For example:

- *In East Africa, HTM managers found a budget of six to ten per cent of the medical equipment stock value was more useful for covering maintenance needs and spare parts, depending on local labour costs.*
- *In Sri Lanka, the Ministry of Health found the budget required for maintenance varied with the age of equipment, as follows:*
  - *one to four years old ⟶ two to three per cent of stock value is needed*
  - *five to six years old ⟶ four to six per cent of stock value is needed*
  - *seven to ten years old ⟶ seven to eight per cent of stock value is needed.*

Nevertheless, it is common for countries to have maintenance budgets as low as, or even less than, one per cent of the equipment stock value, making it impossible to keep the equipment functioning or safe. Also because maintenance funding over many years has been generally so low, maintenance staff have automatically self-limited their estimates and disregarded the need to return many items of equipment stock to a working condition.

Country Experience

- *Many health service providers have not calculated their equipment stock values, and therefore they do not know what finances are required to sustain their stock.*
- *Many health service providers measure maintenance budgets as a percentage of the health budget allocation (to a facility), rather than as a percentage of the equipment stock value.*
- *Some countries are introducing new initiatives to try to increase maintenance allocations by requiring health facilities to put aside a certain amount for maintenance. For example:*
  - *the Central Board of Health in Zambia requires hospital boards (semi-autonomous facilities) to use 10 per cent of their recurrent budget allocations (net of salaries) for maintenance*
  - *the Ministry of Health in Kenya requires autonomous health facilities to use 25 per cent of their generated income for maintenance.*
- *Such directives are welcomed, and are a step forward. However there is a danger that they can be misleading, since the percentage allocated does not relate to the equipment stock value and is not a measure of the well-being of the equipment. For example:*
  - *in the Zambian example given above, at the central teaching hospital the 10 per cent directive translates into a figure that is only approximately 1.6 per cent of the equipment stock value estimate.*
- *Other initiatives are being tried. For example:*
  - *the Ministry of Works, Transport, and Communication in Namibia is selling off government fixed property which is not in government use, and residential properties (not in remote locations). The money raised will be invested to generate funds for general maintenance of the remaining government facilities, and for building staff housing in remote areas.*

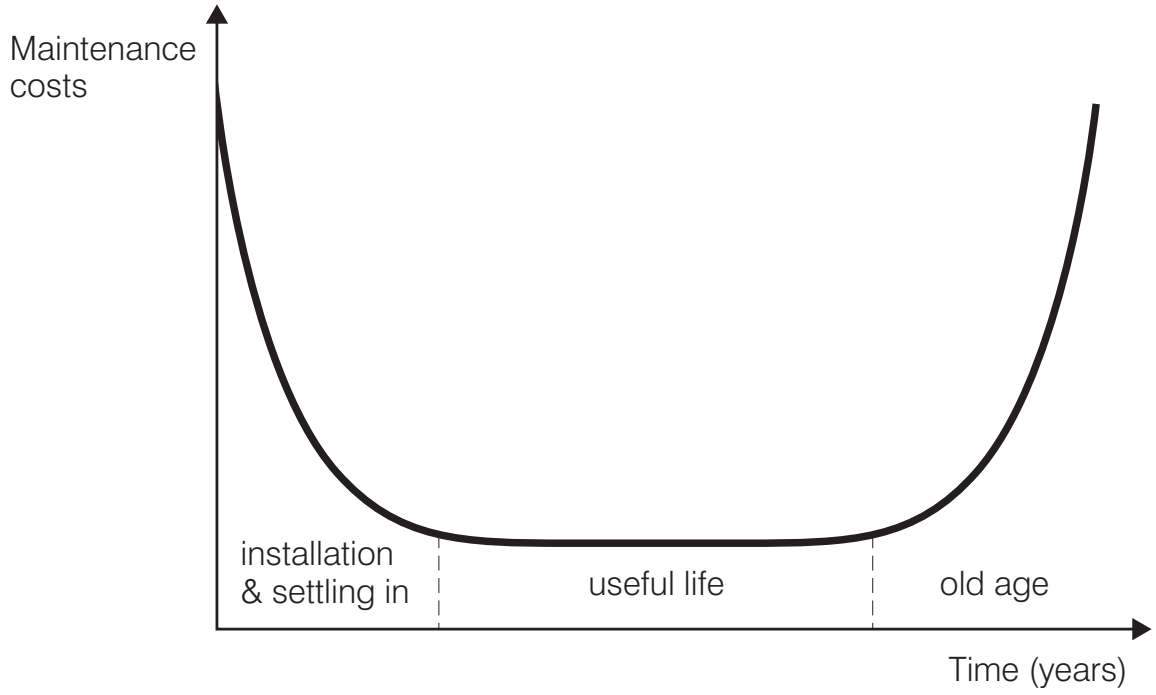
As a start, you will need to allocate at least some percentage of the equipment stock value as your maintenance budget, if your situation is to start to improve. However, you may have a large backlog of equipment waiting to be repaired. If so, this will have a knock-on effect on your maintenance budgets, since the real value of annual maintenance requirements will be much greater than your current planned maintenance budget levels.

Maintenance costs are more than compensated by the gains obtained from extending the useful life of equipment (*Guides 1 and 5* provide examples as proof). Once you have overcome any backlog of equipment that is waiting to be repaired, you should ultimately find that **maintenance will not generate costs, but save you money**.

In some industrialized countries, there are laws in place which regulate that planned preventive maintenance (PPM) must take place in order to ensure that equipment is safe (see *Guide 1*). This is useful, as it means that funds for PPM must be allocated by health service providers.

It is likely you will have a great deal of equipment within your facility which is very old. Some of this equipment may be past the end of its lifetime and awaiting replacement. Other items may be waiting to be repaired. However, it must be recognized that it might be uneconomical to continue to try to repair such equipment. *Figure 19* illustrates how the cost of maintenance rises as equipment gets older.

Figure 19: Traditional 'Bath-tub' Curve of Maintenance Costs over the Lifetime of Equipment



If a large proportion of your equipment is past rehabilitation, it may be necessary to make maintenance calculations based on a smaller proportion of the stock which you can keep working, while increasing the replacement budget (*Section 5.1*). The longer you leave it to improve maintenance services, the greater your equipment replacement bill will be.

Who is Responsible for Calculating Maintenance Costs?

Who?		Takes what action?
- HTM Managers with technical skills - HTM Working Groups - Finance Officers	→	Need to learn how to budget for maintenance costs

Which level?		Takes what action?
Any health facility, workshop, or service level that: - makes its own plans - sets or requests its own budget allocations - runs its service as a business.	→	Can make maintenance calculations
Central or regional service levels that: - cover the needs of many facilities - cannot go into specific details.	→	Are more likely to make **rough estimations** for long-term forward plans and budget allocations, and business plans
Facility, workshop, or district service levels	→	Are more likely to make more **exact detailed estimates** for annual requirements.

How to Calculate Maintenance Costs

You can:

a. make **rough estimations**

b. make **specific** or **annual estimates**

c. determine **monthly estimates** within the annual allocation.

These three different approaches to calculating maintenance costs are described in greater detail below.

a. Making Rough Estimations of Maintenance Costs

You can make a variety of rough estimations for long-term plans, depending on:

- the information available to you (refer to your Maintenance Management Information System, such as your equipment service histories – see *Guide 5*)
- the sort of forward projections you are making
- how much of your equipment stock it is possible to return to a working condition, and how much you can afford to rehabilitate.

Figure 20 describes these calculations.

Figure 20: How To Make Rough Estimations of Maintenance Costs for Forward Planning

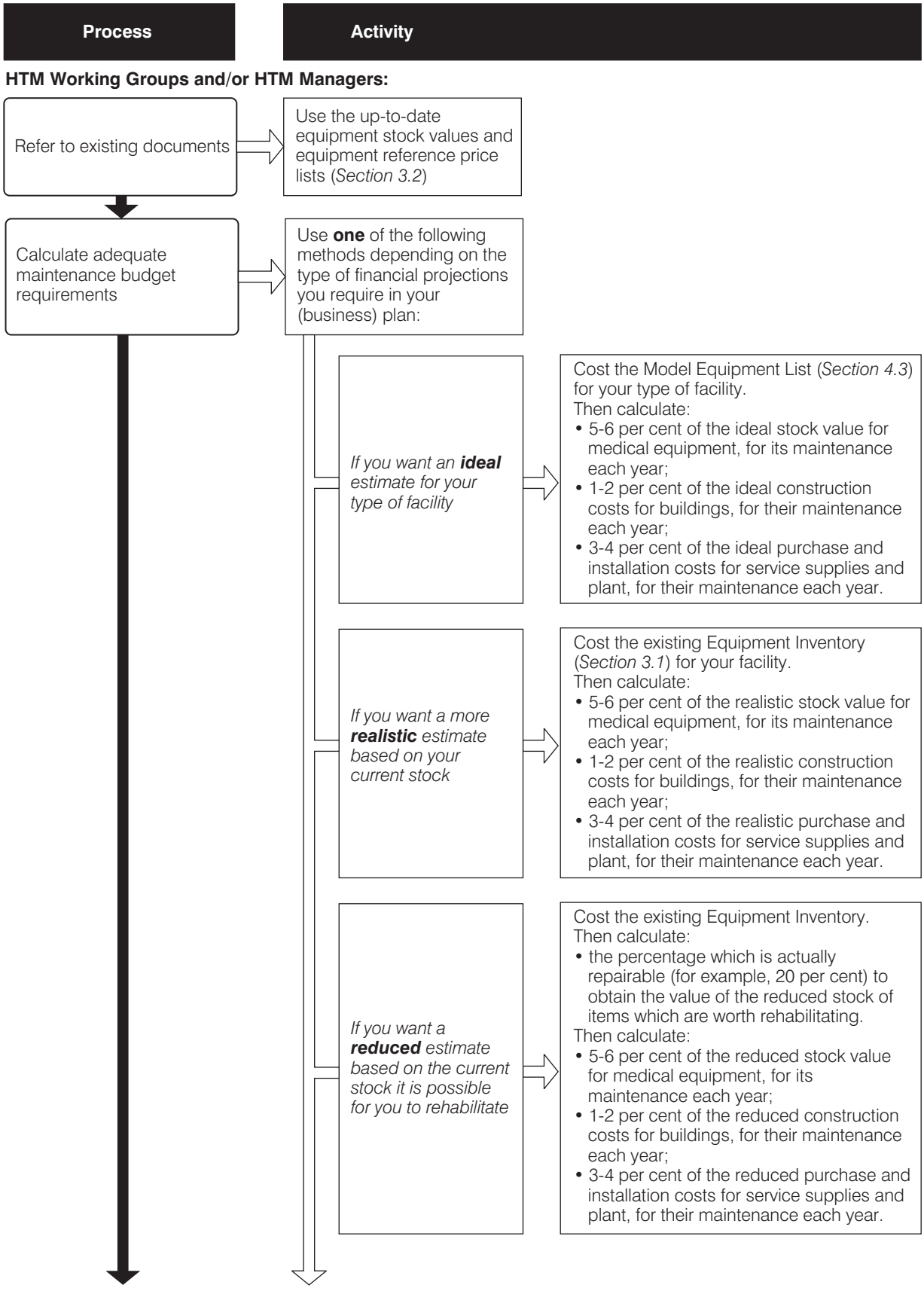


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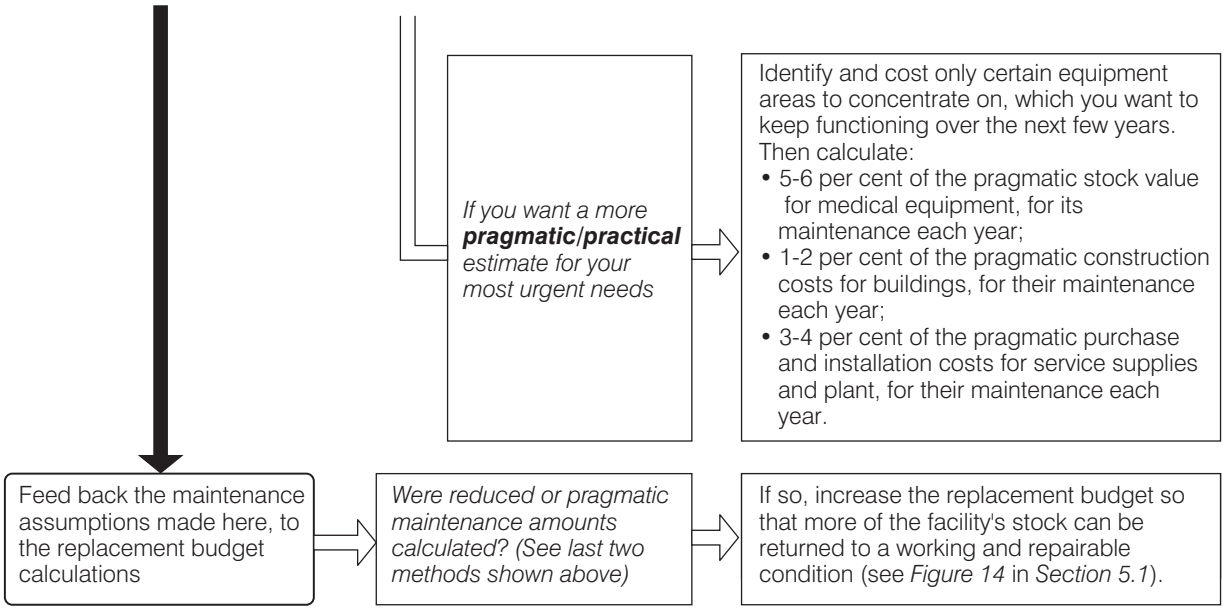
Figure 20: How To Make Rough Estimations of Maintenance Costs for Forward Planning (continued)



b. Making Specific or Annual Estimates of Maintenance Costs

A different calculation is required when making specific or annual estimates. It should be undertaken by HTM Managers with technical skills (such as those located at a maintenance workshop – *Section 1.1*).

Annual maintenance budgets should be based on more exact estimates. They are not always easy to predict, since breakdowns in most cases cannot be anticipated. However, two types of budgeting can be identified (see *Box 29*, below). Generally with experience, and where standardization of equipment is in place (*Section 2.1*), the projection for equipment spare parts and maintenance materials becomes more predictable.

BOX 29: Elements of Annual Maintenance Budgets

I. Planned Budgets:

These allocate funds for anticipated maintenance costs, which can be derived from the following main areas of expenditure (see *Figure 21* for strategies on how to calculate your requirements):

a) spare parts – which are required regularly, determined from previous experience and any planned remedial work
b) spare parts – which are required according to planned preventive maintenance (PPM) schedules and timetables
c) maintenance materials – which are required regularly, determined by previous experience and any planned remedial work
d) maintenance materials – which are required according to PPM schedules and timetables
e) service contracts – required for any planned remedial work
f) service contracts – for breakdowns which are likely to be required, determined from previous experience
g) service contracts – required for PPM of complex equipment
h) calibration of workshop test equipment
i) replacement of tools at the end of their life
j) office material
k) any increased maintenance requirements brought about by planned new equipment purchases under the capital expenditure budget.

Note: there will be other elements which may fall under other budgets. These could include:

- other administrative costs which are included in budgets held by other departments (*Section 6.3*)
- major repair works – in some cases the planned rehabilitation of equipment which requires major work with the purchase of substantial amounts of materials or contracts. The large sums of money required for such projects may have to fall under the capital budget (*Section 5.5*)
- pre-installation work (such as site-preparation). This often falls under capital funds as it is linked to specific purchases (*Section 5.3*).

II. Contingency Budgets:

In addition to planned budgets, contingency budgets also exist. These allocate funds for unplanned maintenance work, such as emergencies, or sudden breakdowns which could not be predicted.

Tip

- When planning for spare parts and maintenance materials, it makes sense to:
  - budget well in advance so that you have sufficient funds and do not run out of stocks
  - buy in bulk so that you can make procurement savings
  - only procure essential spares
  - for perishable items, only buy quantities that you can use up before their shelf-life expires.

No spare parts should be allowed to sit on shelves for too long as this ties up money which could otherwise be used for other essential purchases. The only exception to this is when buying equipment from abroad, when it makes sense to buy a stock of spare parts at the same time as the equipment, because that is when the capital funds are available, and you are in contact with the manufacturer (*Section 5.2*). If you leave it until later, it becomes much more difficult to obtain the funding, the foreign currency, and the spare parts from abroad. Details of how to stock up with spare parts and maintenance materials are given in *Guide 5*.

Having purchased your initial stock with the equipment (*Section 5.2*), you must review your recurrent stock needs. It is important to consider 'economies of scales' – for example, you can get better prices and save on shipping costs if you buy in bulk. Therefore it is a good idea to consider:

- buying for many locations (for example, to cover several health facilities or workshops)
- buying stocks to cover an extended period (for example, stocks for one or two years).

Previously, equipment spare parts and maintenance materials have not always been considered 'stockable' items in the Stores system. For this reason, there is often insufficient information regarding their requirements and rates of use. Thus one of your planning tools is an exercise to investigate their needs (*Section 3.4*).

Figure 21 shows the exact estimates you can make for specific or annual requirements.

Figure 21: How to Make Specific or Annual Estimates of Maintenance Costs

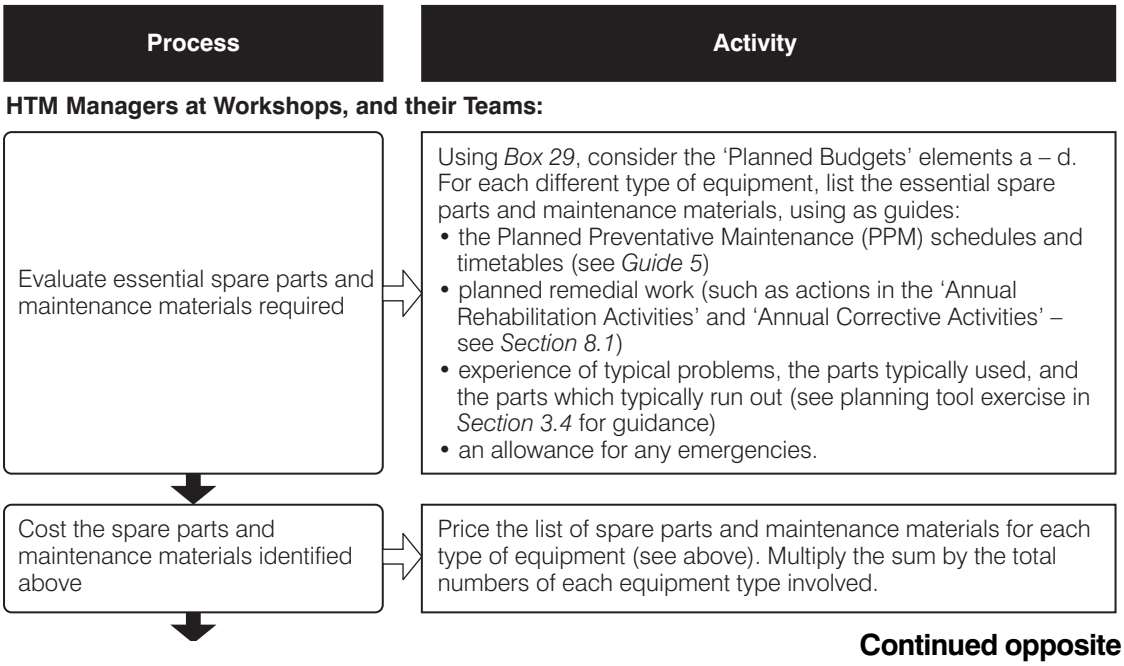


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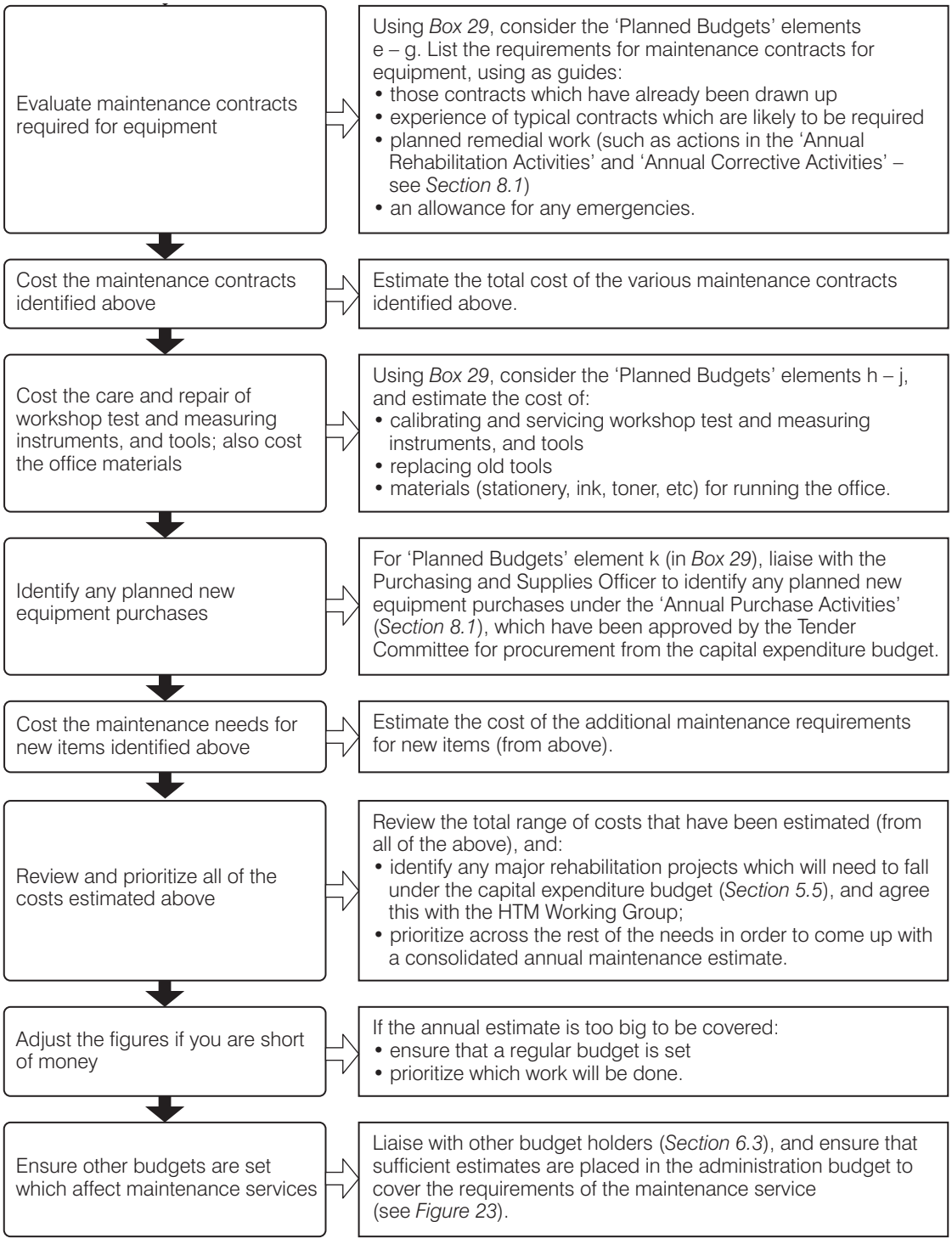
Figure 21: How to Make Specific or Annual Estimates of Maintenance Costs (continued)



c. Determining Monthly Maintenance Estimates within the Annual Allocation

Within the annual maintenance allocation, the HTM Manager will have to determine monthly requirements. As a **rough** estimate, the HTM Manager could consider the monthly maintenance budget to be one-twelfth of the annual maintenance allocation. However there may be seasonal variations which need to be taken into account, for example workload may be heavier at certain times of the year or weather conditions could affect the ability of equipment to function.

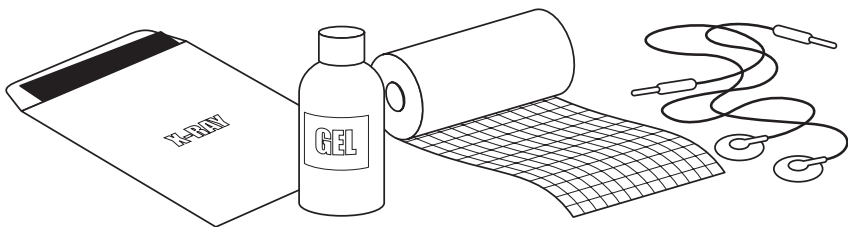
A more **specific** monthly maintenance budget can be derived from a combination of the cost for both the planned preventive maintenance (PPM) work and the planned remedial/repair work identified for that month. This would involve carrying out an estimate of maintenance costs (using the process outlined in *Figure 21*) on a monthly basis. If insufficient financial resources are available, the HTM Manager will have to prioritize what work should be carried out.

Please note: In *Section 6.1*, we have only covered the general planning and budgeting of maintenance work. For a more a detailed explanation of the daily financial management required by HTM Teams, see *Guide 6*.

When undertaking planning and budgeting work, the HTM Teams will need to be sure of their financial responsibility and financial accountability as they undertake maintenance work, undertake other equipment management tasks, and run a workshop. *Guide 6* also discusses the possibility of charging for HTM Services.

6.2 CONSUMABLE OPERATING COSTS

Equipment can only be used daily if there are regular supplies of the **accessories and consumables** it uses when working. Therefore, it is necessary to plan for the annual cost of the consumable items required for operating the equipment stock.



Some of the information in this Section may appear similar to the earlier discussion regarding maintenance costs (*Section 6.1*). However, the key difference is that the calculations described here **are usually made by equipment operators**, or planners.

You will need to estimate the money required to cover the accessories and consumables used by the equipment, in order to ensure that equipment continues to function for as much of the year as possible. It is important that the estimate should be as realistic as possible, since:

- under-estimation will result in periods when the equipment cannot be used during the year
- over-estimation will deprive other essential services in the facility of their necessary resources.

For long-term planning, international experts acknowledge that the percentage of the equipment stock value required **each year** for consumable items can vary widely:

- some equipment requires a great deal for consumable operating costs (10–20 per cent of the equipment stock value), others require none
- the more sophisticated the equipment, the higher the consumable operating costs – therefore the costs will vary according to the health service level
- depending on your inventory, if you estimate on a large scale the consumable operating cost will average each year to 10 per cent of the equipment stock value.

Nevertheless, it is common for countries to have recurrent budgets for equipment consumable items which are far too small. This makes it impossible to keep the equipment functioning. In fact, many countries do not keep track of equipment consumables as a separate budget element at all. As a result, it is impossible to distinguish between expenditure on these items, and other general supplies (such as food and blankets) and medical supplies (such as bandages and gauze). This causes them to run out of essential items such as electrodes, ultrasound gel, batteries, washing powder, paper, reagents, gas, spare patient leads, filters and developer.

Since accessories are often the link between the machine and the patient, they are more vulnerable to daily wear and tear, and thus need to be replaced much more frequently than the machine itself. It must be remembered that stocks of consumables (especially single-use items) and accessories can be very expensive.

Country Experience

Planners often fail to realize that equipment operating costs can have a much greater financial impact than the initial procurement cost, and can be anything from 5% to 100% of the procurement cost per year. For example, health staff in Germany discovered that an infusion pump which cost US$3,000 to buy, cost an additional US$24,000 to run over its 10-year lifetime, mainly due to the cost of the continuous supply of infusion sets required. However, many health service providers have not calculated and budgeted for the real operating requirements of their equipment.

The lifetime of consumables and accessories will vary for different users depending on a number of factors, such as:

- the rate of use of the equipment (how many tests per month, how many patients per year, etc.)
- how many back-up accessories there are (for example, is an accessory used to its limit? Is it overworked or overloaded? While one accessory is being sterilized or repaired, is another one available for use?)
- how the accessory is handled or whether it is abused
- how well the accessory is cared for and cleaned, and what sterilizing techniques are used
- how well the equipment is maintained and whether it is running efficiently or using up too many consumable inputs
- the initial quality of the equipment, and its consumable items
- whether staff are knowledgeable about the items, or use them wastefully
- the physical environment and climate in which the items are used and stored.

The cost of consumable items will also vary, depending on where you buy them from and their quality (see *Guide 3* on procurement and commissioning).

Experience in Ghana

The Ministry of Health distinguishes between two different types of consumable items:

- *Common types of consumable items which can be supplied from many different sources are handled by stores and supplies departments.*
- *More specialized items which can only be supplied by specific equipment manufacturers are handled by their equipment managers. These can be both 'user consumables' needed to operate the equipment, and 'technical consumables' needed for PPM.*

The Ministry of Health endeavours to:

- *purchase an initial stock of these specialized items when buying new equipment, to last a number of years (depending on their shelf-life)*
- *establish channels with the manufacturer for subsequent purchases.*

Where equipment accessories are directly connected to patients, the Ministry of Health always purchases a stock of additional items.

Who is Responsible for Calculating Consumable Operating Costs?

Who?		Takes what action?
- HTM Working Groups - Heads of Department - Finance Officers	→	Need to learn how to budget for consumable operating costs
Which level?		**Takes what action?**
Any health facility service level that: - makes its own plans - sets or requests its own budget allocations - runs its service as a business.	→	Can make consumable operating calculations
Central or regional service levels that: - cover the needs of many facilities - cannot go into specific details.	→	Are more likely to make **rough estimations** for long-term forward plans and budget allocations, and business plans.
Facility or district service levels	→	Are more likely to make more **exact detailed estimates** for annual requirements.

How to Calculate Consumable Operating Costs

You can:

a. make **rough estimations**

b. make **specific** or **annual estimates**

c. determine **monthly estimates** within the annual allocation as follows:

a. Making Rough Estimations of Consumable Operating Costs

You can make a variety of rough estimations for long-term plans, depending on:

- the information available to you (refer to the Health Management Information System – see *Guide 1*, for details such as your patient attendance statistics)
- the type of forward projections you are making
- how much of your equipment stock it is possible to keep functioning, and how much you can afford to finance.

It is difficult to make global rough estimations of consumable operating costs as a percentage of equipment stock values. However, *Box 30* provides some suggestions from various countries.

BOX 30: Suggestions for Rough Estimations of Consumable Operating Costs for Forward Planning

Different countries suggest a number of alternative approaches:

i. Consumption depends on the type of equipment you use, the service you provide, and how many patients you see.

Therefore, you can provide a rough estimation of consumable operating costs by evaluating past usage rates/expenditures, and comparing these with expected patient loads and specific equipment usage rates per intervention.

ii. If your equipment is part of a 'closed' purchasing system, the consumables are only made by one manufacturer and you are limited to one supplier. This monopoly makes the consumable costs larger.

If your equipment is part of an 'open' purchasing system, anyone can supply the consumables and different manufacturers' consumables can fit your machine. This competition makes the consumable costs lower.

You can keep costs down if you use items which can be sterilized/reused rather than disposable items (see *Guide 4*).

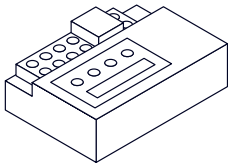
iii. Consumable operating costs vary according to equipment type, and can be expressed as a percentage of purchase cost or stock value, as shown by the examples opposite.

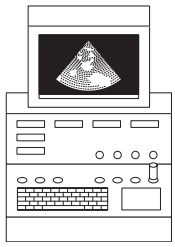
But as the majority of your equipment is likely to be technology that has low to medium consumable costs, you could use averages of:
- three per cent of the stock value for equipment with low consumable usage rates, and

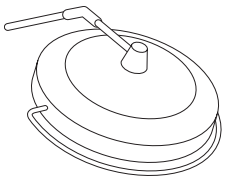
Continued opposite

BOX 30: Suggestions for Rough Estimations of Consumable Operating Costs for Forward Planning (continued)

Description	Consumable cost per year relative to original purchase cost
Equipment with high consumable operating costs, such as:	
Haemodialysis machine	
Automatic biochemical analyser	
Automatic haematology analyser	70–120 per cent
Electrolyte analyser	
Blood gas analyser	
Equipment with medium consumable operating costs, such as:	
Conventional X-ray machine	30 per cent
Anaesthesia machine	20 per cent
ECG recorder, three channel	
Ultrasound, medical/obstetric	
Ventilator, ICU	15–25 per cent
Physiological monitor	
EEG machine	
Autoclave, steam	10–15 per cent
Incubator, baby, ICU	5–15 per cent
Equipment with low consumable operating costs, such as:	
Centrifuge, electrical	5 per cent
Suction pump	2–5 per cent
Delivery bed	
Operating theatre lamp	
Slit lamp	1–2 per cent
Operating microscope	
Water bath	







b. Making Specific or Annual Estimates of Consumable Operating Costs

A different calculation is required when making specific or annual estimates. It should be undertaken by **Heads of Equipment User Departments**.

Annual operating budgets should be based on more exact estimates. These are not always easy to predict since epidemics, outbreaks, or surges in workload cannot, in most cases, be anticipated. However, two types of budgeting can be identified. These are:

- planned budgets for anticipated work
- contingency budgets for unplanned work.

Generally with experience, and where standardization of equipment is in place (*Section 2.1*), the projection for equipment consumables and spare accessories becomes more predictable.

Tip

- When planning for accessories and consumables, it makes sense to:
  - budget well in advance so that you have sufficient funds and do not run out of stocks
  - buy in bulk so that you can make procurement savings
  - only procure essential items
  - for perishable items, only buy quantities that you can use up before their shelf-life expires.

No consumable items or spare accessories should be allowed to sit on shelves for too long, as this ties up money which could otherwise be used for other essential purchases. The only exception to this rule comes when buying equipment from abroad, when it makes sense to buy a stock of accessories and consumables at the same time as the equipment, while capital funds are available, and you are in contact with the manufacturer (*Section 5.2*). If you leave it until later, it becomes much more difficult to obtain the funding and the items. Details of how to stock up with consumables and accessories are given in *Guide 4* on operation and safety.

After the initial stock has been purchased with the equipment (*Section 5.2*), then you must regularly buy your recurrent needs. It is important to consider 'economies of scale' – you can get better prices and save on shipping costs if you buy in bulk. It is therefore a good idea to consider:

- buying for many locations (for example to cover several health facilities)
- buying stocks to cover an extended period (for example, stocks for one or two years).

Equipment accessories and consumables have not necessarily been 'stockable' items in the Stores system up to now, so there is often insufficient information regarding the requirements and rates of use. So use the planning tool exercise in *Section 3.4* to investigate your equipment accessory and consumable requirements.

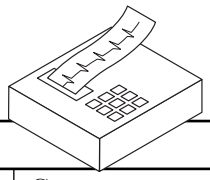
Figure 22 shows the exact estimates you can make for specific or annual requirements.

Box 31 provides some examples of how specific consumable operating costs can be calculated.

Figure 22: How to Make Specific or Annual Estimates of Consumable Operating Costs

Process	Activity
Heads of Department, with their teams:	
Evaluate essential consumables and spare accessories required	For each different type of equipment, list the consumables and spare accessories required to operate the equipment in your department, using as guides:- • experience of typical requirements for expected workloads, departmental patient statistics, data gathered regarding departmental requirements and rates of use (see planning tool exercise in *Section 3.4* for guidance); • any new requirements for items being brought back into a working condition (as agreed in the 'Annual Rehabilitation Activities' and 'Annual Corrective Activities'– see *Section 8.1*); • any additional requirements for planned new purchases of equipment from the 'Annual Purchase Activities' (*Section 8.1*) in the capital expenditure budget; • the user planned preventative maintenance schedules and timetables (see *Guides 4 and 5*); • an allowance for any emergencies.
Cost the consumables and spare accessories identified above	Price the list of consumables and spare accessories for each type of equipment (from above), and multiply the sum by the total numbers of each equipment type involved.
Review and prioritize the costs estimated above	Review the total range of costs that have been estimated (from above), and: • prioritize the needs in order to come up with a consolidated annual estimate of consumable operating needs.
Adjust the figures if you are short of money	If the annual estimate is too big to be covered: • ensure that a regular budget is set.
Ensure other budgets are set which affect equipment operation	Liaise with other budget holders (*Section 6.3*), and ensure that sufficient estimates are placed in the administration budget to cover the requirements of your department (see *Figure 23*).

BOX 31: Examples of Calculations for Consumable Operating Costs



Example 1: An electrocardiograph (ECG) recorder				
Description	**Rate of use (average)**	**Units needed per year**	**Costs per set/unit (US$)**	**Costs per year (US$)**
Recording paper	one roll of paper per week	52	23.00 per roll	1,196
Electrodes (single use, set)	one set per day	365	10.00 per set	3,650
Electrodes (reusable type, set)	two sets per year	2	70.00 per set	140
			Total per year =	US$4,986

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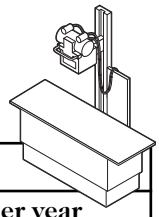


BOX 31: Examples of Calculations for Consumable Operating Costs (continued)

Example 2: A conventional X-ray machine:				
Description	**Rate of use (average)**	**Units needed per year**	**Costs per set/unit (US$)**	**Costs per year (US$)**
Cassettes and screens	Set of five different sizes of cassette and five different sizes of screen (i.e. two items per size). Replace this set of 10 items every five years.	Each year replace one fifth of the set (in other words, two items out of a set of 10).	3,400.00 per set	680
Films	50 films per day	18,250	1.40 per film	25,550
Reagents	five litres of developer per month and five litres of fixing agent per month	60 litres and 60 litres	2.70 per litre 1.70 per litre	162 102
			Total per year =	US$26,494

Tip • When ordering consumable items, the lead-times (delivery times) can introduce delays (see *Guide 4*), so staff may order larger quantities to avoid shortages.

c. Determining Monthly Consumable Estimates within the Annual Allocation

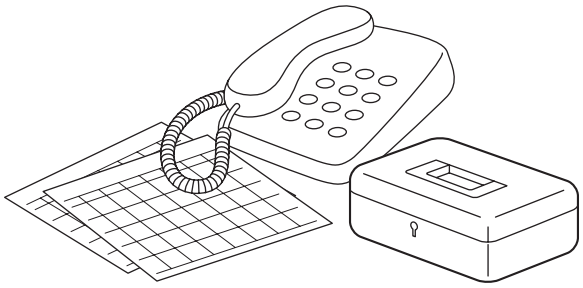
Within the annual departmental allocation, the Heads of Department will have to determine monthly requirements. As a **rough** estimate, they could consider the monthly departmental budget for equipment-related consumables to be one-twelfth of the annual allocation. However, there may be seasonal variations which need to be taken into account, due to factors such as workload or weather conditions.

To calculate a more **specific** monthly departmental budget for equipment-related consumables, you can work out a combination of the cost for the likely work for each month, using a process similar to that described in *Figure 22*. The Head of Department will have to prioritize what equipment-related consumables to order if the required financial resources are not available.

Tip • The time between orders (frequency of ordering/supply period), will dictate whether you can place orders every month (see *Guide 4*).

6.3 ADMINISTRATIVE COSTS

There are several important elements of equipment operation and maintenance which are classified as 'administrative costs', and fall under budgets that are not under the control of the equipment operators and maintenance staff. If you do not make sure that they are adequately financed, your equipment service can fail for want of simple things like paper, a phone connection or fuel allocations.



The calculations described here are usually carried out by various staff members in departments other than those with equipment operators and maintenance staff. These are **usually administrative staff**.

Such administrative expenses are often hidden in sub-divisions of the administration budget. Categories of expenditure which may fall under the budgets of departments other than the equipment user or maintenance department could include:

For Equipment Use:

Equipment-related departmental operating costs (such as materials, literature, fuel) which are necessary for work, safety and record-keeping activities to take place.

For Equipment Maintenance:

Departmental operating costs (such as materials, literature, fuel, utilities, staff costs) which are necessary for work, safety, travel and record-keeping activities to take place.

Please note: This Section only covers the general planning and budgeting of the administration side of maintenance work. In contrast, *Guide 6* provides a full explanation of the daily financial management required by HTM Teams so that they can undertake maintenance work, undertake other equipment management tasks, and run a workshop.

Who is Responsible for Calculating Administrative Costs?

Who?		Takes what action?
- HTM Working Groups - Heads of Department - HTM Managers - Finance Officers	→	Need to learn how to budget for administrative costs

Which level?		Takes what action?
Any health facility, workshop or service level that: - makes its own plans - sets or requests its own budget allocations - runs its service as a business	→	Can make calculations of administrative costs
Central or regional service levels that: - cover the needs of many facilities - cannot go into specific details	→	Are more likely to make **rough estimations** for long-term forward plans and budget allocations, and business plans
Facility, workshop or district service levels	→	Are more likely to make more **exact detailed estimates** for annual requirements.

How To Calculate Equipment-related Administrative Costs

You can make:

- either **rough estimations** for long-term forward planning purposes, as shown in *Box 32*
- or **exact estimates** for annual requirements, as shown in *Figure 23*.

It is difficult to make global rough estimations for long-term plans, but *Box 32* provides suggestions from various countries.

Box 32: Suggestions for Rough Estimations of Equipment-related Administrative Costs for Forward Planning

Different countries suggest alternative approaches:

i. Administrative costs are a small percentage of any operating budget, for example:
   - the biggest percentage expense is for staff, taking 50–55 per cent
   - supplies/spares take 35–45 per cent
   - administration only takes 10–20 per cent

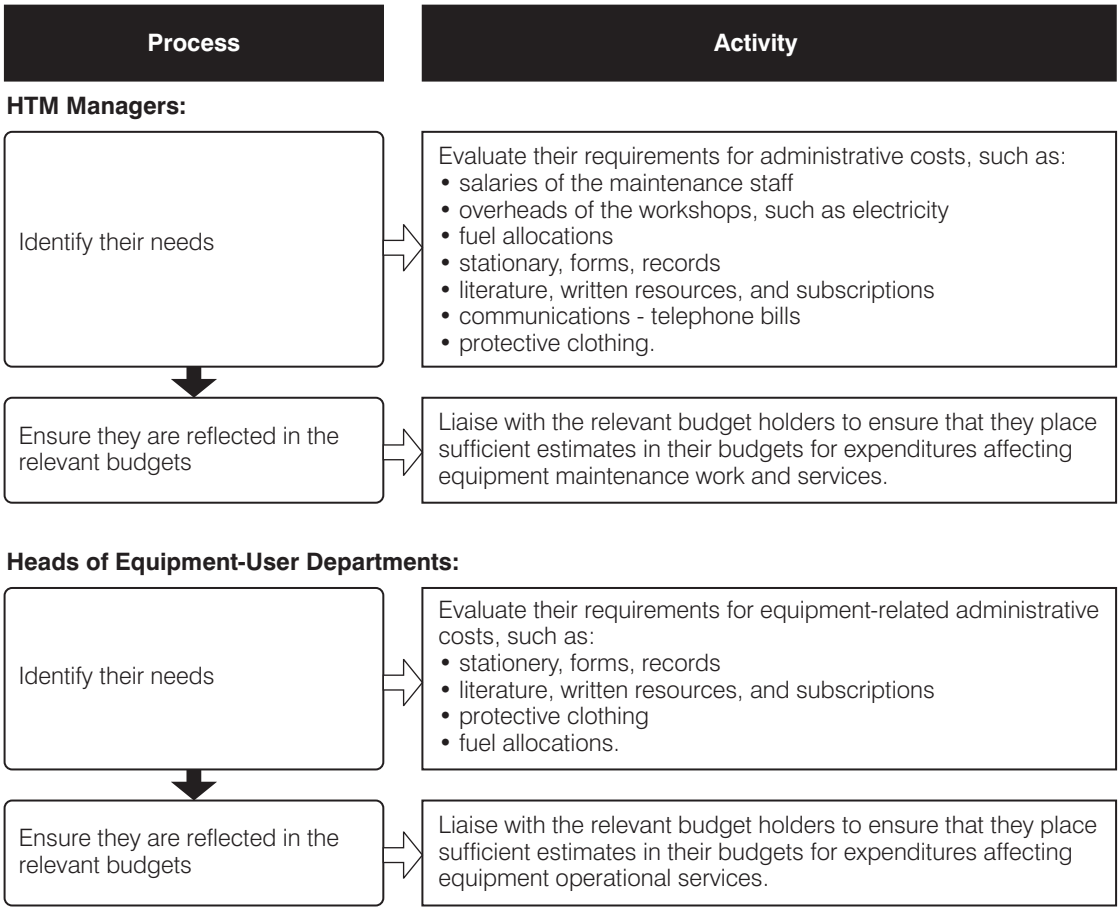
   Thus an equipment-user department could use an average of 15 per cent of their total operating budget for administrative costs.

ii. For HTM Teams and maintenance workshops, their administrative needs are not much higher than other administrative units in health facilities.
   Therefore, a reasonable estimate for the administrative costs for HTM Teams could be calculated by taking 10–20 per cent of their total operating budget.

iii. A starting point is to use five per cent of the equipment stock value to cover equipment-related administrative costs.

Figure 23 shows the exact estimates you can make for specific or annual requirements.

Figure 23: How to Make Specific Estimates of Assorted Equipment-related Administrative Costs Annually



Experience from Mozambique

The Ministry of Health discovered the dangers of underestimating some aspects of the equipment-related administrative costs. In Mozambique, the travel costs for maintenance departments can be extremely expensive.

The travel expenses allocated per day work out to be equivalent to one-third of the monthly salary of a technician. Thus a technician applying for three days travel effectively doubles their monthly salary.

The provinces planned for two days per month of travel per technician. To achieve this, they would have to budget for an additional 67 per cent of the technicians' salaries each month.

6.4 ONGOING TRAINING COSTS

In order to maximize your staff skills and make the best use of equipment, you will need to draw up an annual training budget, covering ongoing equipment-related training.

Your HTM Working Group, or a smaller training sub-group (*Section 1.2*), should develop an Equipment Training Plan to cover the rolling programme of refresher training required by your staff (*Section 7.2*). This is needed in order to ensure adequate skill development in all areas of equipment use, maintenance, and management.

Section 5.4.2 has covered the cost of initial training that is linked to the arrival of equipment purchases. However, there will be other ongoing training needed throughout the year to cover:

- induction training – when staff are newly placed in post, move to a new department/facility, or move to a new location with different responsibilities
- refresher training – to update and renew skills throughout the working life of staff.

Equipment-related skills development will be required in the following areas (see *Guides 4 and 5*):

- good practice when handling equipment – basic 'dos and don't's'
- how to operate equipment
- the correct application of equipment
- care and cleaning
- safety procedures
- planned preventive maintenance (PPM) for users
- PPM and repair for maintainers
- assorted activities as applied specifically to equipment needs, such as procurement, tender adjudication, stores management, financial management and computing skills.

There are a wide range of options available for developing skills, using the training provided by the following sources:

- equipment suppliers
- other health facilities, workshops, or health service providers
- academic or vocational training institutions
- on-the-job learning and practical experience
- self study and peer group support.

These are described in full in *Box 40* in *Section 7.2*, and each facility will need to use a combination of the strategies available.

You will require a variety of resources when training staff, whether someone else trains them or you do it yourselves. These vary depending on the training source and skill-development option you choose (see above and full description in *Box 40*). *Box 33* shows the type of resources which you will usually have to organize and finance.

BOX 33: Resources Required when Training Staff

Resources Required if Sending Staff Away for Training:	
Information	about the training required (background and needs assessment) and the training sources available (see *Box 40* in *Section 7.2*).
Expenses	overnight accommodation, travel and subsistence for the trainees, trainers' fees or course fees, plus any other likely costs.
Records	a system for keeping a record of the specific training that a staff member has received.
Recognition	a formal way of ensuring that the additional skills attained by staff are reflected in their promotion chances and job grades by the Human Resource Department.
Additional Resources if Running the Training Courses Yourselves:	
Training materials	appropriate to the piece of equipment to be studied (see *Guides 4 and 5*).
Space	suitable for carrying out the training in.
Equipment	to be practised on during the training courses.
Test and calibration instruments	in order to verify technical conditions and safety during training.
Spare parts and materials	appropriate for maintenance training.
Supplies	consumables, medical supplies, and cleaning materials for user training.
Manuals	to refer to, such as manufacturers' operator and service manuals.
Test method and certificate	a formal way of testing trainees and issuing them with a certificate at the end of the training course, as a quality control and motivating factor (depending on the extent of the training).
Additional expenses	possible room hire, overnight accommodation, travel and subsistence for the trainers, trainers' fees, visual aids/teaching equipment, etc.

Who is Responsible for Calculating Ongoing Training Costs?

Who?		Takes what action?
- HTM Working Group, or smaller training sub-group - Finance Officer	→	Need to learn how to budget for ongoing training needs
Which level?		**Takes what action?**
Any health facility, workshop or service level that: - makes its own plans - sets or requests its own budget allocations - runs its service as a business	→	Can make ongoing training calculations
A service level (such as facility or district) that makes: - detailed estimates for annual requirements	→	Will find the calculations here most useful for **exact estimates**
Service levels (such as central or regional/district levels) that: - cover the needs of many facilities - cannot go into specific details	→	Only need to make **rough estimates** for their long-term forward plans and budget allocations.

Tip

- The service level which makes these calculations will have to know about, or obtain information about, the staffing and training requirements at each site.

How To Calculate Ongoing Training Costs

You can make:

- either **rough estimations** for long-term forward planning purposes, as shown in *Box 34*
- or **exact estimates** for annual requirements, as shown in *Figure 24*.

It is difficult to make global rough estimations for long-term plans, but *Box 34* provides suggestions from various countries.

Box 34: Suggestions for Rough Estimations of Equipment-related Ongoing Training Costs for Forward Planning

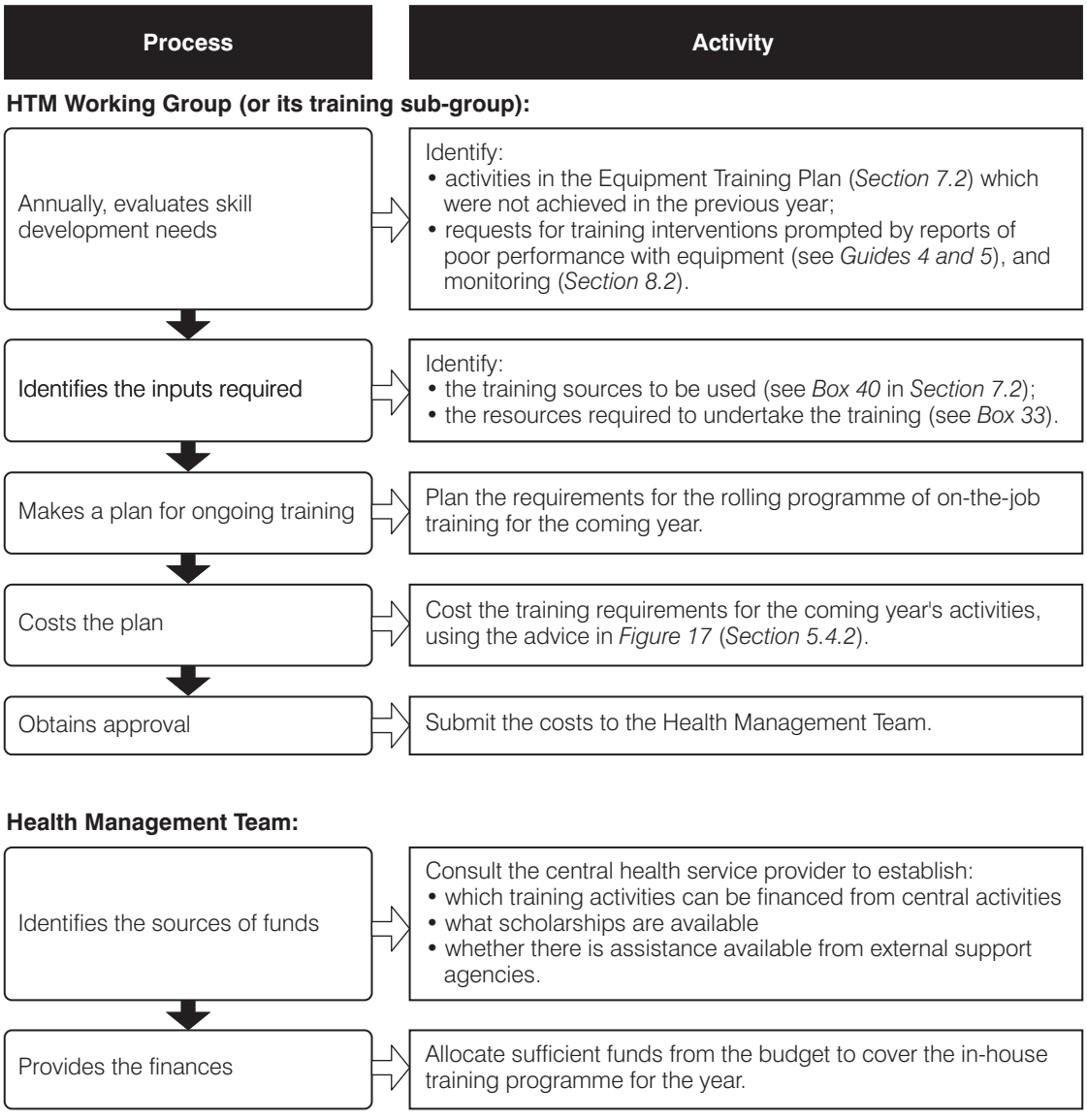
Different countries suggest alternative approaches:

i. Plan and budget for ongoing training costs by using a percentage of staff costs (the salary budget). Generally, ongoing training costs can be taken as two per cent of payroll costs.

ii. Plan and budget for ongoing training costs by using a percentage of the equipment stock value. As a starting point, ongoing training costs can be taken as five per cent of the stock value.

Figure 24 describes how to make exact estimates for annual requirements.

Figure 24: How To Make Specific Estimates of Annual Equipment-related Ongoing Training Costs



Once you have learnt how to undertake these recurrent budget calculations, as described in this Section, you can use them to make your long-term Core Equipment Expenditure Plan (*Section 7.3*) and to undertake annual budgeting (*Section 8.1*). An example of a total recurrent budget plan is given in *Section 7.3*.

Box 35 contains a summary of the issues covered in this Section.

BOX 35: Summary of Procedures in Section 6 on Recurrent Budget Calculations

Maintain	**HTM Working Group, HTM Manager, Finance Officer**	◆ make rough estimations of maintenance costs for long-term forward plans and budget allocations, by using a percentage of the equipment stock value (see *Figure 20*)
	HTM Managers in Workshops	◆ make specific or annual estimates of maintenance costs, by costing specific requirements (see *Box 29* and *Figure 21*)
Operate	**HTM Working Groups**	◆ make rough estimations of consumable operating costs for long-term forward plans and budget allocations, by considering the suggestions relating to a percentage of the equipment price (see *Box 30*)
	Heads of Department	◆ make specific or annual estimates of consumable operating costs, by costing specific requirements (see *Figure 22*)
Admin	**HTM Managers and Heads of Department**	◆ make rough estimations of administrative costs for long-term forward plans and budget allocations, by considering the suggestions relating to a percentage of the equipment stock value or departmental operating budgets (see *Box 32*) ◆ make specific or annual estimates of administrative costs, by costing specific requirements (see *Figure 23*).
Training	**HTM Working Group (or Training Sub-group)**	◆ make rough estimations of ongoing training costs for long-term forward plans and budget allocations, by considering the suggestions relating to a percentage of the equipment stock value or payroll costs (see *Box 34*) ◆ make annual estimates of ongoing training costs, by costing specific requirements (see *Figure 24*)
	Health Management Teams	◆ consult with the health service provider on central training plans, and scholarships available ◆ lobby them for external resources for the training required.

7. HOW TO USE THE TOOLS TO MAKE LONG-TERM EQUIPMENT PLANS AND BUDGETS

Why is This Important?

If you have a large amount of equipment needs, you require a method of prioritizing between them for your health facility or service level. An Equipment Development Plan will help you to define which equipment you can afford to concentrate on, in any given year.

The development of the equipment stock will help you to identify the range of equipment-related training required by your staff. Therefore you need an Equipment Training Plan to cover all aspects of equipment-related skill development in an ongoing rolling programme.

To finance these plans, you need a Core Equipment Expenditure Plan which ensures you allocate sufficient funds (both capital and recurrent) to provide functioning healthcare technology over the long-term. You will also need a Core Equipment Financing Plan which ensures you identify sufficient sources of funds to cover your needs.

In this Section, we will show you how to apply the planning tools you have established (*Sections 3 and 4*) and the budgeting tools you have previously learned (*Sections 5 and 6*), for the purpose of making long-term plans and budgets.

Undertaking planning and budgeting together is important. Even if you have agreed upon the type of equipment to buy (determined by planning), you can only purchase what you can afford (determined by budgeting, prioritizing, and financing).

Facilities regularly identify equipment requirements. However they may have more needs than they can afford, in which case they will need to prioritize them. Currently, all facilities are faced with a number of unavoidable facts:

- They need a wide range of equipment if they are to provide the health services they wish to offer.
- All equipment should be functioning, but many items are not working, thus affecting the services that can be offered.
- Due to the age and shortfall of equipment, many different new items are required.
- Staff require a range of different equipment-related skills, but many staff have not received the necessary training.
- Each year there are only limited funds available to address these issues.

Therefore, it is very important that each facility, service level, and health service provider is able to plan its response to this situation by undertaking an **Equipment Planning and Budgeting Process**.

It is preferable to undertake **forward** planning and budgeting. This enables you to plan ahead and determine your needs and actions in the near future (one to two years) and the longer-term (three to five years). For this, you will have to:

- identify your equipment needs
- cost them
- identify sources of funds
- prioritize which activities you can afford and when they should take place.

In addition, your health service provider or the owner of your facility (such as a Board) may wish to develop a strategic or business plan which is less detailed. This enables you to make rough estimations of the long-term financial requirements for the development of your health facility or service level, so that you can forecast the need to raise money or recover costs.

This Section concentrates on the following long-term plans and budgets:

- an Equipment Development Plan (*Section 7.1*)
- an Equipment Training Plan (*Section 7.2*)
- your Equipment Budget – made up of a Core Equipment Expenditure Plan and a Core Equipment Financing Plan (*Section 7.3*).

Once you have developed these long-term goals, you will need to undertake an annual planning and budgeting process within these goals. Also, the long-term plans will need to be updated to reflect your annual plans and changes in circumstance. These issues are described in *Section 8.1*. The equipment rehabilitation, purchase, and training goals which you set should be monitored each year to see if they have been achieved (*Section 8.2*).

7.1 EQUIPMENT DEVELOPMENT PLAN (EDP)

Each facility and service level usually makes plans and sets itself targets which prioritize its departmental work activities for the coming year (see *Guides 4 and 5*). However, such annual action planning usually focuses on the improvements that can be achieved with existing equipment, and specifically omits the major investments required for additional equipment. Your **Equipment Development Plan** is the means for the facility to set itself rehabilitation, replacement, purchase, and corrective goals for its equipment stock.

If you have a large quantity of needs to improve your equipment stock, you require a method of prioritizing between the needs across your facility or service level, since you will not be able to buy everything at once. An Equipment Development Plan will help you to do this, by defining which items of the equipment you need to concentrate on in any given year.

Why Equipment Development Planning is Necessary

An Equipment Development Plan brings to your attention information about:

- the current stock of equipment (medical equipment, plant, service supply installations, fabric of the building)
- the condition of the equipment
- the basic shortfalls in equipment
- the action required to rehabilitate, replace, purchase, or correct problems
- what should be attempted in both the short- and the long-term.

The Equipment Development Plan will be of help because it:

- identifies and forecasts your requirements in advance
- clarifies the direction of development
- allows cost estimates to be made for the actions required
- highlights where you need to allocate funds, and helps you to rationalize resources
- enables you to focus on the areas where fund-raising is required
- provides you with a time-frame for monitoring that the development is achieved.

The actions you must take are to:

- use the planning tools established (*Sections 3 and 4*)
- evaluate the current equipment stock and its needs
- evaluate your future requirements
- adhere to your purchasing, donations, replacement, and disposal policies
- present your decisions as the long-term Equipment Development Plan.

Tip

- As can be seen from your purchase and donations policies (*Section 4.4*), the majority of purchases are likely to be for replacing existing stocks as they reach the end of their lives. Equipment should **only** be replaced for valid reasons as determined by the criteria given in your replacement and disposal policies (*Section 4.4*).
- **All** your capital expenditure requirements should be covered by the Equipment Development Plan. Thus all requests for replacement equipment, additional new items, and major rehabilitation needs, should only be honoured if they are part of the long-term goals detailed in the Equipment Development Plan.

Who is Responsible for Equipment Development Planning?

Preference

Equipment development planning should be undertaken by a multi-disciplinary team, so that single types of staff (such as clinicians) do not have too much influence.

Who?		Takes what action?
- HTM Working Group, or smaller planning sub-group - HTM Team (which prepares background technical information)	→	Is responsible for Equipment Development Planning

Which level?		Takes what action?
At facility level	→	It is possible to undertake **basic** equipment development planning
At service levels (such as district, region, or centre) that cover: - the needs of many items of equipment - many different locations.	→	Require a **bulk** equipment development planning process, most likely computerized, possibly with specialist support

Tip

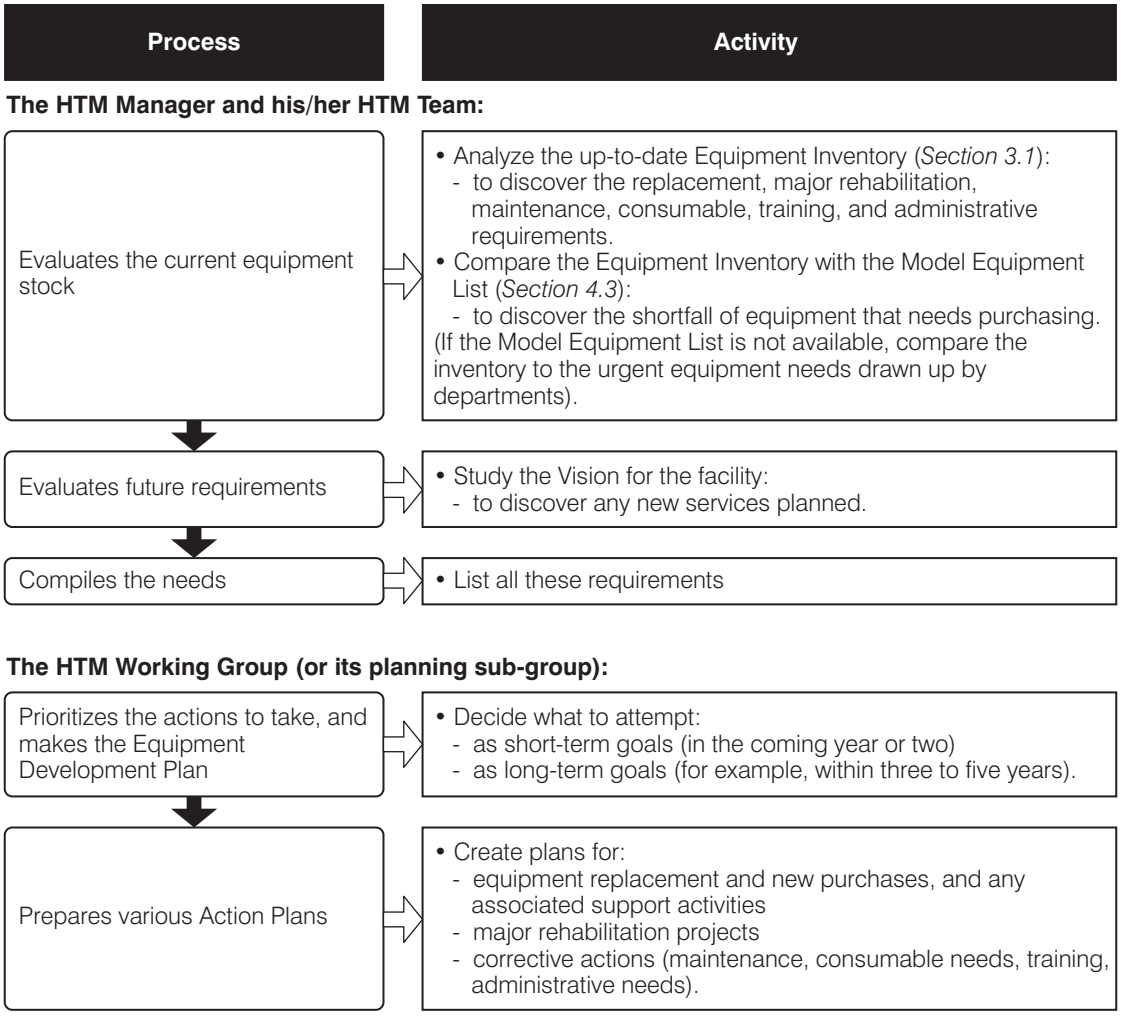
- If you want to gain from standardization of equipment and economies of scale, it is better to undertake needs assessment and procurement at a service level that covers many health facilities (*Section 2.2*). Therefore try to collaborate in these tasks.

Principles Involved in Basic Equipment Development Planning

Figure 25 shows the basic process involved in equipment development planning.

However, to make the necessary decisions you should undertake some analysis of the data you are studying. *Box 36* illustrates the principles involved for the analysis, in relation to the activities shown in *Figure 25*.

Figure 25: The Basic Equipment Development Planning Process



BOX 36: Analysis Required for the Equipment Development Planning Process (in *Figure 25*)

Analysis	Method of Measurement
HTM Manager and his/her Team:	
◆ When analyzing the up-to-date Equipment Inventory:	
Discover the condition of the equipment.	a. Identify those items needing maintenance and repair (including maintenance contracts). b. Identify those items requiring major rehabilitation (including maintenance contracts). Note: It may be necessary to set priorities for renovating equipment if you have a large backlog. A good indicator (way of measuring this) is to monitor each year what percentage of your Equipment Inventory has been returned to working order. Provide the HTM Working Group with this percentage figure (see below).
Discover: - where the equipment is in its life-cycle (refer to typical lifetimes in *Annex 3*). - whether the health service that can be delivered is deteriorating.	c. Identify those items to be scrapped and not replaced, according to the replacement and disposal policies (*Section 4.4*). d. Identify those items needing replacement, according to the replacement and disposal policies. Note: It may be necessary to set priorities for replacing the equipment if you have a large backlog. A good indicator of priorities is to monitor what percentage of your Equipment Inventory is beyond its expected lifespan. Provide the HTM Working Group with this percentage figure (see below).
Discover what hinders the use of equipment	e. Identify where consumable and administrative inputs are required. f. Identify where training is required (this information will be used when developing the Equipment Training Plan – *Section 7.2*).
◆ When comparing the Equipment Inventory with the Model Equipment List:	
Discover the shortfall of equipment in the existing facility.	g. Identify those items which are missing and must be purchased, according to the purchasing and donations policies (*Section 4.4*). Note: It may be necessary to set priorities for purchasing the missing equipment. A good indicator of priorities is to monitor each year what percentage of the Model List is covered by your Equipment Inventory. Provide the HTM Working Group with this percentage figure (see below).
◆ When studying the Vision for the facility:	
Discover any new services to be offered by the facility in the long-term.	h. Identify those new additional items of equipment which must be purchased, according to the purchasing and donations policies.

Continued opposite

BOX 36: Analysis Required for the Equipment Development Planning Process (in *Figure 25*) (continued)

Analysis	Method of Measurement
HTM Working Group (or its planning sub-group): ◆ When prioritizing which actions a–h (above) will be attempted:	
Decide which actions will be achieved: - as short-term goals (in the coming year or two) - as long-term goals (for example, within three to five years).	◆ Ensure the equipment remains in good working order – refer to the indicator provided by the HTM Manager (see point b above). ◆ Ensure the health service delivered does not deteriorate – refer to the indicator provided by the HTM Manager (see point d above). ◆ Follow the principles in the purchase/replacement policies – refer to the indicator provided by the HTM Manager (see point g above). ◆ Conform to the available finances for the facility. ◆ Consider how important the equipment is for clinical operations (see discussion of priorities in *Section 8.1*).

The first time you establish an Equipment Development Plan, you consider the needs for a span of around five years. After that, you update and modify the information annually (*Section 8.1*) to create a rolling programme of action plans.

To help you to review all the necessary actions and prepare the Equipment Development Plan, you can use an Equipment Development Plan Record Sheet to lay out the needs.

Layout of the Equipment Development Plan

A variety of layouts can be used for the Equipment Development Plan (EDP). *Box 37* (overleaf) shows a possible layout of the Record Sheet used to capture the details, which can then be used to help create your final EDP. Your equipment inventory will be used as the first column on the Record Sheet. You can decide how best to sort your inventory data (*Section 3.1*). In the example shown, the inventory is sorted by location.

The EDP Record Sheet (*Box 37*) is ordered according to department (area, or room), with each column providing different information and highlighting decisions which need to be made. The activities recommended in these columns can form the basis of your short- and long-term Action Plans. If you wish, you can add on extra columns to record rough price estimates for the purchases and actions you propose. This is useful, as you will need these estimates as the basis for your cost calculations when preparing your Core Equipment Expenditure Plan (*Section 7.3.1*).

It is possible to mark up a printed copy of your Inventory, then type up the decisions made in the column format of the EDP Record Sheet. However, creating an EDP is easier if you have computerized records and know how to create spreadsheets. This is discussed further in the next section on creating a bulk EDP.

Ultimately, it may be easier to work from a Summary EDP, rather than a large pile of EDP record sheets. The summary combines the data and presents all the action plans for the short term and long term in one place. *Box 38* (overleaf) shows how you might summarize the data from your EDP record sheets, and continues the example started in *Box 37*. It assumes that the health facility concerned is large enough to have an HTM workshop of its own and shows its needs. In smaller facilities these requirements would be covered by the EDP for the district/regional HTM Service.

How to Create a Basic Equipment Development Plan at Facility Level

At facility level you can go as far as you like. For example:

- you could simply follow the basic equipment development planning process shown in *Figure 25*
- in addition, you could undertake the analysis described in *Box 36*
- you can make use of an EDP Record Sheet to assist you with laying out the details, as shown in *Box 37*
- you can also develop a summary of your plans, as shown in *Box 38*.

How To Create a Bulk EDP at Service Levels which Cover Many Facilities

Larger facilities (tertiary) and district, regional, or central health authority levels should have drawn up equipment inventories on all assets. However, preparing an Equipment Development Plan on the basis of analyzing each item would be an enormous amount of work. You will therefore require strategies to make the task less of a burden.

If you only consider complex and large items of equipment, you risk omitting small but important items. In many countries, it is common for the needs of major items to be well addressed, but for smaller, essential items to be ignored due to the high level of effort involved in calculating the numbers required. Since small equipment and instruments are just as important and are used by many members of staff, planning for this type of equipment should be done in a way which relieves the burden of the administrative procedure.

Often, procurement may be triggered not by the size and complexity of equipment, but by the price bracket. Since many small items used by many staff members can add up to a large amount, they should not be forgotten. The same principles as those described for basic equipment development planning are used, but instead you consider the equipment in categories for a bulk EDP. *Box 39* provides examples of strategies that can help.

BOX 37: Example of the Layout for an Equipment Development Plan Record Sheet

Description:

Department/Room:					
Column 1 **Equipment**	Column 2 **Condition**	Column 3 **Short Term Action**	Optional Column 4 Price Estimates	Column 5 **Longer Term Action**	Optional Column 6 Price Estimates
a. Existing equipment & its particulars (type of equipment, the make, your inventory code number). *b. Additional equipment required to provide basic services, which is currently absent. This reflects the equipment levels defined in the Model Equipment List (see Section 4.3).*	*Age & Expected life. Condition of the equipment, such as:* *• working or not;* *• details of problems.* *Codes can be used for condition (ie. poor, fair, excellent) and to show replacement is needed, eg.* *• damaged beyond* *• repair technically* *• obsolete clinically,* *etc.*	*Short term action required (things that should happen within the following couple of years), such as:* *• rehabilitate* *• replace* *• buy for the first time* *• undertake corrective actions, such as training users, buying consumables, hiring a maintenance contractor.*	*Rough price estimates of short term actions.*	*Longer term action (things that must happen within 3–5years), such as:* *• rehabilitate* *• replace* *• buy for the first time* *• continue corrective actions, such as hiring a maintenance contractor.*	*Rough price estimates of longer term actions.*

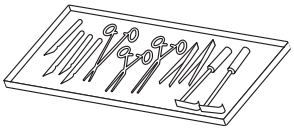
Example:

Department/Room: X-RAY DEPARTMENT, DARKROOM					
Equipment	**Condition**	**Short Team Action**	Price Estimates (optional)	**Longer Term Action**	Price Estimates (optional)
Automatic film processor, Kodak RP X-omat, BD654321	8 years old, used all the time; not serviced enough; maybe wrong chemicals	Use local contractor to service. Educate staff. Buy correct consumables.	US$ 75 US$ 25 US$ 250 p.a.	Enter into a new maintenance contract.	US$ 100 p.a.
Manual processor, Kodak P3, BD:1453	30 yrs old, not working, parts missing.	Replace to ensure manual back-up is available.	US$ 3,000		
Red safe lights	Need red filters.	Purchase filters.	US$ 30		

BOX 38: Example of a Summary Equipment Development Plan

Action	Department	Needs	Price Estimates US$ (optional)	Short-term		Long-term		
				2004	2005	2006	2007	2008
Equipment to replace	casualty	1 x ECG recorder	12,000		x			
	casualty	1 x ambulance	30,000			x		
	CSSD	2 x instrument sets	5,000		x			
	dental	1 x dental suite	19,000		x			
	laboratory	1 x fridge/freezer	500			x		
	laboratory	2 x microscopes	4,000					x
	maternity	2 x infant incubators	13,000				x	
	mortuary	1 x 3-body box & plant	14,000				x	
	paediatrics	1 x oxygen tent & humidifier	1,500	x				
	theatre	2 x diathermy units	15,000	x				
	theatre	2 x suction pumps	3,000			x		
	theatre	2 x operating theatre lights	30,000					x
	wards	20 x light fittings	700			x		
	workshop	assorted hand tools	4,000	x				
	X-ray	1 x manual film processor	3,000	x				
New equipment to purchase	administration	1 x computer & printer	2,500	x				
	labour and OPD	3 x foetal heart detectors	1,200		x			
	physiotherapy	1 x ultrasound unit	5,000					x
	waste handling	1 x incinerator	10,000				x	
	workshop	1 x safety tester	3,500			x		
Major rehabilitation projects	buildings	water storage tanks	4,000	x				
	buildings	roof	15,000				x	
	kitchen	cold room and plant	5,000					x
	service installations	overhaul generating set	7,000		x			
	wards	overhaul all beds	3,000			x		
Maintenance corrective actions (*add to general annual needs*)	maternity	introduce PPM for incubators	200 p.a.					x
	service installations	introduce PPM for plumbing	600 p.a.	x	x	x	x	x
	service installations	introduce PPM for electrics	700 p.a.		x	x	x	x
	theatre	service anaesthetic machines	400	x				
	theatre	maintenance contract for anaesthetic machines	600 p.a.			x	x	x
	X-ray	service automatic film processor	75		x			
	X-ray	maintenance contract for automatic film processor	100 p.a.				x	x
Consumable corrective actions (*add to general annual needs*)	casualty	source ECG recorder supplies	6,000 p.a.				x	x
	maternity/physio	source ultrasound gel	200 p.a.					x
	theatre	source operating theatre light bulbs	140 p.a.			x	x	x
	X-ray	source red safe-light filters	30 p.a.		x	x	x	x
	X-ray	source correct developer and fixer	250 p.a.	x	x	x	x	x
Administrative corrective actions (*add to general annual needs*)	library	subscriptions for literature	300 p.a.			x	x	x
	user departments	maintenance report files	30 p.a.		x	x	x	x
	workshop	safety clothes	400 p.a.	x	x	x	x	x
	workshop	maintenance record files	15 p.a.		x	x	x	x
Training needs (*forward to Equipment Training Plan – Section 7.2*)	laboratory	skills in photometer repairs	50		x			
	theatre	user PPM for suction pumps	10			x		
	X-ray	correct use of film processor chemicals	25	x				

Box 39: Ways of Categorizing Equipment for a Bulk EDP

Strategy	Example
Consider major items of equipment per department	Include: - medical equipment - service provisions (such as electrical installations, steam reticulation, sewage and water pipelines) - elements of the fabric of the building (such as doors, windows or roof)
Consider individually: - those items of equipment above a certain value - those items of equipment above a certain size	For example: - above US$500 - not handheld items (such as diagnostic sets), possibly not portable items (such as resuscitators/ambu bags)
Lump together: - small items which are used by many staff so the large quantities required can be purchased in bulk - items which can be considered collectively as larger 'sets'	For example: - stethoscopes and sphygmomanometers  - instrument sets, kitchen crockery and cutlery, and toolkits
Use a computerized process to help with the number-crunching	See *Annex 2* for information on suitable software

At a service level requiring a bulk EDP:

- use the strategies shown in *Box 39* to categorize your equipment into groups
- follow the basic planning process shown in *Figure 25*
- undertake the analysis described in *Box 36*
- use an EDP Record Sheet to lay out the details, as shown in *Box 37*
- develop a summary of your plans, as shown in *Box 38*.

For a bulk EDP covering many items or many facilities, you could type up the information but it is easiest if you have computerized your records. Then you simply enter the data into the computer according to the EDP layout, and use trained technical staff and secretarial or computing support to assist with data entry.

With access to computers and spreadsheets, you could employ further columns in the EDP record sheet or the summary EDP to hold additional useful data. For example, you could programme the columns with codes for:

- the condition of equipment, and therefore its need for replacement or maintenance
- the number of years left in the equipment's lifetime, and therefore when it is likely to need replacing
- how many additional pieces of equipment you need to meet the standard level set in the Model Equipment List, and therefore the need for new purchases
- a running total of the possible rough costs involved
- your decisions on which actions to take in which year.

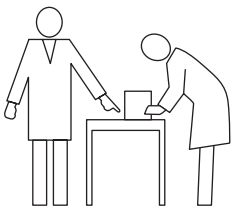
7.2 EQUIPMENT TRAINING PLAN (ETP)

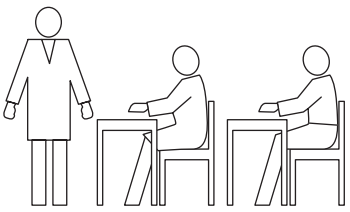
Once you have drawn up an Equipment Development Plan (*Section 7.1*), you can use this to tailor your training requirements.

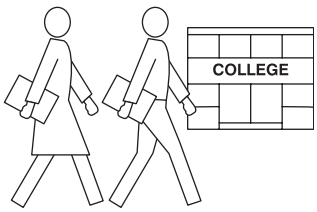
If you want to maximize your use of equipment, a wide range of staff require training in equipment-related skills throughout their careers. To ensure that healthcare technology needs are not forgotten, the **Equipment Training Plan (ETP)** is an essential planning tool.

The first time you establish an ETP, you will need to consider the equipment training requirements over the long-term, for example for five years. After that, you can simply update and modify the information annually (*Section 8.1*) to create an ongoing programme of equipment-related skills development.

Skill Development Requirements


on-the-job


seminars



going to college

Types of Training

Healthcare technology is developing rapidly, with new models and makes of equipment appearing almost every year. Health service providers need to be able to cope with this wide range of rapidly changing products. Unfortunately, problems with equipment often arise due to mishandling by users, or a failure to understand fully how the equipment works. In order to be able to use and maintain the equipment found in health facilities effectively, training must therefore be seriously addressed.

Throughout their careers, your staff will need both:

- basic training, and
- additional skill development opportunities.

The basic health training requirements for medical staff are generally covered by the Human Resources Development Plan. However, it is common for health service providers to forget:

- basic training and career development requirements for maintenance staff (for a description of the needs, see *Guide 1*)
- specific training modules on equipment operation for medical and support staff (see *Guide 4*)
- equipment-related training needs of general staff, such as purchase officers, stores staff and finance officers (see *Guides 3 to 6*).

Major training needs (such as long courses, training abroad or specialization training) may have to be covered by the capital budget.

Experience from Southern Asia

The Human Resource Development Division of the Ministry of Health in one Southern Asian country is responsible for training but has no specific budget for equipment or facility-related training.

Their budget for training is small, and only gets used for clinical skills for new recruits (such as nurses and laboratory technicians). None is used for maintenance technicians, skills in equipment operation, or upgrading equipment knowledge.

Although they use the WHO country budget to get funds for assorted training needs, this is not sufficient to keep up with new technical advancements.

Equipment-related skills development will be required in the following eight areas:

- good practice when handling equipment – basic 'dos and don'ts'
- how to operate equipment
- the correct application of equipment
- care and cleaning
- safety procedures
- planned preventive maintenance (PPM) for users
- PPM and repair for maintainers
- assorted activities as applied specifically to equipment needs, such as procurement, tender adjudication, stores management, financial management and computing skills.

This range of training is required at varying times throughout a member of staff's career. Key training stages include:

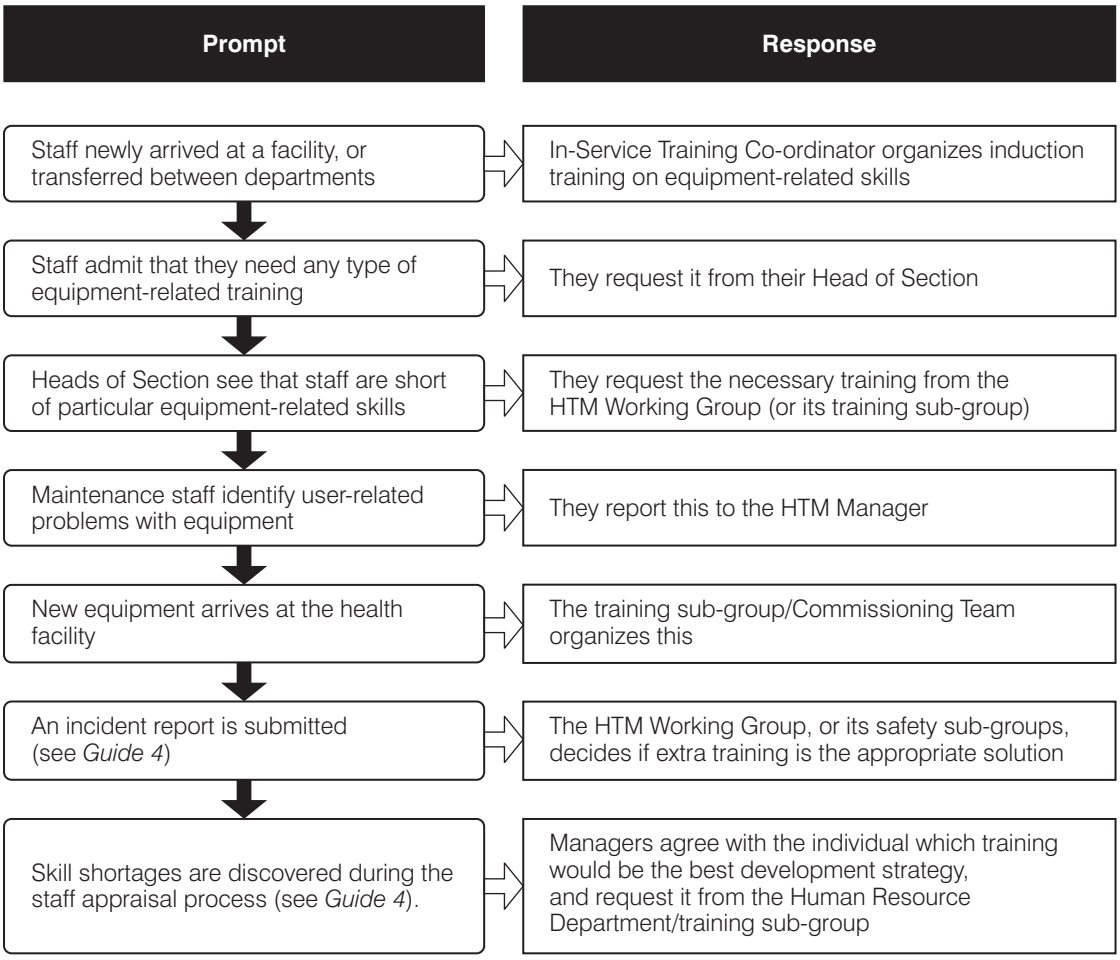
i. induction training – when staff are newly placed in post, move to a new department/facility, or move to a new location with different responsibilities (*Section 6.4*)

ii. training at the commissioning of equipment – when new equipment first arrives (*Section 5.4.2*)

iii. refresher training – to update and renew skills throughout the working life of staff (*Section 6.4*).

Monitoring how equipment works and how it is used will provide prompts that training is required, which should be passed onto the Health Management Team (*Section 8.2*). *Figure 26* shows the likely prompts.

Figure 26: Example of Prompts Showing that Training is Required



Sources of Training Available

There are a number of options available for developing skills, and each facility has to use a combination of the strategies shown in *Box 40*.

Whichever options prove to be the most feasible, a skills development programme is vital. The health service provider organization plays a significant role at central level, such as:

- developing training plans
- organizing and providing training scholarships
- approaching donors to finance training programmes.

Therefore equipment training requirements at facility or district/regional level should be submitted to the central body of your health service provider organization.

BOX 40: Strategies for Developing Equipment Skills

Strategy	Advantage/Disadvantage
Send staff to factories that manufacture equipment (this may be appropriate for high-cost equipment).	This can be good training but may be expensive as it often entails going abroad and paying in foreign currency. However, the company may have a local representative that has the skills to provide the training; this will be a more affordable option. Dangers are that the manufacturer will offer a course which is too simple (not much more than a factory tour), or alternatively a very theoretical course. Good communication is required to ensure that the training is appropriate to maximize the potential of this equipment-specific training.
Invite engineers from manufacturers to visit your facility to conduct training on their equipment.	If you are facing financial constraints, it may not be possible to afford this easily. However if the company's local representative has sufficient skills and can offer a well-organized plan for on-site training, this can be more affordable.
Send staff to other locations which have already developed the skills required.	Other facilities/workshops/teams may already have developed skills that you need. Here your staff can either attend specific training courses, or have a period of secondment in order to obtain skills through on-the-job training, work experience, or work exchange visits.
Link the provision of training to the procurement process.	When equipment is purchased from a company, you ask them to provide training at the time of commissioning (see *Guide 3*). Who covers the cost of the training and where it will take place is negotiated in the procurement contract, and may be dependent on the type and total cost of the equipment.
Run in-house (on-the-job) training sessions	You can make use of local, national, or regional experts who are maintenance and/or clinical staff. It may be necessary to send some staff for training abroad so that they can become the local trainers/experts.
Make use of regular clinical/professional meetings	These can be used as a forum to introduce staff to particular equipment concerns. They can be run at facility, district, central, or international levels.

Continued overleaf

BOX 40: Strategies for Developing Equipment Skills (continued)

Strategy	Advantage/Disadvantage
Make use of academic courses at various levels	These are useful for gaining additional specialist skills. They will be available nationally, regionally, and overseas (see *Annex 2*).
Approach local colleges to develop, run, and accredit new modules specifically designed for your equipment needs	- The **Trade Testing Authority** can develop trade tests suited to the range of skills used by artisans/craftsmen who maintain healthcare technology, so they can progress in their careers. - The **Polytechnic** can combine a mixture of existing engineering modules to create a certificate or diploma course suited to the range of skills used by technicians who maintain healthcare technology, so you can hire and train more suitably qualified staff. - The **health colleges** (who provide basic training for nurses, doctors, physiotherapists, and other health practitioners) can introduce new modules aimed at developing equipment-related skills for equipment users.
Provide opportunities for practical on-the-job experience	Practical experience, with or without supervision, provides excellent training as long as it is at the right skill level. When a piece of equipment is not in use, staff should be encouraged to familiarize themselves with the equipment, and learn its principles and its different uses and problems.
Provide opportunities for studying and teaching	Books, manuals, and articles from journals will give answers to many questions on principles of operation and maintenance for different types of equipment (see *Annex 2*). If staff are given opportunities to study, with a little pressure/expectation to lecture to colleagues afterwards, the benefits for individuals can be great.
Let the different types of staff (both equipment operators and maintainers) attend their peer group meetings	This allows staff to share experiences regarding equipment, learn from their colleagues, and develop a professional approach to work. The meetings will be available nationally and internationally.
Provide various training materials for staff to refer to (see *Guides 4 and 5*).	The materials, together with demonstrations, help staff to learn and provide them with something to regularly refer to when uncertain. The materials can be hand-outs, posters, OHP acetates, laminated cards, etc.
Provide work placements for student maintainers in your workshop	This will raise your profile and give you contacts with training institutions. The students may also return to you for employment when they graduate, and you will already have a good idea of their abilities.

Resources Required

You will require a variety of inputs when undertaking training, and they will vary depending on the training source and skill-development option chosen (as described in *Box 40*). *Box 33* (*Section 6.4*) shows the type of resources which you will usually have to organize and finance.

Who is Responsible for Developing the Equipment Training Plan?

Who?		Takes what action?
HTM Working Group, or smaller training sub-group	→	Is responsible for establishing all training requirements

Which level?		Takes what action?
Every level	→	Needs to develop an overall Equipment Training Plan to cover all aspects of equipment-related skill development, and pass it on to higher levels.
Higher levels (such as district, region, and central level)	→	Must include equipment training plans developed at lower levels into their service-wide equipment training plans.

Tip

- If you want to gain from economies of scale, it is better to undertake needs assessment and organize training courses at a service level that covers many health facilities (*Section 2.2*). Therefore try to collaborate in these tasks.

How to Create an Equipment Training Plan

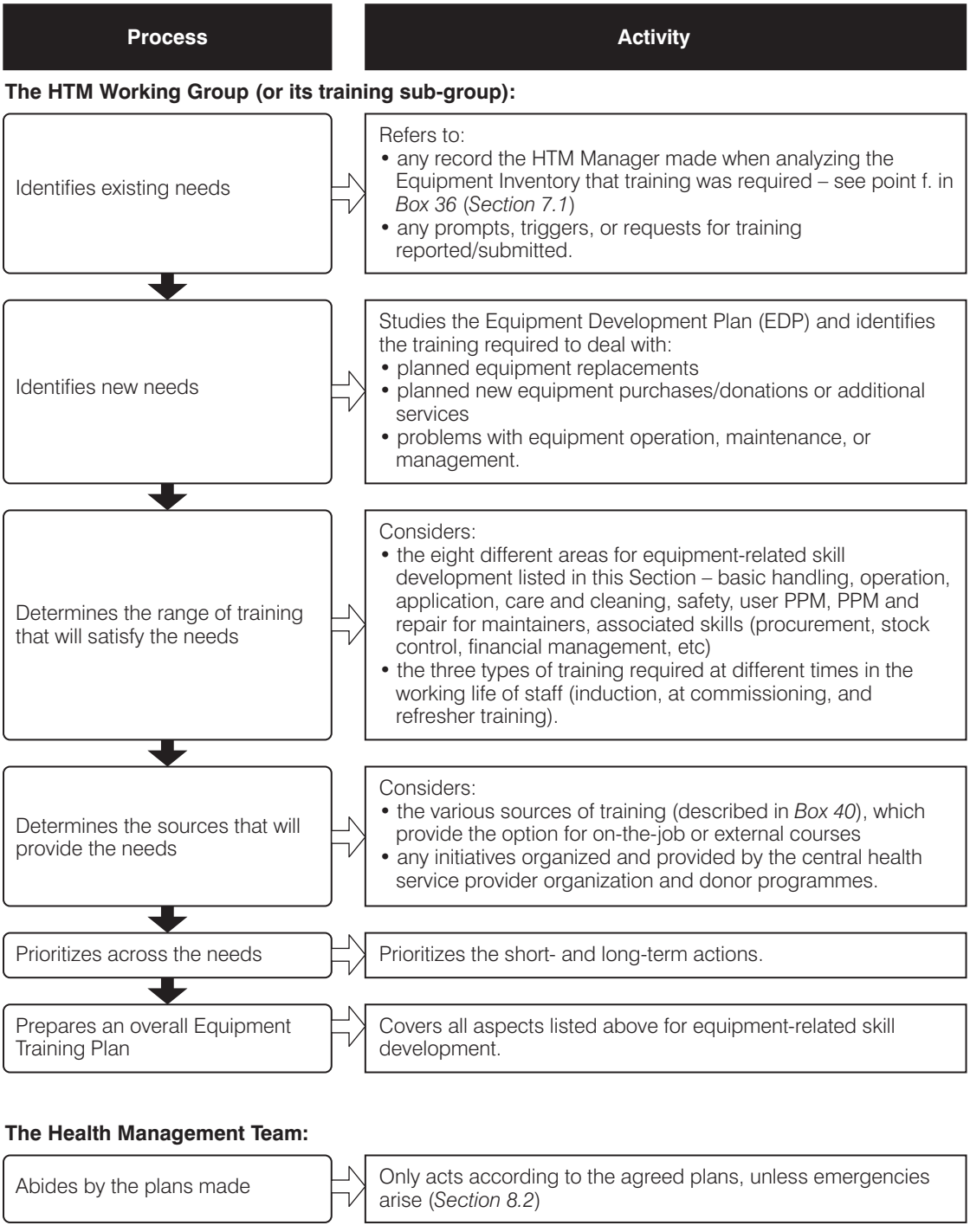
The **Equipment Training Plan** should be an annually-updated rolling programme of training covering many years. At service levels compiling and overseeing plans for many facilities, the use of computers and spreadsheets will make the task easier.

Figure 27 shows how to create an Equipment Training Plan.

Box 41 provides an example of an Equipment Training Plan, and continues the example from *Box 38*. It assumes that the health facility concerned is large enough to have an HTM workshop of its own and shows its needs. For smaller health facilities, these requirements would be covered by the Equipment Training Plan for the district/regional HTM Service.

As *Box 41* shows, if you wish you can have an optional column where you record rough cost estimates of the training planned. This is useful as you will need to make these calculations later anyway when preparing your Core Equipment Expenditure Plan (*Section 7.3.1*).

Figure 27: Making an Equipment Training Plan



BOX 41: Example of an Equipment Training Plan

Type of Training	Needs	Short-term		Long-term			Trainees (Numbers)	Source of Training	Price Estimates US$ (optional)
		2004	2005	2006	2007	2008			
Application training	ophthalmoscopes	x					clinical officers (3)	eye doctor	For example: 10
Operator re-training	ECG recorder use film processor chemical use	x	x				clinical officers & nurses (8) X-ray assistants (2)	in-house technicians local manufacturer's representative	10 25
PPM for users	suction pumps			x			theatre nurses (9)	in-house technicians	10
Upgrade operator skills	casualty equipment laundry procedures		x	x			nurses & clinical officers (8) laundry staff (6)	placement at referral hospital casualty central laundry supervisor	10 25
Re-training for maintainers	photometers repairs solar panel repairs		x	x			technicians (2) artisans (2)	local manufacturer's representative in-house engineers	*NOTE: the price estimates will depend on the training resources required (as detailed in Box 33, Section 6.4)*
PPM for maintainers	compressors bench-top autoclaves ambulance infant incubators	x	x		x	x	artisans (2) technicians (2) technicians (2) technicians (1)	in-house senior artisans in-house engineers in-house senior technicians visit manufacturer's factory	
Upgrade skills of maintainers	craft certificates technical diplomas	x		x	x		artisans (2) technicians (2)	local Trade Testing Centre local Polytechnic	
Management skills	equipment record-keeping	x					HTM Team members (5)	HTMS – central level	
Safety skills	use of safety tester			x			technicians (2)	in-house engineers	
New equipment arrivals	use of diathermy machines computer use incinerator maintenance use of physio ultrasound	x x			x	x	surgeons (3) admin-secretarial staff (5) artisans (2) physiotherapist (2)	in-house engineers local College local manufacturer's representative local manufacturer's representative	
Create trainers	in use of Bowie & Dick tests in user PPM for incubators	x			x		CSSD staff (1) midwives & ICU staff (2)	infection control officer in-house technicians	

7.3 EQUIPMENT BUDGET – FINANCIAL PLANS

Having drawn up a long-term Equipment Development Plan and Equipment Training Plan, you need to identify and allocate the finances to cover your proposed actions. To do this, you need an **Equipment Budget**. This ensures you have sufficient funds (both capital and recurrent) to provide functioning healthcare technology over a set period of time.

Any budget should have two parts to it:

- the **income** portion identifies the funds you have coming in, or must find
- the **expenditure** portion identifies how you wish to spend the money, and therefore how to allocate the funds.

Thus you need a **Core Equipment Financing Plan (CEFP)** and a **Core Equipment Expenditure Plan (CEEP)**.

For government health facilities, your income usually consists of only the funds given to you by government from its own finances, and the development funds provided by external support agencies. However, if your health facility is more autonomous, it is your responsibility to also identify various possible sources of income from fund-raising and income-generating activities.

The financial planning process is circular:

- you need to know the income available before you can spend it
- however, you need to know what you plan to spend before you can raise funds.

It is necessary to start the discussion at some point in the cycle; therefore this Section discusses:

- the Core Equipment Expenditure Plan in *Section 7.3.1*
- the Core Equipment Financing Plan in *Section 7.3.2*.

7.3.1 Core Equipment Expenditure Plan (CEEP)

The expenditure plan can be developed in two ways:

- A **General CEEP** for the Health Management Team, which displays the funds required for the short- and long-term actions proposed in your Equipment Development Plan (EDP) and Equipment Training Plan (ETP). This will form the basis of your allocations and spending every year.
- A **Strategic Business Plan** for the health service provider (or Board/Trustees). This makes use of rough estimations to provide a long-term financial overview so that they can forecast the need for raising money or recovering costs.

The expenditure plan should be designed according to your budget lines (or sub-divisions) for capital and recurrent costs. However, it is important to try and use the planning tool developed in *Section 3.3*, so that the budget is laid out with sufficient budget lines to show how money is allocated for different equipment requirements. In this way, you can adequately monitor how the money is spent on equipment.

Tip

- Part of financial planning is to ensure that you manage the allocations between different expenditure requirements. Your aim is to obtain an effective balance between capital and recurrent expenditure. For example, there must be a balance:
  – between the amount spent on capital items, and sufficient allocations for the recurrent costs required to keep the items functioning (including costs such as consumables, maintenance and training)
  – between the amount spent on staff salaries, and the amount spent to ensure there is sufficient equipment for the staff to work with.

Who is Responsible for Developing Equipment Expenditure Plans?

Who?		Takes what action?
- HTM Working Group, or smaller training sub-group - Finance Officers	→	Is responsible for equipment expenditure planning

Which Level?		Takes what action?
Any service level	→	Can prepare a **general CEEP** by budgeting for the proposed actions in the Equipment Development Plan and Equipment Training Plan
Service levels such as autonomous or donor-targeted facilities, districts, regions, or the centre	→	Can prepare rough estimations for a **strategic business plan**

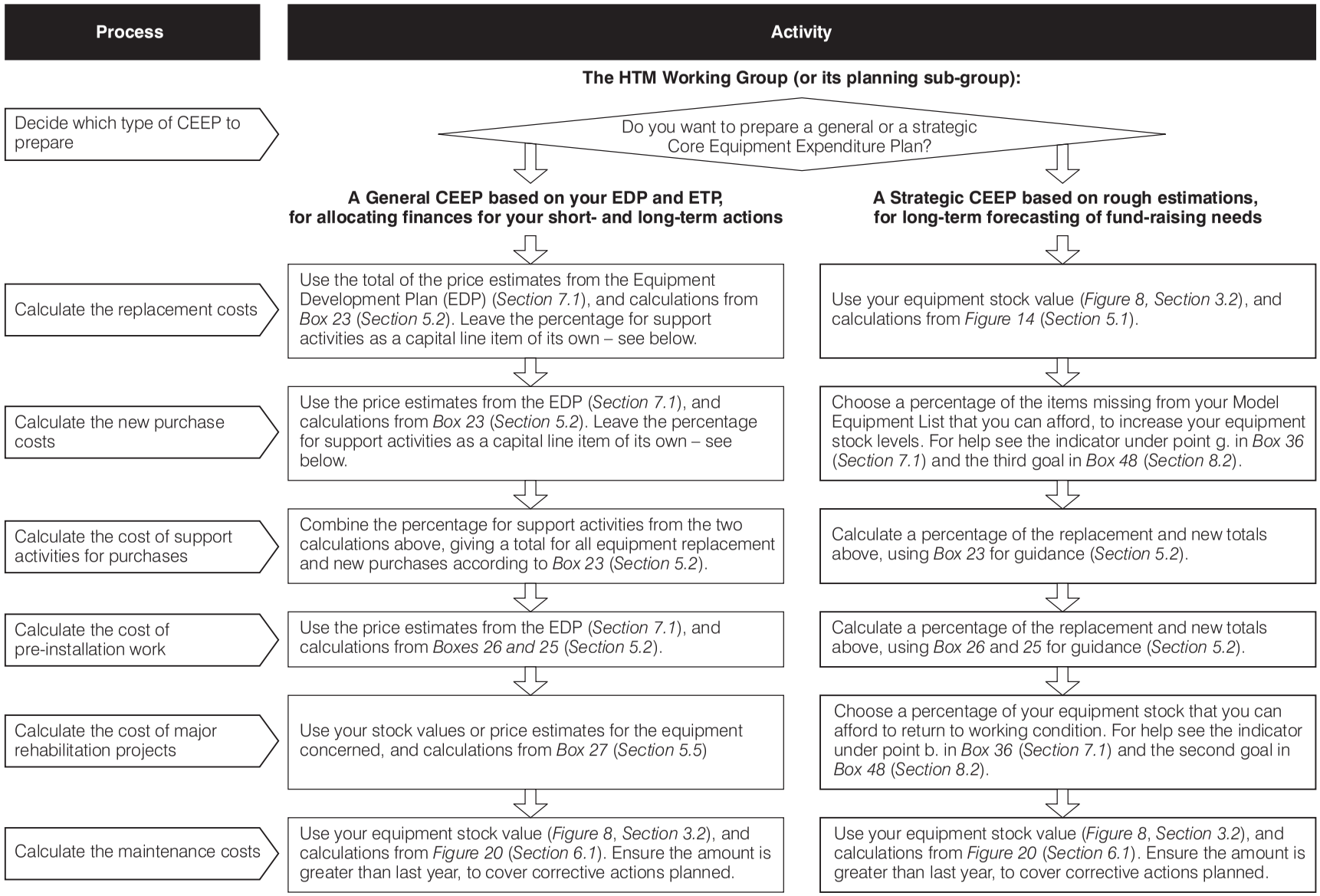
How to Create a CEEP

If you have a large number of activities and requirements as part of your long-term Equipment Development Plan and Equipment Training Plan, you must calculate the expenditure required and balance the needs across the facility.

To do this, you simply use your 'budgeting tools' for rough estimations (*Sections 5 and 6*) to cost each element, with the strategic CEEP using the quickest roughest estimates. Then you summarize the results and present them as the expenditure portion of your budget. At service levels compiling and overseeing plans for many facilities, the use of computers and spreadsheets will make the task easier.

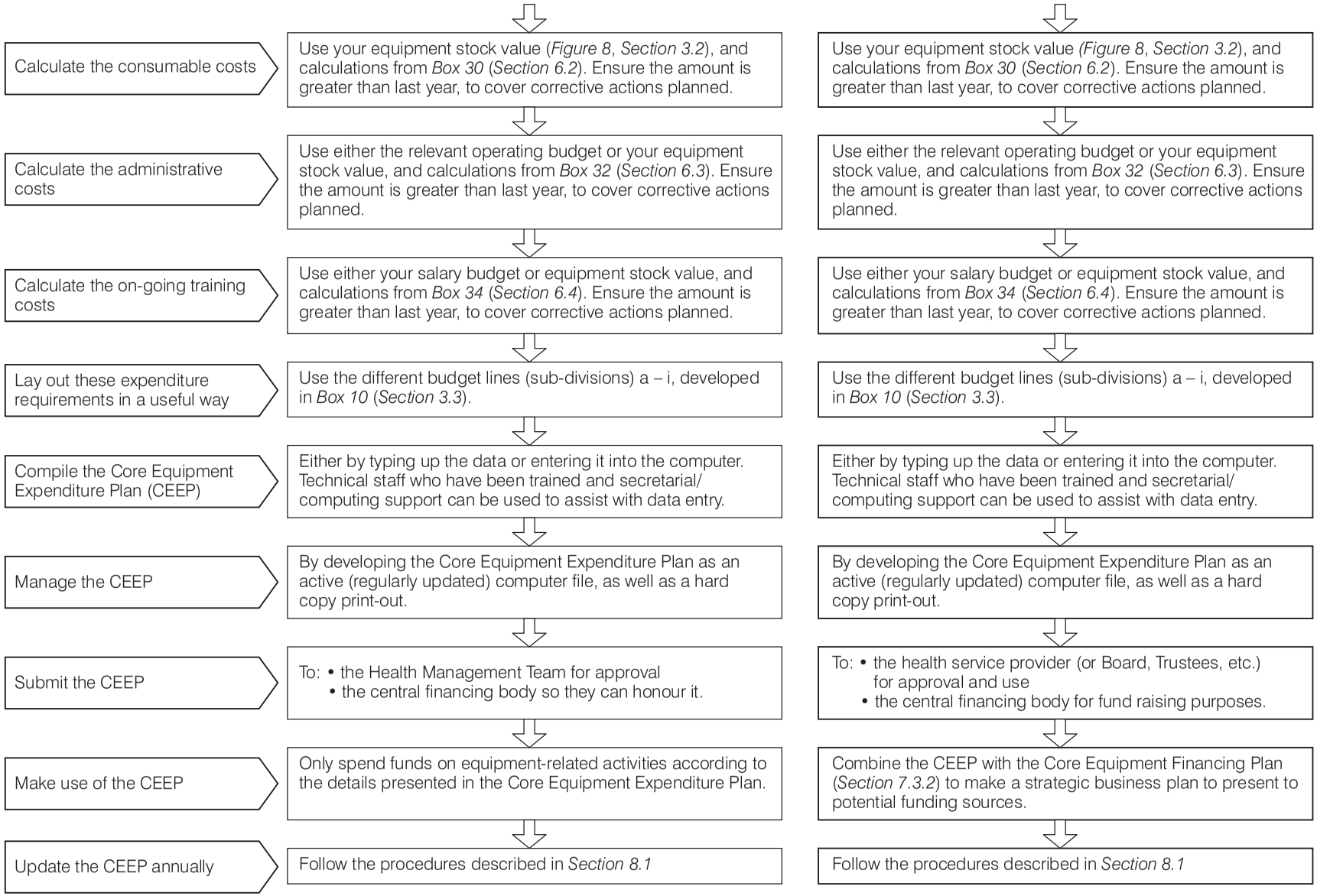
Of course, you then need to ensure that the central financing body of your health service provider accepts your plan and honours it. You will also need to identify a way of financing your needs (*Section 7.3.2*).

Figure 28: Making a Core Equipment Expenditure Plan



Continued opposite

Figure 28: Making a Core Equipment Expenditure Plan (continued)



Box 42: Example of a Core Equipment Expenditure Plan

Capital Expenditure (US$)	Short-term		Long-term			Total
	2004	2005	2006	2007	2008	
Replacement	*Use calculations for rough estimations from Section 5 (see Note below)*	48,000	*NOTE: In this example of a general Core Equipment Expenditure Plan, the rough prices from the Equipment Development Plan (Box 38, Section 7.1) and the Equipment Training Plan (Box 41, Section 7.2) have been increased by the percentage required for the 'package of material inputs' (see Box 23, Section 5.2), and the total placed in the year column.*			
New equipment		2,000				
Support activities linked to purchases		5,000				
Pre-installation		2,000	*NOTE: Rough estimations of these capital costs have been calculated based upon the prices from the example Equipment Development Plan (Box 38, Section 7.1), and the totals placed in the year column.*			
Rehabilitation		7,000				
Sub-Total		64,000				
Recurrent Expenditure (US $)						
Equipment maintenance	*Use calculations for rough estimations from Section 6 (see Note below)*	25,000	*NOTE: The rough prices in the Equipment Development Plan and the Equipment Training Plan are already included in these rough estimations of general recurrent needs per year.*			
Consumables		20,000				
Administration		6,000				
On-going training		15,000				
Sub-Total		66,000				
Total Expenditure		**130,000**				

Note: Initially, rough estimations are used for the short- and long-term overview when preparing this Core Equipment Expenditure Plan. During annual planning (see *Section 8.1*) the estimates are revised using calculations for specific requirements, to obtain your Annual Equipment Budget. The experience you gain from that annual revision process may mean that you have to alter the long-term estimates in this Core Equipment Expenditure Plan, so that they are more realistic.

Figure 28 (page 182) shows how to create a CEEP. This will help you to budget for the finances required to achieve your health service delivery goals over a set period.

Box 42 shows a possible layout for a Core Equipment Expenditure Plan using the various budget lines (subdivisions) discussed in *Section 3.3*. It continues the example started in *Boxes 38 and 41*.

How to Create a Strategic Business Plan

The aim of this plan is to ensure that functioning healthcare technology will be provided, at the level defined by the Model Equipment Lists (*Section 4.3*), by the end of a specified period – possibly five or 10 years.

To create a strategic business plan, you simply combine your strategic CEEP with an outline core equipment financing plan (*Section 7.3.2*). Depending on your type of health service provider and your level of autonomy, you can then use this strategic business plan to raise the necessary finances by approaching potential sources of funding. You can also use it when planning how to recover costs.

7.3.2 Core Equipment Financing Plan (CEFP)

Having drawn up your Core Equipment Expenditure Plan (either general or strategic), you need to identify funds from various sources to finance the equipment expenses. These elements will be laid out in a Core Equipment Financing Plan, which forms the 'income' portion of your Equipment Budget.

You then use the CEFP to allocate the necessary finances. Depending on your type of health service provider and your level of autonomy, these finances may come from a variety of different internal, national, or international sources.

Who is Responsible for Developing the Core Equipment Financing Plan?

Who?		Takes what action?
- HTM Working Group, or smaller planning sub-group - Finance Officers	→	Is responsible for developing the equipment financing plan

Which level?		Takes what action?
Any service level	→	Can prepare a CEFP as the income portion of their equipment budget
Service levels such as autonomous or donor-targeted facilities, districts, regions, or the centre	→	Are most likely to use the CEFP as part of their strategic business plan for fund-raising purposes.

How to Create a Core Equipment Financing Plan (CEFP)

To create a CEFP, you simply consider your capital and recurrent needs per year from your CEEP (see *Box 42*), and determine which type of funding source can finance which element. Then the results are summarized and presented as the income portion of your Budget.

Box 43 (overleaf) shows a possible layout for a Core Equipment Financing Plan, and continues the example figures from *Box 42*. The layout uses a variety of entries showing income sources that are either:

- internal (your own), such as patient fees, income generating projects
- national, such as government grants, sponsorship from local businesses/clubs; or
- international, such as grants and loans from external support agencies.

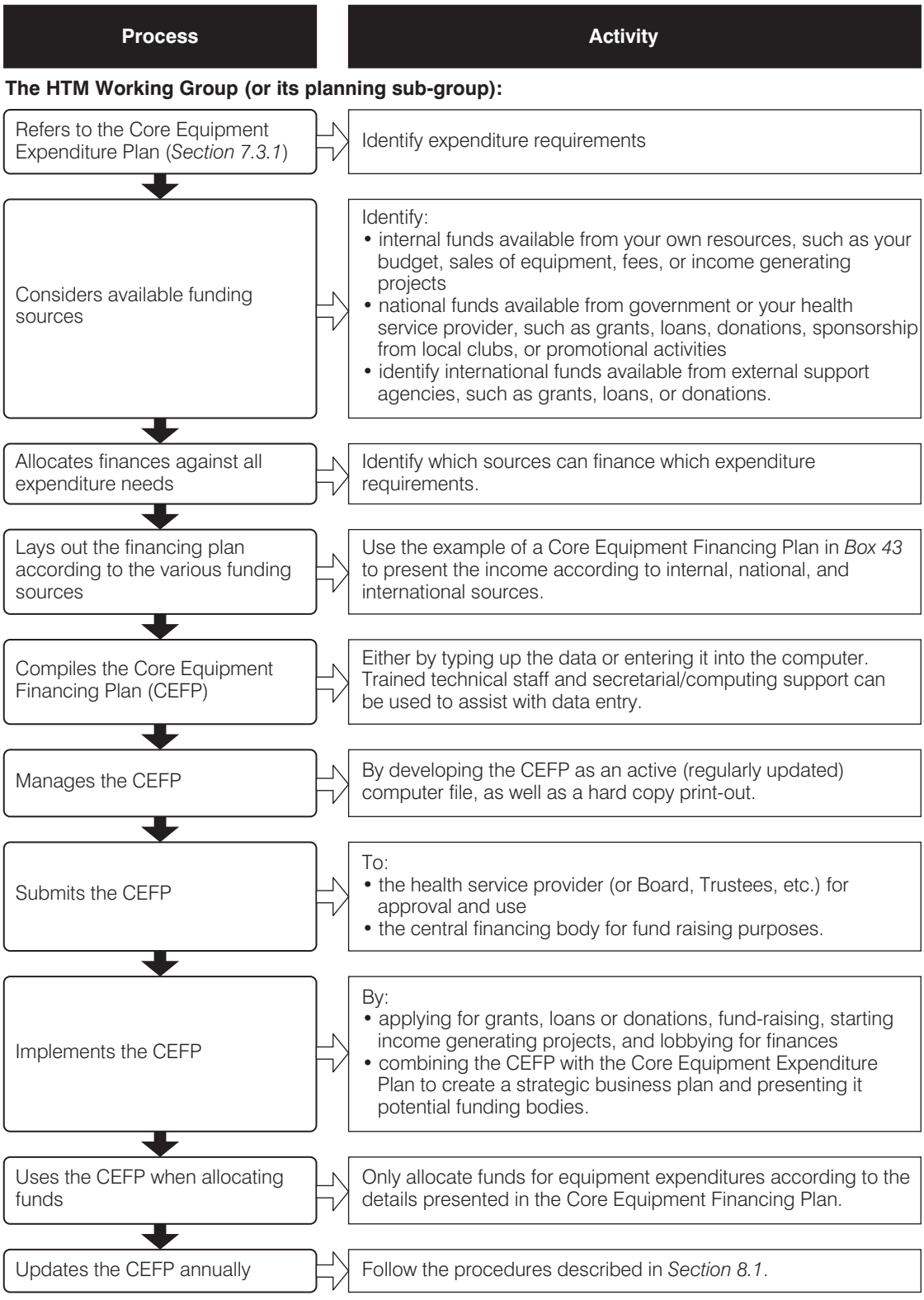
At service levels compiling and overseeing plans for many facilities, the use of computers and spreadsheets will make the task easier.

Either yourself or the central financing body of your health service provider will need to ensure that fund-raising activities are carried out and finances are obtained, so that the planned expenditure (*Section 7.3.1*) can be allocated. By combining the Core Equipment Financing Plan with your strategic business CEEP, you can draw up a strategic business plan to present to potential funding agencies.

Figure 29 shows how to create a CEFP, and allocate sufficient funds to achieve your health service delivery goals over a set period.

Once you have undertaken the one-off exercise to establish these long-term plans, as described in this Section, you then update and modify the information during the annual planning process (*Section 8*) to create a rolling programme of equipment plans.

Figure 29: Making a Core Equipment Financing Plan



Box 43: Example of a Core Equipment Financing Plan

	2004		2005		2006		2007		2008	
Financial Resources	**Capital Expenditure**	**Recurrent Expenditure**	**Capital Expenditure**	**Recurrent Expenditure**	**Capital Expenditure**	**Recurrent Expenditure**	**Capital Expenditure**	**Recurrent Expenditure**	**Capital Expenditure**	**Recurrent Expenditure**
Own Resources										
Accumulated retained surplus from previous years			500							
Income from sale of equipment			500							
Patient fees				2,000						
Income generating projects				3,000						
etc.										
Sub-Total			1,000	5,000						
National Resources										
Government grants	*For capital and recurrent requirements, insert rough estimates of likely incomes from:*		34,000	60,000						
Government loans	** known sources*		1,000							
Donations	** your fund-raising efforts*		1,000							
Local business sponsorship	** promises*		1,000	1,000						
etc.	*(see Note below)*									
Sub-Total			37,000	61,000						
International Resources										
External support agency grants			20,000							
External support agency loans			5,000							
Donations			1,000							
etc.										
Sub-Total			26,000							
Total	*The figures must equal the totals in your Core Equipment Expenditure Plan*		**64,000**	**66,000**	*NOTE: In this example, figures from the sample Core Equipment Expenditure Plan (Box 42, Section 7.3.1) have been used*					

Note: Initially, rough estimates are used for the short- and long-term overview when preparing this Core Equipment Financing Plan. During annual planning (see *Section 8.1*) the estimates are revised to reflect actual incomes obtained. The experience you gain from that annual revision process may mean that you have to alter the long-term estimates in this Core Equipment Financing Plan, so that they are more realistic.

Box 44 contains a summary of the issues covered in this Section.

BOX 44: Summary of Procedures in Section 7 on Making Plans and Budgets

EDP	**HTM Working Group (or Planning Sub-group)**	◆ uses the planning tools to establish an Equipment Development Plan for the short- and long-term, either: - a basic one at facility level (according to *Figure 25*), or - a summarized one at higher service levels (using strategies in *Box 39*) ◆ updates the Equipment Development Plan annually (*Section 8.1*)
	Health Management Team	◆ implements the Equipment Development Plan
ETP	**HTM Working Group (or Training Sub-group)**	◆ uses the Equipment Development Plan and training requests to establish an Equipment Training Plan as an ongoing rolling programme (according to *Figure 27*) ◆ updates the Equipment Training Plan annually (*Section 8.1*)
	Health Management Team	◆ consults with the health service provider organization in order to: - identify the central training plans - identify the scholarships available - lobby for external resources for the training required ◆ implements the Equipment Training Plan.
Budget	**HTM Working Group (or Planning Sub-group)**	◆ uses the Equipment Development Plan, Equipment Training Plan, and budgeting tools to establish either a general or strategic Core Equipment Expenditure Plan (CEEP) for the short- and long-term (according to *Figure 28*), as the expenditure portion of the budget ◆ considers all possible funding sources to establish a short- and long-term Core Equipment Financing Plan (CEFP) as the income portion of the budget (according to *Figure 29*) ◆ updates the Core Equipment Expenditure Plan and the Core Equipment Financing Plan annually (*Section 8.1*) ◆ combines the strategic CEEP and the CEFP to create a Strategic Business Plan to present to potential funding sources when fund-raising.
	Health Management Team	◆ implements the Core Equipment Expenditure Plan ◆ implements the Core Equipment Financing Plan ◆ makes use of the strategic business plan.

8. HOW TO UNDERTAKE ANNUAL PLANNING, BUDGETING, AND MONITORING

Why is This Important?

Having drawn up your short- and long-term equipment plans and budgets, you will need to carry out some annual planning and budgeting to find out what activities you can attempt each year within these goals. This allows you to revise the overall plans as time goes by.

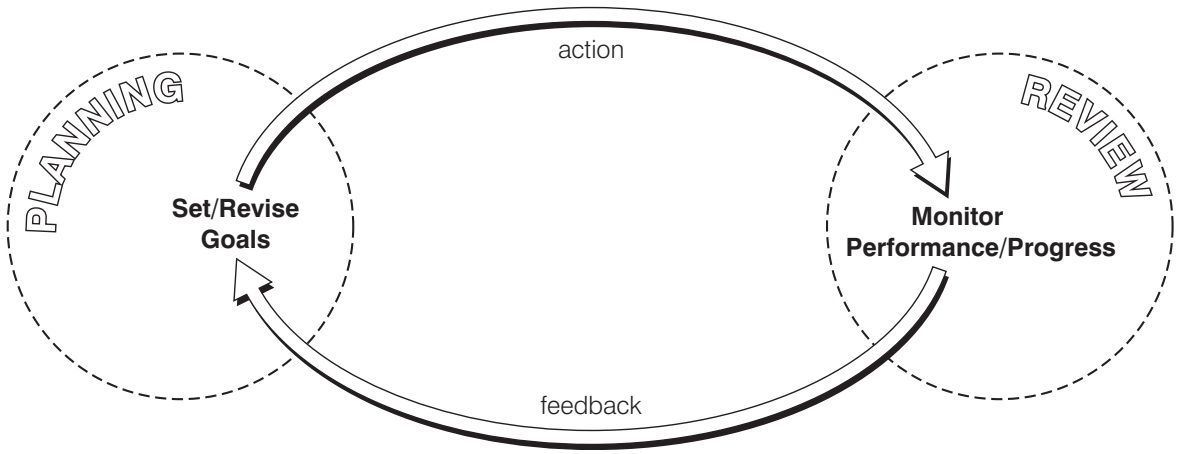
Managing the activities described in this Guide will involve a cycle of actions. You need to monitor your performance, and set yourself goals so that you can improve. Then you monitor your progress, revise your goals, and review your progress again – thus undertaking a continuous cycle of planning and review.

Such evaluation helps you to ensure the quality of your work. This is one element of quality management – an important goal for managers.

The planning and review activities are interlinked in a cycle, as shown in *Figure 30*, but it is necessary to start the discussion at some point in the cycle. This Section discusses:

- the annual planning and budgeting process (setting goals) in *Section 8.1*
- the review process (monitoring progress) in *Section 8.2*.

Figure 30: The Planning and Review Cycle



All staff involved in equipment planning and budgeting should be involved in planning and reviewing their progress with this work. Therefore, this Section is relevant for all different types of personnel, including:

- staff from the equipment-user departments
- HTM Teams
- HTM Working Groups (managers, technicians, finance officers, health workers, etc.)
- their various sub-groups.

The main outcome of the planning and review process is that you are able to evaluate your performance. This is important for ensuring the quality of your work (quality assurance), which is an essential component of quality management.

Aims of Quality Management

- client satisfaction
- cost efficiency
- compliance with laws

We recommend that quality management is introduced into the health management systems of all the decentralized levels of the health service. It can help to improve staff attitudes and this, in turn, can help staff handle the challenges connected with the many reforms and new management tasks they face (such as those described in this Guide). Important elements of quality management are:

- a management team approach
- supervision and evaluation
- participative leadership
- methods for encouraging staff
- individual responsibility and initiative
- control measures such as performance measurements and impact analysis
- community participation.

8.1 ANNUAL EQUIPMENT PLANNING AND BUDGETING (SETTING GOALS)

Each facility and service level needs to have goals and plans which set out their priority activities. The goals and plans must be clearly defined so that they guide the work of:

- health facilities
- service levels
- their staff
- the health service as a whole.

The goals and plans also enable staff and managers to monitor their own performance and progress with regard to the planning and budgeting of equipment.

Every department or team can benefit from **Annual Action Plans** which contain clear, specific goals relating to its key activities. An action planning process should take place once a year, as standard practice. This is an opportunity for the teams to agree the range of activities (initiatives and changes) they want to implement.

The annual action planning process for normal departmental activities is described in *Guides 4 and 5*. However, there are boundaries and limitations to such departmental planning, and the needs for major investments in equipment, staff, and resources are normally discussed outside their annual process. In this Guide, we outline the planning processes required for such major investments. For example:

- major equipment needs fall under the Equipment Development Plan (*Section 7.1*)
- skill development for equipment falls under the Equipment Training Plan (*Section 7.2*), although hiring of staff and other skill development needs fall outside the scope of this Guide
- resources for equipment fall under the Equipment Budget (*Section 7.3*), although resources for other aspects of healthcare work also fall outside the scope of this Guide.

Having drawn up short-term (one to two years) and longer-term (three to five years) equipment plans and budgets, you will need to carry out the following activities annually:

- review the activities planned for the year
- determine the activities you can pursue
- identify and allocate your funds for those purposes
- revise the long-term plans.

This is the annual planning and budgeting process, and involves:

- identifying needs
- costing them
- prioritizing which activities will occur in the coming year.

From the Equipment Development Plan you need to prioritize your requirements annually according to available funds, and therefore determine the:

- **Annual Purchase Activities (APA)** for replacement and new equipment, including all material inputs (stocks of accessories, consumables, spare parts) and associated work (such as pre-installation, installation, commissioning, initial training)
- **Annual Rehabilitation Activities (ARA)** for major large-scale renovation projects
- **Annual Corrective Activities (ACA)**, for undertaking repairs, introducing PPM, increasing consumable inputs, and ensuring administrative inputs are available.

From the Equipment Training Plan you need to prioritize your requirements annually according to available funds, and therefore determine the:

- **Annual Training Activities (ATA)**.

These capital and recurrent requirements combined will determine the expenditure and income portions of your **Annual Equipment Budget (AEB)**.

All your long-term plans (and many of your planning tools) are active records. In other words, they must be kept up-to-date if they are to be of any use. Data used for planning and budgeting purposes is of little help if it is out of date. Identifying equipment needs on an annual basis enables you to keep your plans and tools up-to-date.

Who is Responsible for Annual Planning and Budgeting?

Who?		Takes what action?
- HTM Working Group, or its planning sub-group and training sub-group - HTM Team (which prepares background technical information)	→	Are responsible for annual planning and budgeting

Which level?		Takes what action?
Every service level	→	Needs to undertake annual planning and budgeting

How to Undertake Annual Planning and Budgeting

The timing of your actions is important. Your plan must be produced in time for your health service provider's deadline for submitting budget estimates. This will be determined by the timing of the financial year, and the time required for the negotiation process between your health service provider and the central financing authority. *Figure 31* shows a time-line in your annual calendar for the steps in your planning and budgeting process, in relation to your health service provider's deadlines.

As *Figure 31* illustrates, the process of undertaking annual planning and budgeting involves the following six steps:

Step 1 – Update your Equipment Inventory

Step 2 – Review your Equipment Development Plan to determine your annual needs

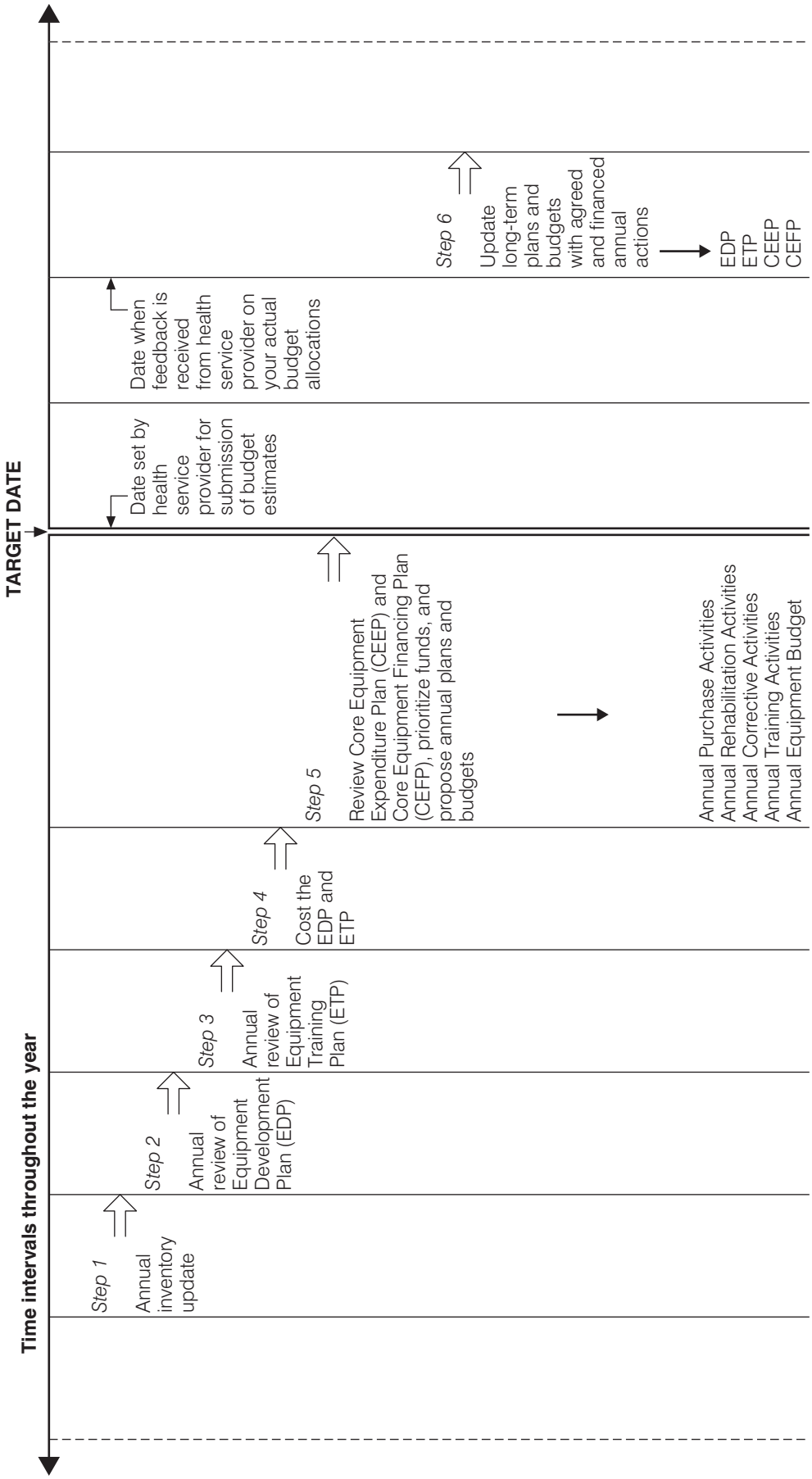
Step 3 – Review your Equipment Training Plan to determine your annual needs

Step 4 – Cost the annual needs

Step 5 – Review your Core Equipment Expenditure Plan and Core Equipment Financing Plan, prioritize the needs, and prepare proposed annual plans

Step 6 – Update existing plans with final agreed Annual Plans and Budgets, once funding has been approved.

Figure 31: Annual Calendar for the Planning and Budgeting Process

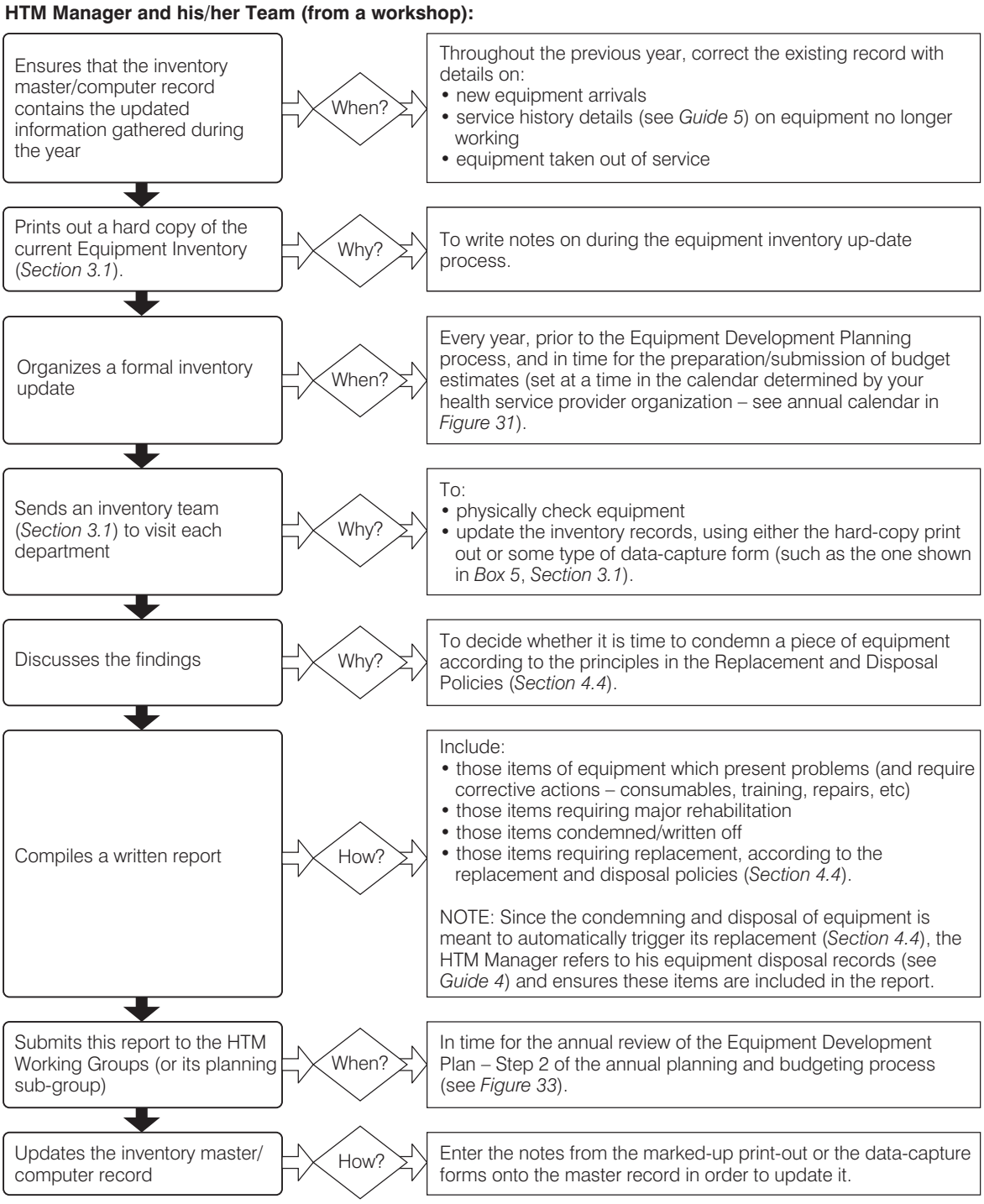


The activities you need to undertake for each of these six steps are outlined over the following pages.

Step 1 – Update your Equipment Inventory

Use the process shown in *Figure 32*.

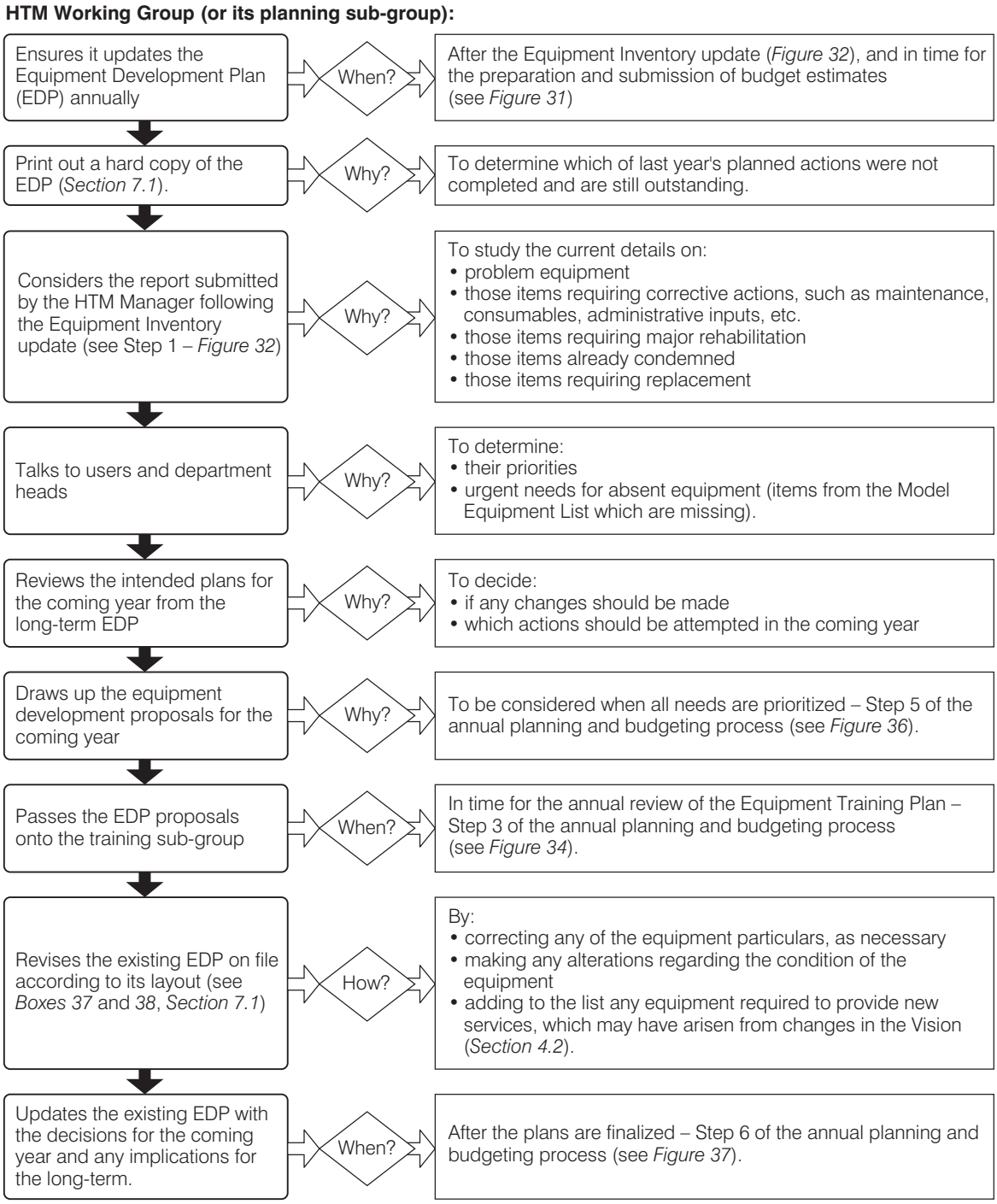
Figure 32: Updating the Equipment Inventory as part of the Annual Planning Process



Step 2 – Review your Equipment Development Plan and determine your needs for the coming year

Use the process shown in *Figure 33*.

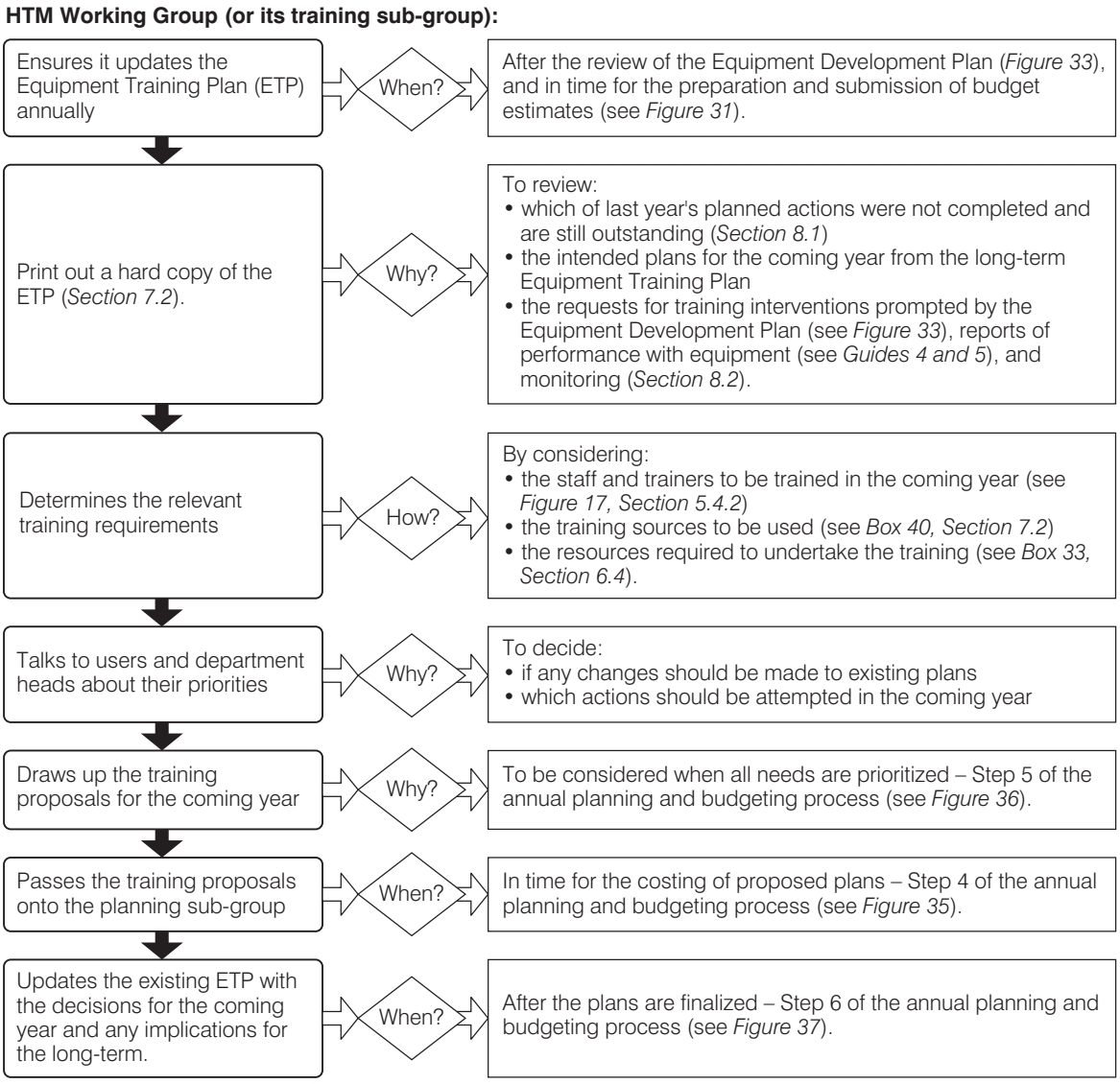
Figure 33: Reviewing the Equipment Development Plan to Determine your Annual Needs



Step 3 – Review your Equipment Training Plan and determine your needs for the coming year

Use the process shown in *Figure 34*.

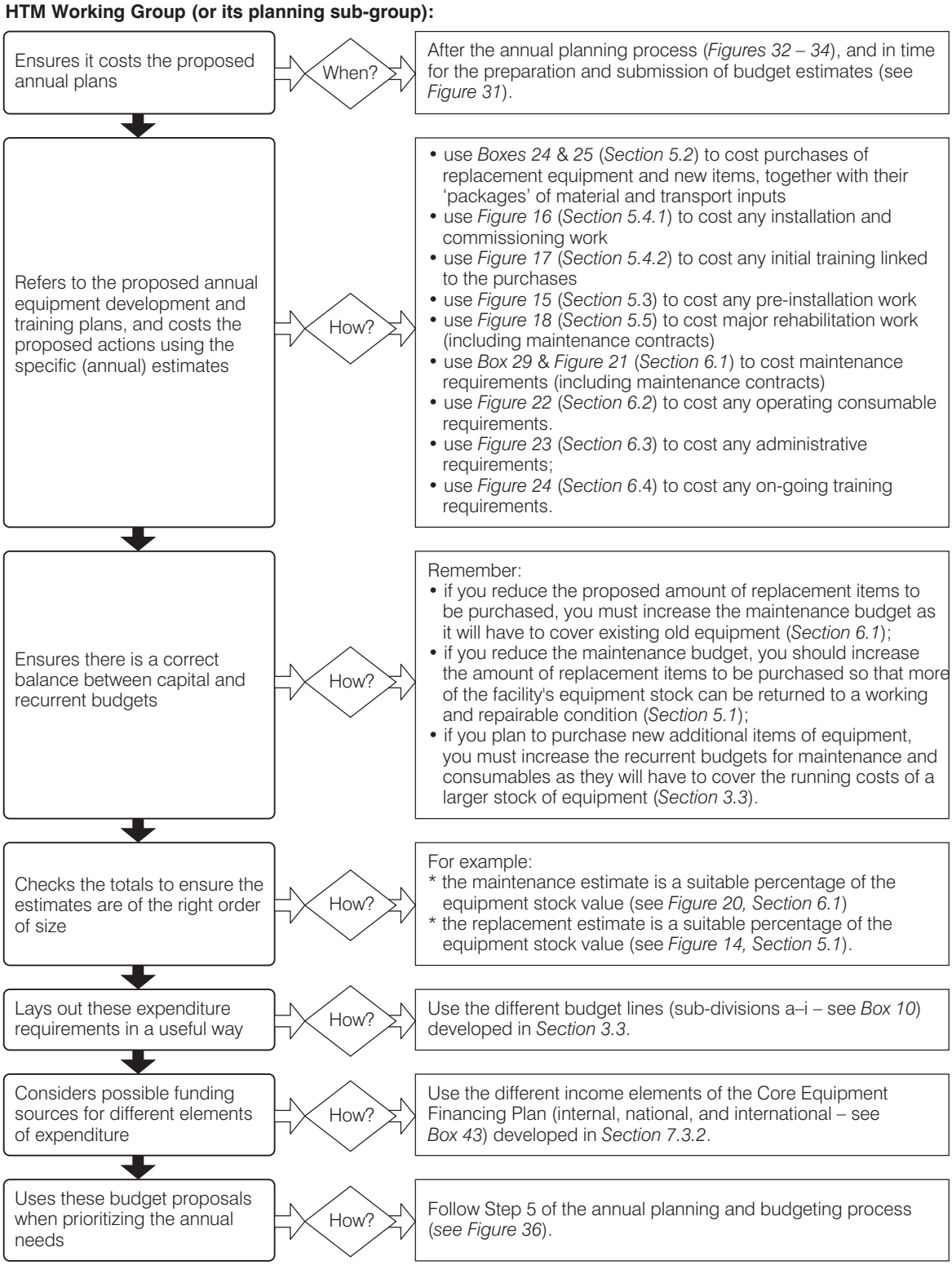
Figure 34: Reviewing the Equipment Training Plan to Determine your Annual Needs



Step 4 – Cost the annual needs using the calculations for specific (annual) estimates

Use the process shown in *Figure 35*.

Figure 35: Costing Your Annual Needs



Step 5 – Review the Core Equipment Expenditure Plan and Core Equipment Financing Plan, prioritize what you can do in the coming year, and prepare various proposed Annual Plans

Use the process shown in *Figure 36*, having considered the following issues.

It is quite common to be faced with a wide range of tasks, so you will need to prioritize between them. If money is short, you must choose to cut activities in such a way as to minimize the effect on healthcare delivery. The tasks you attempt can be chosen according to how important the equipment is for clinical operations. For example, one suggestion is to concentrate on:

plant covering:	medical equipment covering:
sterilization	operating theatres (e.g. suction pumps)
electricity supply (including the generator)	syringes
water supply	anaesthetics
laundry	basic laboratory (e.g. microscope)
refrigeration	ultrasound (maternal/obstetric)
kitchen	X-ray departments
steam for heating	labour/delivery
sewage and sanitation installations	basic diagnostics (e.g. BP machines)
cooling/air-conditioning (if climate is very hot)	

Contrary to popular belief, sophisticated and electronic medical equipment are not always the most important items to own and maintain. In terms of patient care and comfort, items such as sufficient water, power generation for operating theatres, effective sterilizers, and good beds are of greater importance than ECG or X-ray machines. *Box 45* shows a strategy used by some planners for working out which equipment should be the first priority for purchase or corrective actions.

BOX 45: The VEN (or VED) System for Prioritizing Actions

Planners in several countries use a VEN (VED) system which helps to set priorities for taking actions on equipment and deciding what to do first. Under this system, you do not simply consider the value or complexity of the equipment or task, but you consider the effect on health service delivery if the equipment is not available for use. Thus items are categorized as:

Vital – items that are crucial for providing basic health services and should be kept functioning at all times (for example, electrical generator, operating theatre light, suction pump in the theatre, mortuary refrigerator)

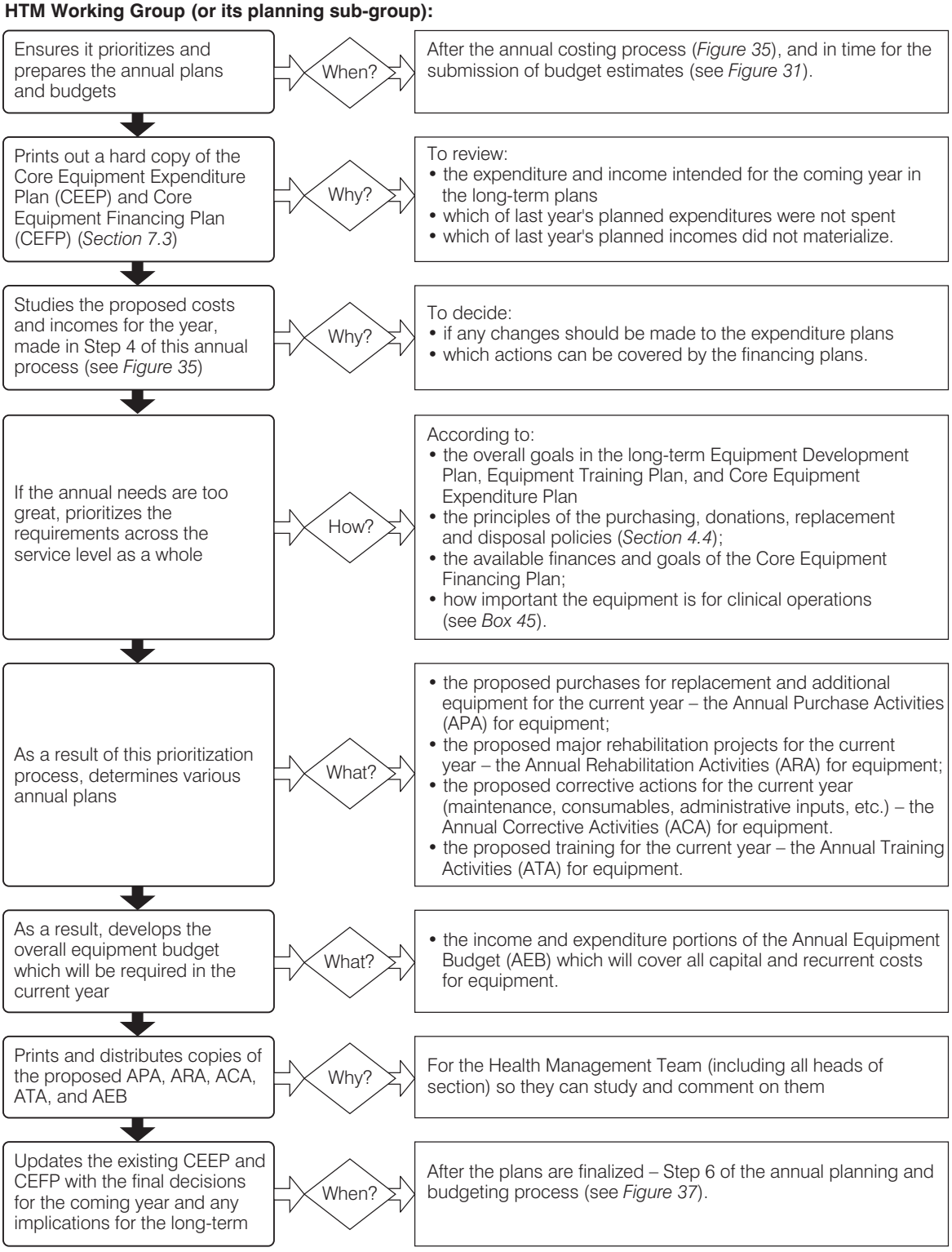
Essential – items that are important but are not absolutely crucial for providing basic health services and a period when they are out of operation can be tolerated (for example, suction pump in a ward, dental compressor, physiotherapy ultrasound)

Not so essential/ Desirable – items that are not absolutely crucial for providing basic health services. In other words, it is possible to adapt and plan around their absence if they are out of operation (for example, ECG recorder, lift, a back-up X-ray machine).

The same types of equipment can have various different classifications depending on their location. For example, a microscope may be considered 'vital' in the main laboratory but only 'not so essential/desirable' in the out-patients department (OPD).

If funds are limited, actions involving vital items should be given first priority, followed by those involving essential items, and so on.

Figure 36: Reviewing the Core Equipment Expenditure Plan and Core Equipment Financing Plan, Prioritizing the Allocation of Funds, and Preparing Proposed Annual Plans and Budgets.

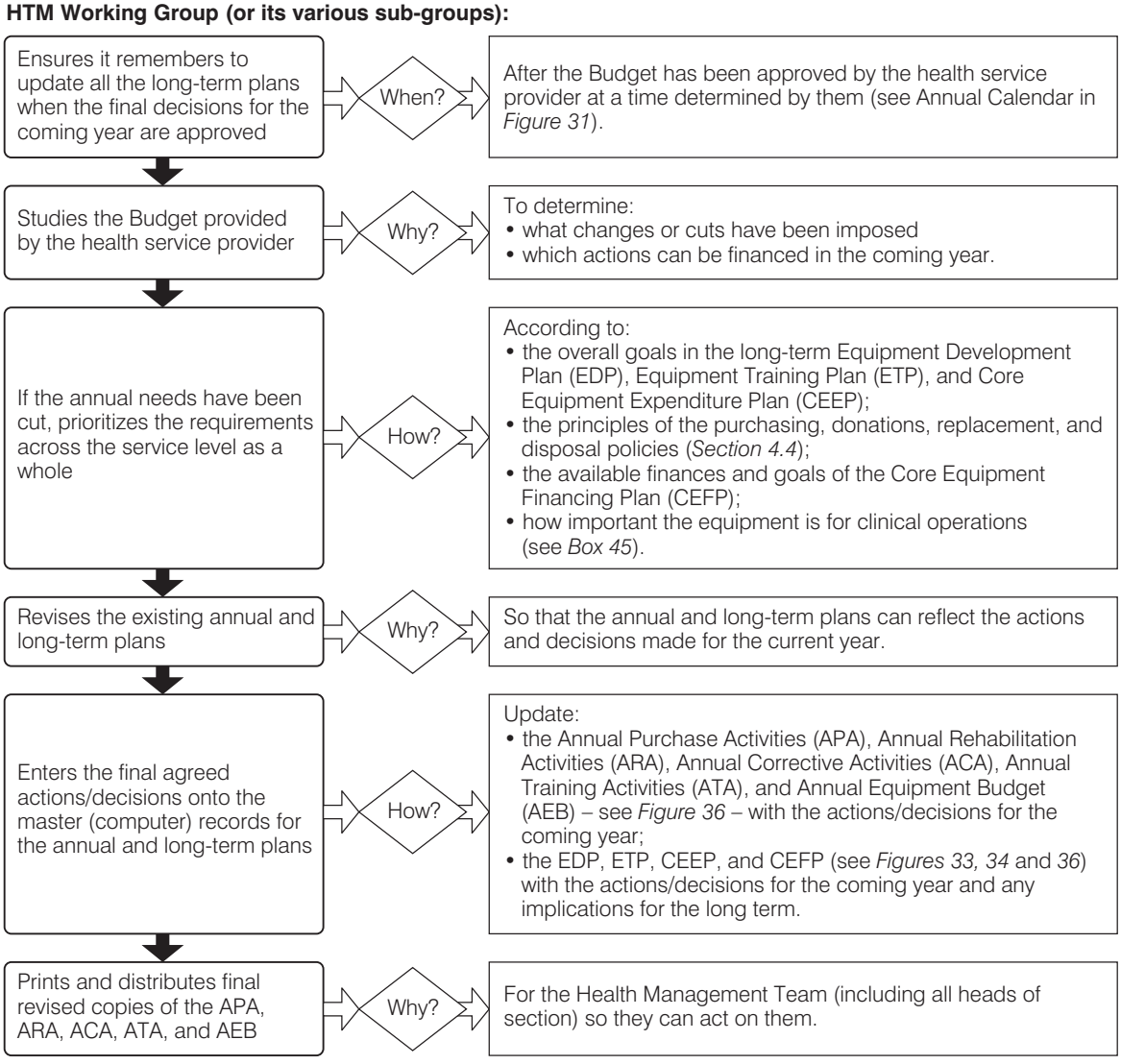


Step 6 – Finally, when your budget has been approved by the central health service provider, you update the EDP, ETP, CEEP, and CEFP with the final agreed Annual Plans and Budgets

Use the process shown in *Figure 37*, having considered the following issues.

Of course, your health service provider may not have provided you with all the funds requested. In this case, you will have to undertake another round of prioritization using the principles discussed under Step 5. We recognize that there may also be problems with the flow of money and the time it arrives at each health facility (*Section 8.2*).

Figure 37: Updating All Long-term Plans and Budgets with the Final Agreed and Financed Annual Actions



Once these plans are ready, other staff will need to implement the plans, as follows:

Finance Officer	submits the budgetary requirements in the **Annual Equipment Budget** to the central financing body of the health service provider
Central Financing Body	raises and allocates all (or part) of the funds requested
Health Management Team	on receipt of the funds: ◆ further prioritizes actions if funds are cut ◆ raises additional funds (if allowed and required to) ◆ allocates sufficient budgets to cover all the annual work plans agreed.
Purchasing and Supplies Officer	◆ buys equipment only according to the agreed **Annual Purchase Activities** ◆ liaises with the Specification Writing Group regarding the necessary Generic Equipment Specifications (*Section 4.5*), and purchase contract details (see *Guide 3*) ◆ liaises with the relevant users to raise the 'Purchase Order Requisitions' and initiates the normal process for purchasing (see *Guide 3* for more details on these procedures).

Box 46 provides an example of the annual action plan taken from the sample Equipment Development Plan (see *Box 38*) and the sample Equipment Training Plan (see *Box 41*). This assumes that the health facility concerned is large enough to have an HTM workshop of its own and shows its needs. For smaller health facilities, these requirements would be covered by the annual plan for the district/regional HTM Service.

As the example shows, the actions have had to be altered because:

i. some activities will have been left over from the previous year which need completing
ii. emergency activities may have arisen
iii. some activities can no longer be afforded.

BOX 46: Sample Annual Action Plans for Equipment (using examples for 2005 from *Boxes 38 and 41*)

Plan	**Actions** (comments on changes from the EDP and ETP)
Annual Purchase Activities (APA)	◆ replace the casualty ECG recorder ◆ replace one instrument set for the CSSD (number reduced from original EDP) ◆ replace the dental suite ◆ purchase two foetal heart detectors (number reduced from original EDP) ◆ purchase package of material inputs for these items, as necessary ◆ purchase package of support inputs for these items, as necessary ◆ undertake pre-installation work for these items, as necessary
Annual Rehabilitation Activities (ARA)	◆ overhaul the generating set ◆ overhaul half the beds (left over from 2004)
Annual Corrective Activities (ACA)	◆ service the automatic film processor ◆ introduce PPM for electrical installations ◆ continue PPM for plumbing installations ◆ source and purchase red safe-light filters ◆ purchase correct X-ray developer and fixer ◆ purchase safety clothes for the maintenance workshop staff ◆ purchase maintenance report files for user department ◆ purchase maintenance record files for the workshop
Annual Training Activities (ATA)	◆ re-train clinical officers and nurses on ECG recorder use ◆ upgrade laundry staff skills in laundry procedures ◆ re-train technicians on photometer repairs ◆ PPM training for artisans on compressors ◆ upgrade artisans' craft certificates (left over from 2004)

Box 47 provides an example of the annual equipment budget showing the expenditure and financing plans taken from the sample Core Equipment Expenditure Plan (see *Box 42*) and the sample Core Equipment Financing Plan (see *Box 43*). It continues with the examples which were shown in *Box 42* and *Box 43*. However, as can be seen, the figures are altered because:

i. when you prepare your annual budget your calculations are more realistic than the original long term estimates

ii. you must cut your planned expenditure to fit your likely income.

BOX 47: Sample Annual Equipment Budget (using examples for 2005 from *Boxes 38 and 41*)

Income [US$] (update figures with current more exact estimates)		**Expenditure [US$]** (use calculations for specific annual estimates)	
Category	**Budget** (comments on changes from example CEFP)	**Category**	**Budget** (comments on changes from example CEFP)
Own resources		**Capital**	
Accumulated retained surplus from previous year	450 (less)	Replacement	44,500 (cut)
Income from sale of equipment	600 (more)	New equipment	1,600 (cut)
Patient fees	1,600 (less)	Installation and commissioning	3,000 (estimate too high)
Income generating projects	3,100 (more)	Initial training	500
National resources		Pre-installation	2,000
Government grants	87,000 (less)	Rehabilitation	8,900 (need more)
Government loans	550 (less)	**Recurrent**	
Donations	1,200 (more)	Equipment maintenance	25,600 (need more)
Local business sponsorship	2,500 (more)	Consumables	19,500 (need less)
International resources		Administration	5,500 (need less)
External support agency grants	20,000	Ongoing training	12,200 (estimate too high)
External support agency loans	5,000		
Donations	1,300 (more)		
Total Income	123,300 (less)	**Total Expenditure**	123,300 (less)

Note:

i. If at the end of the year your expenditure is less than your income, you will have a retained surplus/profit for use in the following year (if you are allowed to keep it and do not have to return it to the central financing body such as the treasury).

ii. If towards the end of the year your expenditure looks as though it may exceed your income, you will have to cut your expenditure in order not to be in debt.

8.2 MONITORING PROGRESS

An important part of the management of equipment-related activities is the identification of problems and needs. All equipment-related activities should be monitored and evaluated, and the performance of equipment, staff, and departments should be supervised (this applies to all clinical, technical, and support departments). The results of such monitoring are useful for providing feedback to:

- staff
- Health Management Teams
- the Healthcare Technology Management Service.

This feedback is beneficial as it enables you to learn from your actions, and incorporate the lessons learned into the next round of planning and budgeting.

Each goal you set yourself must be easily measured, so that you can see if it has been achieved or if progress is being made:

- You need a way of determining if you are moving towards your goal – this is called an *indicator*. There will always be several possible indicators for each goal, and more than one way of measuring them.
- You need to know where you are starting from, in other words, what the current situation is – this is called the *baseline data*. The data chosen must be relevant to the indicator.

Box 48 provides examples of different ways of measuring a goal using indicators and baseline data. The examples use calculations that were mentioned during the analysis part of the equipment development planning process (see *Box 36* in *Section 7.1*).

BOX 48: Examples of How to Measure Goals

Goal: Let's ensure that the health service we deliver is not deteriorating

An indicator: Increase the number of equipment items on the inventory which are replaced at the end of their useful life

Calculation required:

Percentage of items on your Equipment Inventory which are within their expected lifespans

$$= \frac{\text{Number of equipment on inventory within its expected lifespan}}{\text{Total number of equipment on inventory}} \times 100 \text{ per cent}$$

Baseline data: You have 150 pieces of equipment on your inventory. In August, you identify that 40 of these items are so old they need replacing. Therefore, there are 110 items within their expected lifespan.
Therefore your baseline data is 73.3 per cent.
Your aim is to improve this situation and increase this percentage.

Goal: Let's have as much equipment as possible in a working condition

An indicator: Increase the completion of outstanding equipment repairs and renovations

Calculation required:

Percentage of your Equipment Inventory which has been returned to working order

$$= \frac{\text{Number of equipment on inventory in working order}}{\text{Total number of equipment on inventory which could be in working order}} \times 100 \text{ per cent}$$

Baseline data: You have 150 pieces of equipment on your inventory. In August, you identify that only 110 of these are within their expected lifespan and could be in working order. However, you find only 75 in working order.
Therefore your baseline data is 68 per cent.
Your aim is to improve this situation and return an additional 10 items to working order by the end of December.

Continued overleaf

BOX 48: Examples of How to Measure Goals (continued)

Goal:	Let's ensure we have enough equipment to offer basic health services
An indicator:	Decrease the shortfall of equipment
Calculation required:	
Percentage of your Model Equipment List available on your Equipment Inventory $= \frac{\text{Number of items on Model Equipment List missing from your Inventory}}{\text{Number of equipment items on Model Equipment List}} \times 100 \text{ per cent}$	
Baseline data:	Your Model Equipment List contains 200 items. You find that 50 of these are not on your Equipment Inventory. Therefore, your baseline data is 25 per cent – i.e. a quarter of the model list is missing. Your aim is to improve this situation and decrease this percentage.

It will be necessary to choose suitable indicators that are specific to all your annual goals. There are many possible indicators for planning and budgeting, so HTM staff and managers should look for the most important activities (or statistics and results) to measure. Some examples of the types of indicators which can be used for equipment planning and budgeting are those describing:

- the existing situation
  - numbers of generic equipment specifications available
  - a vision available for each service level
  - an equipment inventory established
- improved performance
  - the budget set meets the equipment needs
  - income raised meets expenditure requirements
- cost-effectiveness
  - enough equipment is available so that it is possible to manage/treat a significant number of patients satisfactorily
  - the right equipment is available to significantly reduce other expenses such as length of hospital stay, need for referrals to a more expensive higher level facility, expensive personnel or expensive drugs
  - equipment is specified which is not too dependent on foreign skills for spare parts and maintenance.

The HTM Teams, HTM Working Groups, and Health Management Teams should meet to agree on a few suitable indicators that can be measured easily and quickly (if possible). Positive indicators are preferable as they motivate staff. Sometimes it is useful to use common indicators for different teams, groups, and staff, so that their progress can be compared.

Once the indicators have been agreed, they will need regular measuring and charting. It is necessary for the relevant Health Management Team to decide:

- how records of these indicators will be kept (for example, whether in a register, with a form, or on a chart)
- who will be responsible for keeping them
- how regularly the results will be summarized (for example, every quarter)
- what form of charts and displays will be used to show the quarterly summarized results (so that it is easy for people to see how they are progressing).

Monitoring progress involves a number of different activities. In this Section, the monitoring activities described are:

- monitoring progress with the activities in the annual equipment plans and budgets which were set in *Section 8.1* (*Section 8.2.1*)
- monitoring progress in general with your planning and budgeting activities (*Section 8.2.2*).

Who is Responsible for Monitoring Progress?

Who?		Takes what action?
- Health Management Team - HTM Working Group - HTM Team	→	Are responsible for monitoring progress with equipment-related activities

Which level?		Takes what action?
Every service level	→	Needs to monitor progress

8.2.1 How to Monitor Progress Against Annual Equipment Plans and Budgets

Monitoring progress against goals is one of the best ways that staff, managers, and the health service provider can judge their work performance. Thus, it is necessary to follow up the goals set in the equipment plans and budgets (*Section 8.1*), in order to ensure that they are put into practice. If this is not done and goals sit on a shelf gathering dust, then all the time spent planning will have been wasted.

Several aspects of your plans and budgets need to be monitored, and are discussed in this section. These include:

- which parts of the plans were implemented
- which incomes and expenditures were not properly forecast
- the deviations between planned expenditure and actual expenditure
- the consequences for future plans and budgets.

Also, we cover a number of issues which arise and indicate that planning can be improved, such as:

- emergency purchases
- maintenance contingencies
- consumable contingencies.

Monitoring Implementation of Plans

Over the twelve months following planning and budgeting, the Health Management Team and its HTM Working Group should ensure that:

- the finances requested in the Annual Equipment Budget are raised and allocated
- the equipment identified in the Annual Purchase Activities are purchased and commissioned
- the major rehabilitation projects planned in the Annual Rehabilitation Activities are completed
- the corrective actions listed in the Annual Corrective Activities are taken
- the training courses planned in the Annual Training Activities are implemented.

There are usually set times when facilities review budget allocations and can purchase items. These may occur monthly, quarterly, or even annually for large capital items. Thus:

- For equipment purchases and those equipment-related consumable items which are not commonly used (in other words, 'non-stockable' items in the Stores system – *Section 3.4*), the relevant Heads of Department/HTM Managers apply for their needs according to the agreed plans by completing a 'Supplies Order Form' (see *Guides 4 and 5*).
- For equipment-related consumable items which are commonly used (in other words, 'stockable' items in the Stores system – *Section 3.4*), the Stores Controller automatically applies for the departmental/workshop needs on their behalf.
- For expenditures which require assistance from external sources (such as maintenance support or training courses), the relevant Department Head/HTM Manager obtains quotes for the work according to the agreed plans.

The Purchasing and Supplies Officer will follow the normal procurement procedures (see *Guide 3*) for:

- obtaining proforma invoices
- scheduling Tender Committee meetings
- choosing the suppliers to be used
- placing orders.

Occasionally, problems can arise if the central financing body incurs delays obtaining foreign currency or with cash flow. In such cases, your service level may not always get all the agreed elements of the budget requested, or may not receive funds on time. You may therefore be forced to revise your budget (and plans) constantly throughout the year.

Experience in a Southern Asian Country

- *The government treasury imposed a general embargo for all ministries (including Health) on new construction and the purchase of office equipment for the first six months of 2001.*
- *As their financial year runs from January to December, the tenders could not be advertized and processed until the second half of the year.*
- *Thus unfortunately, by the time the tenders could be awarded, the financial allocations for that year had already lapsed.*

Emergency Purchases

As *Section 7.1* says, all capital expenditure should be covered by the Equipment Development Plan (EDP), and the planned purchases should be procured according to the normal procedures which are covered in *Guide 3*. However, in some cases there may be emergency requirements that departments legitimately need outside the planned Annual Purchase Activities (*Section 8.1*). These often arise during the year due to circumstances that could not be foreseen.

Emergency purchases are not planned and lead to deviations between planned and actual expenditures. If there are too many deviations of this kind, it indicates that planning should be improved.

If emergency purchases are requested during the year, you need to take steps to alter your annual plans and budgets, as shown in *Box 49*.

BOX 49: Procedures for Emergency Equipment Purchase Requirements

1. Heads of Department:

- When emergency equipment needs arise outside the planned Annual Purchase Activities (*Section 8.1*), submit their requirements (details, estimated costs, and reasons) to the HTM Working Group.

2. HTM Working Group:

- Meets to:
  - review the submissions
  - discuss the implications of the proposals
  - and either approve them, reject them, or return them for further information.
- Submits approved proposals to alter the Annual Purchase Activities to the Health Management Team, who can grant approval if funds are available.

3. Heads of Department:

- If the changes are agreed, liaise with the Purchasing and Supplies Officer regarding 'Purchase Order Requisitions' and the normal process for procurement (see further details in *Guide 3*).

Maintenance Contingencies

The HTM Team will have estimated their annual maintenance needs according to *Figure 21*, as part of the Annual Corrective Activities (*Section 8.1*). In addition, they will have determined monthly estimates within the annual plans (*Section 6.1*). However, contingencies can arise over time which are difficult to plan for, such as sudden crisis breakdowns of serviceable items.

Maintenance contingencies are not planned and lead to deviations between planned and actual expenditures. If there are too many deviations of this kind, it indicates that planning should be improved.

If maintenance contingencies arise, you need to take steps to alter your annual plans and budgets, as shown in *Box 50*.

BOX 50: Procedures for Maintenance Contingencies

HTM Manager:

- When maintenance needs arise outside those planned:

  Either – submits the contingency cost for inclusion in the following month's maintenance budget (*Section 6.1*)

  Or – puts in a request for contingency funds outside of the existing maintenance budget.

Health Management Team:

- Considers proposals to alter the Annual Funding Plan and grants approval if the funds are available.
- If the changes are agreed, informs the Finance Officer and the HTM Manager.

Consumable Contingencies

The Heads of Department will have estimated their annual equipment-related consumable needs according to *Figure 22*, as part of the 'Annual Corrective Activities' (*Section 8.1*). In addition, they will determine monthly estimates within the annual plans (*Section 6.2*). However, contingencies can arise over time which were difficult to plan for, such as unexpected surges in workload, outbreaks, and epidemics.

Consumable contingencies are not planned and lead to deviations between planned and actual expenditures. If there are too many deviations of this kind, it indicates that planning should be improved.

If consumable contingencies arise, you need to take steps to alter your annual plans and budgets, as shown in *Box 51*.

BOX 51: Procedures for Consumable Contingencies

Heads of Department:

- When equipment-related consumable needs arise outside those planned:

  Either – submits the contingency cost for inclusion in the following month's departmental budget (*Section 6.2*)

  Or – requests for contingency funds outside the existing departmental budget.

Health Management Team:

- Considers proposals to alter the Annual Funding Plan and grants approval if the funds are available.
- If the changes are agreed, informs the Finance Officer and the Head of Department.

Monitoring Expenditure against Allocations

When funds are allocated, it is necessary to show how they are actually spent. This requires you to monitor actual expenditure against allocation, and is often undertaken on a monthly basis.

All Heads of Department and the HTM Manager have a role to play, together with the Finance Officer. By monitoring expenditure against allocation, it is possible to learn whether expenditures were properly forecast, thus enabling you to improve upon your planning and budgeting the next time around.

Information concerning how allocated funds are actually spent should be available **at all levels**, as feedback.

Box 52 shows you what steps to take.

BOX 52: Procedures for Monitoring Expenditure against Allocations

HTM Manager and Heads of Department:

- monitor their actual recurrent expenditure against their allocations on a monthly basis
- keep a record of how the current month's allocation is being spent, according to the formal financial reporting requirements
- follow all accounting guidelines (such as the submission of receipts to the Finance Officer on all purchases arising from allocated funds)
- make estimates for the next month's expenditure (*Sections 6.1 and 6.2*).

Finance Officer:

- compiles the data on expenditure against allocations and the next month's estimates, for all of the departments
- submits a written Financial Report to the Health Management Team for the monthly budget meeting
- provides the information on how funds allocated are actually spent as feedback to all levels.

Reaching Performance Targets

Each facility and service level should have goals and plans which set out their priority activities for all health service work (*Section 8.1*). The normal departmental annual action planning process (see *Guides 4 and 5*) will mean that goals are set for each department regarding their daily work. They will also have indicators to measure whether they reach their performance targets.

At the end of the year, it is essential to review and carefully analyze the results achieved on all the departmental goals that have been set.

Once planning and financial systems are established, it might be possible to link departmental annual planning to the process of setting their departmental budgets. The achievement of proposed targets by a department could then play an important part in justifying the budget allocations it requests from senior management.

For example, the Health Management Team can consider:

- the achievement by the HTM Team of its targets, when determining the budget allocation for maintenance
- achievement by user departments of their targets, when determining their recurrent budget allocations
- the achievement by the equipment training sub-group of their proposed training targets, when justifying the budget allocations for training.

8.2.2 How To Monitor Progress in General

Regular monitoring of activities and services is also essential for improving the quality of healthcare. Management need facts so that they can plan effectively, and need to know how equipment-related activities are performed. Thus it is important that you have some method of collecting information.

The people and groups involved in planning and budgeting need to gather information regularly on the progress of their teams, and their work performance. Such information will not only enable all those involved to manage their teams more effectively, it also provides an important source of feedback for other people and bodies who need to know how they are functioning.

Therefore health planners, finance officers, and HTM Working Groups and other bodies involved in planning need to:

- monitor their progress with establishing the planning and budgeting 'tools'
- ensure they keep active tools up-to-date
- ensure that the information generated by such tools is used to improve activities such as stock control, training and procurement
- study the implications arising from planning and budgeting.

Establishing the Planning and Budgeting Tools

Box 53 shows the steps to take to ensure that planning and budgeting work is implemented.

BOX 53: Monitoring the Establishment of Tools

Health Management Team and its HTM Working Group:

- Monitors progress with establishing the:
  - Equipment Inventory (*Section 3.1*)
  - equipment stock value estimates and a Reference Equipment Price List (*Section 3.2*)
  - budget lines for equipment expenditures (*Section 3.3*)
  - usage rates for equipment-related consumable items (*Section 3.4*)
  - reference materials (*Section 4.1*)
  - Vision (*Section 4.2*)
  - Model Equipment List (*Section 4.3*)
  - Purchasing, Donations, Replacement, and Disposal Policies (*Section 4.4*)
  - Generic Equipment Specifications, and the environmental and technical data sheet (*Section 4.5*).
- Monitors that all the budgeting tools for capital and recurrent expenditure are understood and used (*Sections 5 and 6*).

Keeping Tools Up-to-Date

The HTM Working Group (or its pricing sub-group) needs to:

- revise the Reference Equipment Price List regularly in order to ensure that an up-to-date database of current equipment prices is available (*Section 3.2*)
- revise the equipment stock values periodically (see *Figure 8*)
- annually review the usage rates and requirements for equipment-related consumable items (see *Figure 10*)
- annually update the library of reference materials and subscriptions (see *Box 12*).

Providing Feedback to Improve Procurement and Stock Control

The HTM Working Group (or its pricing sub-group) needs to use the data from the Usage Rate planning tool (*Section 3.4*) to ensure that:

- correct information regarding the requirements and usage rates for equipment-related consumable items is provided to the Stores Controller, for better calculation of reordering quantities and times
- those items which are commonly used become 'stockable' items in the Stores system
- correct information regarding problems with equipment and its related supplies are provided to the Specification Writing Group and Tender Committee (*Section 1.2*), for more appropriate selection of models during procurement (see *Guide 3*).

Providing Feedback to Improve Training

During the planning process various prompts that training is required will emerge, due to:

- the analysis of the equipment inventory, the Equipment Development Plan, and the Equipment Training Plan
- the equipment purchases planned.

Figure 26 provides examples of the types of prompts. These should be passed onto the Human Resources Department.

Implications of Planning and Budgeting

The (central level) Health Management Team needs to analyze the implications arising out of planning and budgeting. For example, they could use the data to determine:

- life-cycle costs of equipment
- costs per intervention (unit costs), and whether the interventions are economic
- the percentage of expenditure used against different equipment budget lines.

The (central level) Health Management Team needs to monitor the planning and budgeting process in order to identify any implications. For example, they could monitor:

- the correct utilization of budget lines (for example, has money previously earmarked for maintenance been moved and used for food, fuel or other commodities?)
- whether decentralized control of budgets is working (for example, do the decentralized authorities leave vital activities unfinanced?).

Box 54 contains a summary of the issues covered in this Section.

BOX 54: Summary of Procedures in Section 8 on Setting Annual Goals and Monitoring Progress

Annual Plans	**HTM Teams**	◆ update the Equipment Inventory according to *Figure 32*
	HTM Working Groups (or their various sub-groups)	◆ review the Equipment Development Plan and Equipment Training Plan for annual needs according to *Figures 33 and 34* ◆ cost the proposals for the coming year according to *Figure 35* ◆ review the Core Equipment Expenditure Plan and Core Equipment Financing Plan, prioritize the allocation of funds, and prepare proposals for: - Annual Purchase Activities - Annual Rehabilitation Activities - Annual Corrective Activities - Annual Training Activities - Annual Equipment Budget, according to *Figure 36*. ◆ update all long-term plans and budgets with the final agreed and financed annual actions, according to *Figure 37*.
	Health Management Teams	◆ raise the funds required ◆ allocate sufficient funds for the action planned
Monitor Progress	**HTM Working Groups (or their various sub-groups)**	◆ monitor progress with: - implementing the annual plans - expenditure against allocations according to *Box 52* - establishing the 'tools', according to *Box 53* ◆ react to emergencies and contingencies outside of the plans, according to *Boxes 49–51* ◆ keep the planning and budgeting tools up-to-date ◆ provide feedback to improve procurement, stock control, and training
	Health Management Team	◆ consider the achievement by departments and groups in reaching performance targets, when determining their budget allocations ◆ consider the implications of the data arising out of planning and budgeting

Tip • Remember – if you have not been able to develop all the tools and plans because you are short of management skills, *Annex 6* contains bare minimum requirements for equipment planning and budgeting for people who are just starting out.

ANNEX 1: GLOSSARY

Acceptance process:	Activities undertaken when equipment arrives at an health facility, at the end of which the equipment will be operational and officially belong to the facility, such as receipt, unpacking, installing, commissioning, initial training, entering into Stores and onto records, payment.
Accessories:	For equipment, those items which connect the machine to the patient (e.g. leads, probes), assist with the use of the machine (e.g. trays, foot-switches), or adapt its performance (e.g. adaptors, lenses).
Acquisition:	To obtain equipment through both procurement and donations.
Administrative level:	See decentralized authorities.
Allocation:	In financial terms, the funds distributed to a unit within an organization to be spent for a particular purpose.
Assets:	All resources owned by an organization, for example money, equipment, land.
Autonomous:	Self-governing or independent.
Budget:	A written financial plan listing future, known, or estimated income and expenditure covering a given period of time, such as a year (annual budget).
Capital budget:	Planned expenditure on capital items (such as buildings, equipment, vehicles) that require substantial (possibly one-off) payments in a year, and should not be included in the recurrent (or operational) budget.
Central level:	Highest authority of your health service provider, such as Ministry of Health or Board.
Commissioning:	A series of tests and adjustments performed to check whether, and ensure that, new equipment is functioning correctly and safely before being used.
Communication equipment:	Any equipment that is used for sending or receiving information, such as telephones, two-way radios, nurse-call systems, paging systems.
Consumables:	For equipment, those items which are used up during the operation of equipment (e.g. film, reagents, gel).
Contingency:	An event in the future that may happen but is not guaranteed to happen; an amount set aside in the budget for contingencies is a reserve for unexpected expenditure.
Cost centre:	A unit of an organization that generates expenses but has no responsibility for generating revenue (income); its goal is to adhere to expense budgets, which are tailored to meet certain objectives Which type of unit (health authority, facility, division, or department) acts as a cost centre depends on whether it is at a level that has the independence and responsibility to be allocated money, spend it, and account for the expenditure.
Decentralized authorities:	Local units of an organization that have had authority transferred to them from the central level of the organization. For example, district, regional, provincial or diocesan health authorities.

Decommission:	Take out of service; dismantle and make safe; board. The process of condemning or writing off equipment and disposing of it.
Depreciation:	The amount by which the monetary value of an asset is reduced over a period of time due to its everyday use ('wear and tear') or due to the fact that it could not be sold second hand for as much as it originally cost; the asset is said to depreciate in value.
Donor:	See external support agency.
Energy sources:	A source of energy or power, such as generating sets, solar panels or transformers.
Equipment-related supplies:	Items which are essential for equipment use, such as consumables, accessories, spare parts, and maintenance materials used with equipment.
Equipment users:	All staff involved in use of equipment, such as clinical staff (e.g. doctors and nurses), paramedical staff (such as radiographers and physiotherapists) and support services' staff (such as laundry and kitchen workers).
Essential service package:	Definitions developed by health service providers of the basic service packages to be offered at each level of healthcare delivery, in terms of healthcare interventions. From these interventions, human resource, space, and equipment requirements can be determined.
Expenditure:	The amount of money spent (or due to be spent) by a unit within an organization; payments made out of a financial allocation provided for a particular purpose; money spent from your income.
External support agency:	A body responsible for providing money, equipment, or technical support to developing countries on various terms, such as international donors, technical agencies of foreign governments, non-governmental organizations, private institutions, financial institutions, faith organizations.
External support agency staff:	People working for external support agencies that health workers come into contact with, such as a country representative, desk officer, consultant, coordinating agency, director.
Fabric of the building:	Items which are part of the integral structure or framework of a building, such as doors, windows or roof.
Facility:	See health facility.
Financial year:	Period over which a set of accounts operate; the date up to which the annual accounts of an organization are prepared (not necessarily the calendar year).
Fire fighting equipment:	Equipment used to put out fires, such as fire blankets, buckets, extinguishers, hose and sprinkler systems.
Fixtures built into the building:	Items which are not part of the integral structure of a building but are installed into the fabric of the building, such as ceiling-mounted operating theatre lights, scrub-up sinks and fume cupboards.
Head of section:	Departmental manager, such as head of department, group leader, officer in-charge, senior operator.

Health facility:	Buildings where healthcare is delivered, ranging from small units (clinics, health centres), and small hospitals (rural, district, diocesan), to large hospitals (regional, referral).
Health facility furniture:	Furniture with a specific clinical use in health facilities, such as beds, cots, trolleys, infusion stands.
Health management team:	Health management body, such as facility management committee, district/regional/diocesan/central health management team, Board.
Health service provider:	A provider of health services, such as Ministry of Health or Defence, non-governmental organization, private institution, employer organization or corporation (for example, mine), faith organization.
Health system:	Comprises all organizations, institutions, and resources devoted to health actions (defined as any effort, in personal or public health services or through intersectoral action), whose primary purpose is to improve people's health (Source: WHO).
HTM Manager:	Head of the HTM Team; ranging from a general member of health staff with some management skills in the smallest HTM Teams, to an engineering manager in the highest level of HTM Team.
HTMS:	Healthcare Technology Management Service made up of a network of HTM Teams and HTM Working Groups.
HTM Team:	A body responsible for the management of equipment, such as, equipment management team, maintenance management team, physical assets management team; part of the HTM Service.
HTM Working Group:	A working group, or standing committee responsible for making decisions on healthcare technology management issues; part of the HTM Service.
Income:	Money received, usually generating from work done or investments made; revenue.
In-house:	Activities undertaken by staff already employed by the health service provider organization (rather than using temporary hired labour or external contractors).
Installation:	The process of fixing equipment into place; can range from building equipment into the fabric of a room, to simply plugging it into an electrical socket.
Inventory:	A systematic listing of stock (or assets) held. An *annual inventory* is prepared at the end of each year following a physical inspection and count of all items owned by an organization. The list gives details, such as location, reference number, description, condition, cost, and the date the inventory was taken.
Laundry and kitchen equipment:	Equipment required for kitchen or laundry activities, such as cookers, cold rooms, washing machines, hydro-extractors, roller-ironers.
Life-cycle costs:	The recurrent cost required to keep equipment going throughout its life (e.g. fuel, consumables, maintenance, training, disposal).
Lifetime:	Lifespan, life expectancy. For equipment, the likely length of time that an item will work effectively, dependent on the type of technology and parts used in its manufacture.

Maintainers:	See maintenance staff.
Maintenance materials:	Those items used up during the maintenance of equipment, and generally available from many sources (e.g. washers, oil, fuses, paint).
Maintenance staff:	Staff responsible for maintenance of equipment, such as craftspeople, artisans, technicians, technologists, engineers.
Manager:	Any staff involved in the management of equipment-related activities. This could include administrator, nurse-in-charge, medical superintendent, chief executive, director, health secretary, medical practitioner, maintenance manager, policy-maker.
Medical equipment:	Equipment used for medical purposes, including X-ray units, diathermy units, suction pumps, foetal doppler, scales, autoclaves, infant incubators, centrifuges.
Model Equipment List:	A list of the essential equipment for a health service level/facility type (rural, district, regional, referral), determined by considering each necessary healthcare intervention (function, activity, or procedure) for example, equipment required for eye-testing, delivering twins, undertaking fluoroscopic examinations, testing blood for malaria.
Office equipment:	Equipment used in an office, such as computers, photocopiers, calculators, record systems.
Office furniture:	Furniture used in an office, such as desks, chairs or filing cabinets.
Plant, general:	Machinery such as boilers, lifts, air-conditioners, water pumps or compressors.
Pre-installation work:	Activities required in preparation for the arrival and commissioning of equipment, such as preparing the site at the health facility so the equipment can be installed, hiring lifting equipment, organizing or hiring warehousing space.
Profit centre:	A unit of an organization that generates both revenue and expenses; its goal is to have revenue exceed expenses.
Quality control:	A system of maintaining standards; testing a sample against specifications.
Recurrent budget:	Planned expenditure on recurrent items for ongoing monthly needs, such as drugs, materials, spare parts, food, fuel, which should not be included in the capital budget.
Rehabilitate:	Restore to a former state; renovate; undertake major repair work to return an item to a working condition.
Service supply installations:	Supply installations such as electrical installations, water and sewage pipelines, gas supplies.
Spare parts:	For equipment, those items which make up the machine, need replacing as they wear out, and may be specific to a particular model (e.g. bearings, bulbs, printed circuit boards).
Specifications:	A detailed description of the design and materials used to make something; a standard of workmanship, materials, etc. required to be met in a piece of work. *Generic specifications* refer to a class or type of thing and do not specifically mention a brand name.

Standard:	A required or agreed level of quality attainment set by a recognized authority, used as a measure, norm, or model for all aspects of health services and healthcare technology.
Standardization:	Rationalization, normalization, and harmonization. In other words, reducing the range of makes and models of equipment available in stock, by purchasing particular or named makes and models.
Stock:	In stores, this is the goods held by an organization for its own use. The 'equipment stock' is all the equipment assets owned by an organization.
Supplier:	Someone who provides equipment, such as a manufacturer, manufacturer's representative, wholesaler, salesman.
Support staff:	Additional types of staff in the health service besides medical personnel, such as planner, finance officer, procurement officer, stores controller, human resource officer.
Training equipment:	Equipment required when running training courses, such as overhead and slide projectors, video and tape recorders.
Users:	See equipment users.
Vehicles:	Any conveyance used for transporting people, goods, or supplies in the health service, such as ambulances, cold-chain motorbikes, mobile workshops, lorries, buses.
Walking aids:	Items used to aid mobility, such as wheelchairs, zimmer frames, crutches.
Waste treatment plant:	Any plant used to treat waste, including incinerators, septic tanks or biogas units.
Working group	A group of people set up to be responsible for a particular subject area, such as a standing committee, select committee, sub-committee.
Workshop equipment:	Equipment used in a workshop, such as hand tools, bench tools or test instruments.
Your organization:	See health service provider.

BOX 54: WHO's Definition of the Technology Management Hierarchy

Equipment support:	undertaking maintenance and repair.
Equipment management:	using the equipment database (inventory and maintenance history) to help you make decisions for improving equipment support.
Asset management:	including cost and utilization information (life-cycle cost analysis) in the equipment database to help you make decisions on replacement and acquisition.
Technology assessment:	reviewing past, current, and future technologies to determine their efficacy and effectiveness, and to help you make decisions for capital planning and acquisition.
Technology management:	using: equipment equipment support equipment management asset management technology assessment to manage technology in health care from conception to retirement.

Source: Department of Health Service Provision, World Health Organization, 2000

ANNEX 2: REFERENCE MATERIAL AND CONTACTS

This Annex is in two parts, and provides information about:

Part i. Books, guidelines, databases, and websites

Part ii. Organizations, sources of publications in part i, resource and information centres.

i. Books, Guidelines, Databases, and Websites

The following books, guidelines, databases, and websites are listed in subject categories according to the topics found in Sections of this Guide. For each publication, a brief description of the content and the main source(s) are included. Contact details for the source organizations are included in *Part ii*. Readers should note that many of the publications are available at low cost. In some countries it may also be possible to obtain these publications from local bookstores, as publishers and distributors increase efforts to ensure wider availability. Published prices may be flexible depending on the order size, discounts available and distribution method.

Tip

- Many books and documents cover a variety of topics that appear in several Sections of this Guide. The first time they appear in this list they are described in full. For each subsequent entry only the basic details are provided.

Healthcare Technology Management Framework Issues

This material covers issues in *Sections 1 and 2*, such as healthcare technology management definitions, policy, regulations, guidance, and services, and in *Section 4.4* on developing purchasing, donations, replacement, and disposal policies. It is listed alphabetically by title.

Developing healthcare technology policy

Examples of Policies

A number of health service providers have already developed their own healthcare technology policies, as well as implementation guidelines to go with them. For example, more information can be obtained from:

- Dr P Asman, Biomedical Engineering Unit, Ministry of Health (Room 33, MOH Building), PO Box M-44, Accra, Ghana. Email: nchtm@africaonline.com.gh
- Ministry of Health, PO Box 7272, Kampala, Uganda. Email: info@health.go.ug, website: www.health.go.ug/support_system.htm
- Dr N Forster, Under Secretary: Health and Social Welfare Policy, Ministry of Health and Social Services, Private Bag 13198, Windhoek, Namibia. Email: nforster@mhss.gov.na
- Director of Health, Lusaka Urban District Health Board, PO Box 50827, Makishi Road, Lusaka, Zambia. Email: msinkala@lycos.com
- Department of Hospital Services, Ministry of Health, 151-153 Kampuchea Krom Boulevard, Phnom Penh, Kingdom of Cambodia. Email: procure.pcu@bigpond.com.kh, website: www.moh.gov.kh

Health care technology management No.1: Health care technology policy framework
Kwankam Y, Heimann P, El-Nageh M, and M Belhocine (2001). WHO Regional Publications, Eastern Mediterranean Series 24. ISBN: 92 9021 280 2
This booklet is the first in a series of four titles. It introduces the ideas of and behind health care technology management, defines terms relating to and sets objectives for health care technology management policy. It examines what should go in to such a policy, and the national policy framework and organization. Capacity-building and human resources issues are considered, as well as economic and financial implications. Attention is also given to legislation, safety issues, cooperation nationally and between countries, implementation, monitoring, and evaluation. See *Guide 1* for information on the three further titles in this Series:
No.2: Eastern mediterranean regional strategy for appropriate health care technology
No.3: Health care technology policy formulation and implementation
No.4: Country situation analysis.
Available from: WHO

Interregional meeting on the maintenance and repair of health care equipment: Nicosia, Cyprus, 24-28 November 1986
WHO (1987). WHO document WHO/SHS/NHP/87.5
This document provides a comprehensive discussion of the problem of non-functioning equipment and of proposed solutions. The major policies, recommendations, and strategies proposed by the conference on the issue of maintenance and repair of health care equipment are presented. It includes four Working Papers which cover in detail: maintenance and management of equipment, the proposed health care technical service, manpower development, and training.
Available from: WHO

Management of equipment
DHSS, UK (1982). Health Equipment Information No. 98
The aim of this booklet is to recommend a system of equipment management that, if fully implemented, would ensure that all equipment used in the British National Health Service was suitable for its purpose, was maintained in a safe and reliable condition, and was understood by its users. Its recommendations and procedures are structured into sections on equipment selection, acceptance procedures, training, servicing (maintenance, repair, and modification), and replacement policy. It also covers the management of inventories, equipment on loan, servicing, long-term commercial contracts, infection hazards.
Available from: Her Majesty's Stationery Office (HMSO).

Medical equipment in sub-saharan Africa: A framework for policy formulation
Bloom, G and C Temple-Bird. (1988). IDS Research Report Rr19, and WHO publication WHO/SHS/NHP/90.7. ISBN: 0 903354 79 9
This book provides a good overview of the situation of medical equipment in Africa. Its approach to the analysis is to unpackage medical equipment technology into its component activities, such as planning, allocating resources, procurement, commissioning, operation, maintenance, training, etc. It provides good general policy formulation strategies to address the problems discussed.
Available from: WHO

Practical steps for developing health care technology policy: A manual for policy-makers and health service managers in developing countries
Temple-Bird, C (2000). Institute of Development Studies, University of Sussex, UK. ISBN: 1 85864 291 4
This book is a practical step-by-step guide for developing health care technology policy. It can be used by health service providers, regional and district health authorities, health facility managers, and external support agencies. It describes a process for developing health care technology policy which is collaborative, participatory, iterative, and involves community stakeholders. Guidance is provided on underlying management concepts, undertaking a situation analysis, running a ideas workshop, formulating policy, developing an implementation plan and procedures manual, as well as the resources required to complete these tasks.
Available from: Ziken International Consultants Ltd

Strategic medical technology planning and policy development
Raab M (1999). Swiss Centre for International Health. August 1999.
This paper discusses the challenge of the fast expansion in technologies, and the choices that have to be made to manage them. It looks at healthcare technology assessment, the elements and formulation of a healthcare technology policy, and the strategic planning process required.
Available from: SCIH

See *Guide 4* for resources that discuss policies for disposing of healthcare waste and the development of a waste management plan.

Regulating relationships with external support agencies that provide equipment

Guidelines for health care equipment donations
WHO (1997). WHO document WHO/ARA/97.3
This document presents guidelines that aim to improve the quality of equipment donations, not to hinder them. They are not an international regulation, but intended to serve as a basis for national or institutional guidelines, to be reviewed, adapted and implemented by governments and organizations dealing with health care equipment donations. They provide detailed guidance and checklists for both the potential donor and recipient. The guidelines are based on extensive field experience and consultations with many experts internationally. They also merge together several earlier documents, including the one listed below.
Available from: WHO

Guidelines on medical equipment donations
Churches' Action for Health (1994). World Council of Churches' publication
This paper is a guide for those accepting and making donations, and is also useful for those planning to buy equipment. It clearly lays out in point form the responsibilities of the recipient and the responsibilities of the donor.
Available from: WCC

Understanding healthcare technology management

International seminar for hospital technicians/engineers: February 1998, Moshi, Tanzania
Clauss J (ed) (1998). FAKT
This document reports the results of intensive work by 38 national and international experts brought together from faith, public, and private agencies to strengthen equipment management measures in the health sector. It includes papers, with country examples, on healthcare technology management, using cost-sharing to finance maintenance, networking, structures of health care technical services, cash control for workshops, training, communication technologies, modification of medical and hospital equipment, energy supply and photovoltaics. There are also lists of standardized equipment for the Evangelical Lutheran Church of Tanzania and the Joint Medical Stores of Uganda, and a description of how they were developed.
Available from: FAKT

International workshop on healthcare technology management: 2-6 October 2000, Catholic Pastoral Centre, Bamenda, Cameroon
Clauss, J (compiler) (2000). FAKT
This document reports the results of intensive work by 35 national and international experts involved in setting up and operating systems for the sustainable management of healthcare technology. It includes papers, with country examples, on healthcare technology management, the role of stakeholders, public/private partnerships for providing HTM, financial management of maintenance organizations, and donations of healthcare technology.
Available from: FAKT

Medical equipment in Botswana: A framework for management development
Temple-Bird C L, Mhiti R, and G H Bloom (1995), WHO publication WHO/SHS/NHP/95.1
This book reports on the results of a study of the healthcare technology sector in Botswana, and the lessons learnt are of relevance to many other countries. The study was undertaken by unpackaging the sector into its component activities, such as planning, allocating resources, procurement, commissioning, operation, maintenance, training, etc. In this way the book provides good general healthcare technology management strategies to address the problems discussed. This book also describes how technical staff obtain their basic technical qualifications either as artisans at local Trade Testing Centres, or as technicians at the local Polytechnic, and provides an understanding of how such systems and qualifications work.
Available from: WHO

Medical technology management
David Y, and T Judd. (1993) BioPhysical Measurement Series, SpaceLabs Medical Inc.
ISBN: 0 9627449 6 4
This book looks at the appropriate management tools needed to make technology's role more clinically effective and cost–effective (based on the healthcare delivery system in the USA). It focuses on strategic technology planning principles, and how they contribute to improved patient outcomes. It also looks at a process for technology assessment and life-cycle cost analysis. It defines many common terms, and the role of useful committees, procedures, and forms.
Available from: SpaceLabs Medical Inc.

Physical assets management and maintenance in district health management
Halbwachs H (2000). GTZ document
This paper provides practical guidance to health workers involved in district health systems concerning health technology - one of the critical areas in managing health service delivery at district level. It presents the physical assets management approach, and elaborates on key strategies for maintenance, financing, quality control, monitoring indicators, cost-benefit analysis calculations, and a basic paper-based maintenance information system.
Available from: GTZ

The effective management of medical equipment in developing countries: A series of five papers
Remmelzwaal B (1997). FAKT, Project Number 390
This document is aimed at the health workers, administrators, maintainers, and overseas aid workers who are involved in medical equipment management in developing countries. It examines the variation in performance with management of medical equipment in different countries, with the objective of identifying successful approaches. It addresses some of the managerial issues related to the conservation of equipment; allocation of human, financial and material resources; and acquisition and use. It looks at the structure for the HTM Service, and the HTM cycle. It includes an example spreadsheet layout to use as an inventory form, with various data collection codes.
Available from: FAKT

See *Guide 1* for more information on further relevant issues, such as health service definitions, the place of HTM in health systems, regulations, and standards.

Equipment Inventories and Price Information

This material covers issues in *Section 3.1* on establishing and keeping an equipment inventory, and an inventory code numbering system, and equipment price data needed for the stock value estimates in *Section 3.2* and the cost calculations in *Sections 5 and 6*. It is listed alphabetically by title.

Note on inventory software: Keeping an equipment inventory is an area where simple computer software programs can be of assistance once you have mastered a manual paper system, have a large enough stock (several hundred items of major equipment), and can obtain sufficient training of staff. For example:

- at a district hospital, any common computer database software could be used such as a commercially available product like Access (part of Microsoft Office) or a shareware program available on the internet free or at competitive rates
- for larger stocks of equipment (for example at a teaching hospital, or a centralized inventory), where analysis of the data is required with the possibility of sorting the data according to several selection criteria in parallel, more sophisticated software programs can be used, such as the ECRI and PLAMAHS products listed below
- more information on deciding when and how to computerize your records, see the GTZ book by Halbwachs and Miethe listed below.

Clinical engineering service departments: Establishment, scope of work and organization
Raab M (1999). Swiss Centre for International Health, Basle, Switzerland
This paper discusses the issues that prompted the evolution of clinical equipment support services, the resources and staff required when establishing clinical engineering service departments, and their scope of work, including details of necessary documentation and reporting using inventories and other recorded data.
Available from: SCIH

Computerizing maintenance for health care facilities in developing countries
Halbwachs H, and B Miethe (1994). GTZ, Eschborn, Germany
This book describes the documentation and analysis required if healthcare technology management is to be undertaken effectively (such as inventory management, planned preventive maintenance timetabling, costs analysis). It illustrates that for large stocks of equipment such work is made easier with the aid of computers. The book goes on to describe when and how to computerize equipment and maintenance records, including details of hardware and software requirements and products available. It includes details of the sort of data to be collected for effective healthcare technology management.
Available from: GTZ

District laboratory practice in tropical countries (part 1)
Cheesbrough M (1998). Tropical Health Technology. ISBN:0 9507434 4 5
A valuable resource aimed at those responsible for the organization and management of district laboratory services but can also be adapted for use by health centres. It covers selection and procurement of laboratory equipment and supplies, including lists of requirements with brief specifications and indicative (1997) prices. It covers parasitological tests, clinical tests and training of personnel, as well as all types of safety issues for laboratories.
Available from: TALC, THT

District laboratory practice in tropical countries (part 2)
Cheesbrough M (2000) Tropical Health Technology. ISBN:0 9507434 5 3
Covers microbiological, haematological and blood transfusion techniques required at district level.
Available from: TALC, THT

Emergency Care Research Institute (ECRI, USA) products
This organization produces a variety of products on healthcare technology. They are available as hard copy and as software regularly renewed by subscription, with special rates for developing countries. The data is comprehensive and primarily written for the US audience, and the software is sophisticated. The products cover various issues, such as:

- **HECS 4 for Windows** (includes inventory management software)
- **Health devices source book** (a directory of manufacturers and distributors for the US market, their contact details, products, and typical price ranges)
- **Healthcare product comparison system** (a reference guide for selecting equipment)
- **ECRI spec** (a database of specifications, instructions to bidders, and terms and conditions, etc)
- **Inspection and preventive maintenance system**
- **Health devices alerts database**
- **Health technology trends newsletter**

Available from: ECRI

Healthcare equipment management
Halbwachs H. (1994). pp 14-20 in *Health Estate Journal*, December 1994, Portsmouth UK
This paper first discusses elements of an equipment management system including selection, inventories, user training, and maintenance services, as well as issues concerning energy, waste, and hygiene. It discusses establishing an HTM system including the organizational structure, personnel requirements, and costs. It also covers typical maintenance running costs for various categories of equipment, discusses budget implications of the backlog of repairs, and the financial balance between preventive and repair activities.
Available from: GTZ

Hospital engineering in developing countries
Dammann V, and H Pfeiff (eds) (1986). GTZ, Eschborn, Germany. ISBN: 3 88085 293 6
This is a report of a symposium held in 1983 in Giessen. It covers the constraints in developing countries, and requirements for establishing healthcare technical services. This includes discussions on tasks, establishing an inventory, data collection, and training of maintenance and user staff.
Available from: GTZ

Management of equipment
DHSS, UK (1982). Health Equipment Information No. 98

Medical supplies and equipment for primary health care: A practical resource for procurement and management.
Kaur M, and S Hall (2001). ECHO International Health Services Ltd. ISBN: 0 9541799 0 0
This book is intended for health workers and those responsible for the procurement and management of medical supplies and equipment at primary healthcare level. It covers guiding principles for selecting supplies and equipment, provides guidelines for ordering and procurement, storage and stock control (with brief guidance on keeping an inventory), care and maintenance, and considers decontamination and safe disposal of medical waste. The manual also discusses the use of standard lists as a tool for encouraging good procurement practice and includes model lists and specifications for medical supplies and equipment required for primary health care activities in both health facilities in the community, and basic laboratory facilities.
Available from: TALC

Physical asset planning and management software (PLAMAHS)
HEART Consultancy
This software package holds information, and supports analysis, on: the equipment inventory, equipment models and standards, existing and planned facilities, procurement support, and maintenance support. The software holds various digital images, model equipment lists, specifications, price and other financial data, and templates for forms, etc., and has a security system. It has been designed especially with developing countries in mind and is available at special rates for developing countries. It is being used in a number of countries, and HEART can assist with the set up and initial training requirements.
Available from: HEART Consultancy

Practical laboratory manual for health centres in East Africa,
Carter J and Olema O (1998). AMREF.
Practical laboratory manual providing information necessary to establish, select and use laboratory tests for patient management. Also includes material on implementation of safe working practices, reporting and recording test results, keeping an inventory of supplies and equipment, ordering supplies and maintaining equipment.
Available from: AMREF

Spare parts and working materials for the maintenance and repair of health care equipment: Report of workshop held in Lübeck, August 1991
Halbwachs H, and C Temple-Bird (eds) (1991). GTZ, Eschborn, Germany
This book, mainly aimed at maintenance technicians, covers the maintenance requirements for common items used at district level (anaesthesia equipment, infant incubators, X-ray equipment, suction pumps, autoclaves and laundry equipment) including some advice on safety testing and test instruments. It also includes information on workshops, stock control of parts, and an equipment inventory code numbering system.
Available from: GTZ

The effective management of medical equipment in developing countries: A series of five papers
Remmelzwaal B (1997). FAKT, Project Number 390

Health Trends and a Vision for the Future

This material covers issues in *Section 1.2* on trends in planning and expenditure for health and healthcare technology, *Section 2.2* on issues affecting service delivery in the future, and *Section 4.2* on developing a vision of service delivery. The material also covers areas that may be new to some health service providers, such as healthcare technology assessment, telemedicine, and energy management. (For more information, refer to the section below on equipment needs). It is listed alphabetically by title.

Addressing the future of healthcare technology management
Halbwachs H (2001). GTZ, Eschborn, Germany
This paper reminds healthcare technology management practitioners how HTM evolved, and warns that it will not be successful unless it is integrated into the way health services are managed and delivered on a daily basis. It lists the requirements for measuring and improving performance, and undertaking a quality management approach. It suggests actions for all the different players involved (countries, international organizations, donors).
Available from: GTZ

Better health in Africa: Experience and lessons learned
World Bank (1994). Development in Practice Series, World Bank, Washington, USA,
ISBN: 0 8213 2817 4
This book is aimed at policy-makers and sets forth a vision of health improvement that challenges African countries and their external partners to rethink current health strategies. The report stresses positive experiences in Sub-Saharan Africa and concludes that far greater progress in improving health is possible than has been achieved in the past – even within existing resource constraints. It proposes that a basic set of health services can be provided in low-income Africa at an annual cost of around US$ 13 per person, presents the key reforms for achieving this, and illustrates the costs and benefits involved.
Available from: World Bank, major internet bookshops

Cost-effective aid for developing economies
Halbwachs H (1999). GTZ, Eschborn, Germany
This paper explains that as funds for aid are dwindling, there needs to be a more effective utilization of resources. It presents strategies and criteria which would help aid used to supply equipment to be more cost effective.
Available from: GTZ

Developing health technology assessment in Latin America and the Caribbean
PAHO (1998). PAHO. ISBN: 92 75 073777
This publication is aimed at policy-makers and health care professionals. The first part provides an introduction to health technology assessment: why it is important, who does the evaluations, when and how the evaluations are done. The second part looks at health technology in Latin America and the Caribbean, and PAHO's recommendations for promoting health technology assessment.
Available from: PAHO

District health care: Challenges for planning, organization and evaluation in developing countries (2nd edition)
Amonoo-Larston R, Ebrahim G, Lovel H, and J Rankeen (1996). MacMillan. ISBN: 0 333 57349 8
This book contains practical support and advice intended for those in the planning, management and evaluation of health services at district level. It covers a wide range of topics based on country experience, including: district health needs, plans, organization and management; staff motivation, teamwork, developing management skills, managing change, managing conflicts, and staff development; managing finances; as well as monitoring and evaluation.
Available from: TALC

Draft final report of the informal consultation on physical infrastructure, technology and sustainable health systems
WHO Health Systems Department (1998). WHO, Geneva, Switzerland
This paper looks at the issues surrounding physical infrastructure in health – it does not pretend to provide the answers but prompts discussion. Using accumulated experience from different countries, the paper defines the role of physical infrastructure in the development of sustainable health systems, discusses the opportunities and challenges facing health systems in developing countries due to the rapid developments in technology, identifies the constraints to progress with effective healthcare technology management at national and international level, and identifies the current gaps in knowledge which need to be filled.
Available from: WHO

Health and disease in developing countries
Lankinen, K et al (eds) (1994). MacMillan Press. ISBN: 0 333 58900 9
This comprehensive book covers health and disease from the wider perspective of development in general. It is of particular interest to medical and other professionals working in developing countries or for international cooperation agencies. It is a valuable resource for district medical officers, and students taking courses in public health and tropical medicine. Besides sections on: society, economy and health; infectious diseases; and challenges for health care, there is a section on health services to meet the challenges. This section contains chapters relating to equipment and/or management such as health systems management and financing, immunization services, essential laboratory services, blood transfusion services, and medical equipment management.
Available from: major internet bookshops

Health in the commonwealth: Challenges and solutions 1998/1999
Commonwealth Secretariat (1999). Kensington Publications Ltd, London
This digest of articles covers a wide range of health issues, such as: resources and planning; equity of access; medical technology and equipment; health promotion; mother and child health; community health; communicable and non-communicable diseases, etc. The content is aimed at policy-makers and planners. There is a range of technology articles on equipment management, telemedicine, radiology, cardiac care, hospital design, sanitation, vector control, water and air supplies.
Available from: Commonwealth Secretariat

Healthcare technology management and health sector reform
Halbwachs H (2001). GTZ, Eschborn, Germany
This paper presents data and arguments for the need for healthcare technology management to be a part of health sector reform. It explains how HTM can contribute to health sector reform, and what needs to be done by the different players involved (countries, international organizations, donors).
Available from: GTZ

Health technology assessment: Methodologies for developing countries
PAHO (1989). PAHO. ISBN: 92 75 12023 4
This publication reviews the main concepts and methodologies involved in assessing the effectiveness, safety, cost, and social impact of health technologies, and discusses the potential contributions of such assessments to improving health care delivery in developing countries. It discusses how the methodologies must be adapted for developing countries, using results from actual examples.
Available from: PAHO

Information technology in the health sector of Latin America and the Caribbean: Challenges and opportunities for the international technical cooperation
PAHO (2001). Essential Drugs and Technology Program, Division of Health Systems and Services Development, PAHO. ISBN: 92 75 12381 0.
This publication is aimed at policy-makers and reviews the challenges and opportunities for technical cooperation in the area of information technology (IT) globally, with a status report from Latin America and the Caribbean. The diffusion and impact of information technology in healthcare services and organizations is reviewed. The publication also aims to start the process of defining measurement indicators for the infrastructure, process, and impact of IT in the health sector.
Available from: PAHO, WHO

Medical technology management
David Y, and T Judd. (1993) BioPhysical Measurement Series, SpaceLabs Medical Inc.
ISBN: 0 9627449 6 4

Myths and realities about the decentralization of health systems
Kolehmainen-Aitken, R-L. (ed) (1999). Management Sciences for Health, Boston, USA, ISBN: 0 913723 52 5
This book is aimed at managers and policy-makers, and provides a comprehensive look at the impact of decentralization on health systems around he world. Decentralization can profoundly influence both the content and quality of health services and the technical support areas necessary to deliver the services equitably and efficiently, but there is little information on the challenges of introducing new policies and services in a decentralized environment. So, this book presents lessons learned to provide an understanding of the positive and negative consequences of decentralization, and offers advice on anticipating and dealing with these issues based on experiences in numerous countries.
Available from: Management Sciences for Health

Strategic medical technology planning and policy development
Raab M (1999). Swiss Centre for International Health. August 1999.

Successful energy management of health facilities
Riha J (1994). In Halbwachs H, and R Schmitt (eds) *La maintenance dans les systemes de santé/ Maintenance for health systems: 4th GTZ Workshop, Dakar, Senegal, September 1993*. GTZ
This paper covers the principles of energy management and its importance for health facilities. It discusses energy costs, strategies, and obstacles to overcome by the health team.
Available from: GTZ

Technology assessment in healthcare
Raab M (2000). Swiss Centre for International Health
This paper discusses and calls for the need to undertake health care technology assessment in developing countries, in order to make the best use of new technologies. It presents some strategies for starting this process.
Available from: SCIH

The world health report 2000: Health systems – Improving performance
WHO (2000). ISBN: 92 4 156198 X
This book is aimed at policy-makers. Drawing from a range of experiences and analytical tools, this book traces the evolution of health systems, explores their diverse characteristics, and uncovers a unifying framework of shared goals and functions. The book presents three fundamental goals for health services, and shows that the achievement of these goals depends on the ability of each health system to carry out four main functions. It aims to stimulate debate about better ways of measuring health system performance and thus finding a successful new direction for health systems to follow.
Available from: WHO

World development report 1993: Investing in health
World Bank (1993). Oxford University Press, New York, USA. ISBN: 0 19 520889 7
This report examines the controversial questions surrounding health care and health policy, and advocates a threefold approach for governments in developing countries and those in transition. First, to foster an economic environment that will enable households to improve their own health. Second, to redirect spending away from specialized care and toward low-cost and highly effective activities, by adopting packages of public health measures and essential clinical care described in the report. Third, to encourage greater diversity and competition in the provision of health services.
Available from: World Bank

Equipment Needs and Equipment Lists

This material covers issues in *Section 4.3* on establishing model equipment lists and includes resources that discuss equipment needs, provide lists of equipment, advise on design and layout implications relating to the use of equipment, and standardization. It is listed alphabetically by title.

Anaesthesia at the district hospital (2nd edition)
Dobson MB (1988). Nuffield Department of Anaesthetics, John Radcliffe Hospital, Oxford, UK.
ISBN: 92 4 154527 5
A practical manual designed to help medical officers in small hospitals acquire competence in the use of essential techniques for inducing anaesthesia for both elective surgery and emergency care of the critically ill. Addressed to doctors having at least one year of postgraduate clinical experience, the book concentrates on a selection of basic techniques, procedures, and equipment capable of producing good anaesthesia despite the limited resources usually found in small hospitals. The manual was prepared in collaboration with the World Federation of Societies of Anaesthesiologists.
Available from: WHO

Anaesthetic equipment: Physical principles and maintenance (2nd edition)
Ward C (1985). Baillière Tindall. ISBN: 0 7020 1008 1
This book provides a comprehensive and practical coverage of the wide range of equipment used in anaesthetic practice. It allows the reader to understand the mode of operation and maintenance of equipment, and how to cope with common causes of mechanical failure. Suitable for trainee and established anaesthetists, intensive care specialists, anaesthetic nurses, and theatre and maintenance technicians.
Available from: book suppliers

A pocket book for safer IV therapy (drugs, giving sets and infusion pumps)
M Pickstone (ed.) (1999). ISBN: 094 867232 3
This pocket book has been written to help clinical staff deliver safe IV therapy. It covers the calculation of drug dose, the make-up of drug solutions and the selection of infusion devices and associated equipment.
Available from: major internet bookshops

Approaches to planning and design of health care facilities in developing areas: Vol 3
Kleczkowski B, and R Pibouleau (eds) (1979). WHO Offset Publication No 45. ISBN: 92 4 170045 9
This volume addresses the issue of hospital design in terms of the building structure itself. It discusses inpatient areas, outpatient department, surgery, radiology department, and mobile facilities. Equipment issues are specifically covered in the sections discussing layout and flow, alternative ways of undertaking procedures, the equipping process, and choosing a complete X-ray system for a rural medical facility.
Available from: WHO

Approaches to planning and design of health care facilities in developing areas: Vol 4
Kleczkowski B, and R Pibouleau (eds) (1983). WHO Offset Publication No 72. ISBN: 924 170072 6
This volume addresses the issue of hospital design in terms of the building structure itself. The design of a hospital is discussed in the context of geographic and demographic data, utilisation, costs and available resources. It is a useful resource for planners, architects and administrators. This volume covers small health care facilities, laboratory facilities, transport systems, local construction materials, health service management, training, commissioning, and engineering and maintenance services. Equipment issues are specifically covered in the sections discussing layout and flow, laboratory design, commissioning, and engineering and maintenance services.
Available from: WHO

Design for medical buildings (4th edition)
Mein P, and T Jorgnesen (1988). University of Nairobi, Housing Research and Development Unit; African Medical and Research Foundation
Construction guidelines for medical buildings with special reference to appropriate designs for developing and tropical countries. Relationship diagrams, flow of patients, linkages between different units and services.
Available from: WHO, AMREF

District health facilities: Guidelines for development and operation
WHO Regional Publications: Western Pacific Series No 22 (1998). ISBN: 92 9061 121 9
This revised and expanded book presents detailed, richly illustrated guidelines for the planning and design of district hospitals including the efficient utilization of space and easy movement of people, equipment, and supplies. It also provides extensive information on the selection and maintenance of medical and laboratory equipment, including specifications for a basic radiological system and a general–purpose ultrasound scanner. Additional material covers sanitation and waste management, emergencies and disasters, the procurement of essential drugs, and test instruments.
Available from: WHO

District laboratory practice in tropical countries (part 1)
Cheesbrough M (1998). Tropical Health Technology. ISBN:0 9507434 4 5

District laboratory practice in tropical countries (part 2)
Cheesbrough M (2000) Tropical Health Technology. ISBN:0 9507434 5 3

Essential equipment for district health facilities in developing countries
Halbwachs H, and A Issakov (eds.) (1994). GTZ, Eschborn, Germany
This book describes the types of equipment required at different levels within the district health services – at health post level (sub-health centre without beds), at health centre or small district hospital level (with 1-75 beds), and at district or provincial hospital level (with 76-250 beds). It also provides guidance on the maintenance skill levels required for each equipment type.
Available from: GTZ, WHO

Essential healthcare technology package (EHTP)
WHO Collaborating Centre for Essential Health Technologies, Medical Research Council, South Africa
The WHO and MRC-SA have developed a tool (concept, methodology, and software) which systematically relates planning to essential health interventions, rather than relying on static equipment lists. The software links all internationally classified diseases (ICD codes) to their respective procedures (CPT codes), then to the technologies (medical devices, drugs, human resources, facilities) required for their execution. The EHTP templates are modified through country specific consultations and consensus. An in-built query and simulation capability ensures that planners can see the implications and costs of their choices. The EHTP is being field tested and modified in 20 – 25 countries. Various papers are available describing the software and the results of pilot application studies, contact: heimannp@who.int, or issakova@who.int.
Available from: http://www.ehtp.info

Examples of model equipment lists

A number of health service providers have already developed their own model equipment lists. For example, more information can be obtained from:

- Dr P Asman, Biomedical Engineering Unit, Ministry of Health (Room 33, MOH Building), PO Box M-44, Accra, Ghana. Email: nchtm@africaonline.com.gh
- Ministry of Health, PO Box 7272, Kampala, Uganda. Email: info@health.go.ug, website: www.health.go.ug/support_system.htm
- Dr N Forster, Under Secretary: Health and Social Welfare Policy, Ministry of Health and Social Services, Private Bag 13198, Windhoek, Namibia. Email: nforster@mhss.gov.na
- Ministry of Public Health, Conakry, Guinea. In French. Contact: mboule.andre@hotmail.com
- Ministry of Health, Gaborone, Botswana. For district hospitals and primary hospitals. Contact: Ziken International on info@ziken.co.uk

Furniture and equipment in relation to activities, personnel and architecture – Primary and secondary health care in developing countries
Knebel P (1984). Club du Sahel, OECD
This book, based on experience in the Sahel region, contains lists of the minimum requirements for furniture and equipment for health facilities. There are also sections on UNICEF ordering procedures, inventory control, catchment areas, basic demographic assumptions and calculation of manpower needs. Two additional sections cover, in more detail, i) advice on staffing levels by facility and activity and, ii) proposed architectural layouts for facilities.
Available from: OECD, WHO

Future use of new imaging technologies in developing countries.
Report of WHO Scientific Group (1985). WHO Technical Report Series No.723. WHO, Geneva, Switzerland
This document discusses the use of ultrasound and computed tomography and the specifications for the required equipment.
Available from: WHO

General surgery at the district hospital
Cook J, Sabkaran B, and A Wasunna (eds) (1998). Dept. of Surgery, Eastern General Hospital, Edinburgh, Scotland. ISBN: 92 4 154235 7
A richly illustrated guide to general surgical procedures suitable for use in small hospitals that are subject to constraints on personnel, equipment, and drugs. The book presents an overview of basic principles, and detailed information on simple but standard surgical techniques for the face and neck, chest, abdomen, gastrointestinal tract, urogenital system, and paediatric surgery. Lists of essential surgical instruments, equipment and supplies are included.
Available from: WHO

If not in use – switch off!: Guidelines and key recommendations for a sustainable and cost-effective energy supply for health facilities in remote locations
Röttjes M (1995) FAKT, Stuttgart, Germany
This practical document aims to provide a variety of courses of action that medical and administrative staff can pursue when health facilities are hit by energy problems. It covers sustainable and cost-effective energy supplies, the different energy requirements, possible energy sources, and suggestions for a hospital energy supply. It includes PPM schedules for air-cooled diesel power plants.
Available from: FAKT

Infusion systems
Medicines and Healthcare Regulatory Authority (1995). MDA Device Bulletin, No. DB 9503 (May 1995)
This publication addresses many aspects of the use and selection of infusion systems. Its purpose is to raise awareness of the nature of infusion systems, their advantages and their potential risks, with a view to reducing the number of adverse incidents that arise from their use. It describes the different types of infusion devices, risks and applications, training programmes, safety recommendations, purchasing, and management responsibilities.
Available from: MHRA

Instrumentation for the operating room: A photographic manual (5th edition)
Brooks Tighe S (1999). ISBN 0323003508
Colour photographic reference manual illustrating in detail a range of instruments for major surgical procedures: endoscopic, neurosurgery, ophthalmic, orthopaedic, and oral, maxilla and facial surgery. Also includes a section describing the care and handling of instruments from cleaning to sterilization, inspection and testing.
Available from: major internet bookshops

International Centre for Eye Health (ICEH) standard lists of equipment
ICEH produces annual standard lists of equipment, instruments and optical supplies for eye care in developing countries.
Available from: online at http://www.ucl.ac.uk/ioo

International seminar for hospital technicians/engineers: February 1998, Moshi, Tanzania
Clauss J (ed) (1998). FAKT

Medical administration for frontline doctors: A practical guide to the management of district-level hospitals in the public service or in the private sector (2nd edition)
Pearson C (1990). FSG Communications Ltd, Cambridge, UK. ISBN: 1 871188 03 2
This book provides information for doctors who combine wide clinical responsibilities with administration and support for primary health care services. It covers a wide range of topics, with country examples, including: management structures; infrastructure and maintenance; buildings, support services, and equipment; hospital supplies; training; outreach programmes; and wider responsibilities in the district and above.
Available from: TALC

Medical supplies and equipment for primary health care: A practical resource for procurement and management.
Kaur M, and S Hall (2001). ECHO International Health Services Ltd. ISBN: 0 9541799 0 0

Medicines and Healthcare Regulatory Agency (MHRA, UK) products
This agency of the UK government (formerly the Medical Device Agency) ensures medical devices and equipment meet appropriate standards of safety, quality, performance, and effectiveness, are used safely, and that they comply with relevant Directives of the European Union. The MHRA provides a variety of publications, such as:

- **Device evaluations** (replacing former evaluation reports) which evaluate and compare different makes and models of equipment
- **Device bulletins** (one of many types of safety warnings produced about specific types, makes and models of equipment)
- **Medical device alerts** (replacing former hazard notices, safety notices, device alerts, advice notices, etc.)
- **Advice on a wide variety of safety topics** (visit the website, click on contacts, then medical devices, then search under a subject area such as decontamination, or laundry for example).

Available from: MHRA

Physical asset planning and management software (PLAMAHS)
HEART Consultancy

Provisional reference lists of equipment and supplies for peripheral health services
Torfs ME (1975). WHO, Geneva, Switzerland, WHO/SHS/75.2
The document begins with a discussion of the methodology used in drawing up the lists. Recommended lists of furniture, equipment, supplies, disposables, and pharmaceuticals are provided for: i) static facilities, ii) mobile facilities, and iii) kits and sets.
Available from: WHO

Selection of basic laboratory equipment for laboratories with limited resources
Johns ML and ME El-Nageh (2000). ISBN: 9290212454
This book provides a framework to help laboratory workers, supply officers and decision makers to choose and buy laboratory equipment and consumables. Includes information on maintenance and energy requirements for laboratory equipment, quick reference buyer's guides and equipment data specification sheets provide easy reference for equipment buyers. The framework can be adapted to guide general equipment purchasing.
Available from: WHO

Surgery at the district hospital: Obstetrics, gynaecology, orthopaedics and traumatology
Cook J, Sabkaran B, and A Wasunna (eds) (1991). Dept. of Surgery, Eastern General Hospital, Edinburgh, Scotland. ISBN: 92 4 154413 9
An illustrated guide to essential surgical procedures in small hospitals for treating the major complications of pregnancy and childbirth, common gynaecological procedures, and managing traumatic injuries, including fractures and burns. Emphasis is placed on standard surgical protocols that represent the safest line of action in hospital settings where equipment may be primitive, drugs limited, and specialist services sparse – these requirements are discussed.
Available from: WHO

Surgical instruments: A pocket guide (2nd edition)
Papanier Wells M, and M Bradley (1998). ISBN: 00721678017
A pocket guide listing and describing surgical instruments: sharps/dissectors, forceps, clamps, retractors, suction tips, dilators, endoscopic instruments, internal stapling devices, and most commonly used instrument sets for a variety of surgical procedures. Includes a picture of the instrument with a brief description explaining the uses, varieties, and alternative names.
Available from: major internet bookshops

See *Guide 4* for more literature that discusses equipment needs for particular disciplines but does not contain lists of equipment, and for training videos.

Equipment Specifications and Appropriate Models

This material covers issues in *Section 4.5* on developing generic equipment specifications and technical data, as well as material that discusses appropriate design of equipment. It is listed alphabetically by title.

Appropriate medical technology for developing countries: Report of IEE 1st seminar in February 2000
IEE Medical Focus Group. Report 00/014
This document contains papers on appropriate products that have been designed for use in developing countries, such as an anaesthetic machine, diagnostic instruments for primary health care, laboratory equipment, and an incinerator. It also contains discussions on issues such as solar power, repair and maintenance of equipment, selection and procurement options, and sustainability.
Available from: IEE

Appropriate medical technology for developing countries: Report of IEE 2nd seminar in February 2002
IEE Healthcare Technologies Professional Network. Report 02/057
This document contains papers on appropriate products that have been designed for use in developing countries, such as a healthcare technology management information system, laboratory equipment, a growth monitor, observation of respiratory dysfunction, a virtual doctor system, solar energy, ophthalmic examination and surgical equipment. It also contains discussions on issues such as a global medical devices nomenclature, management systems, the use of Cobalt 60 teletherapy for cancer, a call for a biomedical instrument development centre, and an update of the anaesthetic machine, diagnostic tools for medical surveillance, and an incinerator
Available from: IEE

Appropriate medical technology for developing countries: Report of IEE 3rd seminar in February 2004
IEE Healthcare Technologies Professional Network. UK ISSN: 0963 3308, reference no.: 03/10408
This document contains mainly scientific papers on research and design work being undertaken on appropriate products and techniques for developing countries.
Available from: IEE

District health facilities: Guidelines for development and operation
WHO Regional Publications: Western Pacific Series No 22 (1998). ISBN: 92 9061 121 9

District laboratory practice in tropical countries (part 1)
Cheesbrough M (1998). Tropical Health Technology. ISBN:0 9507434 4 5

District laboratory practice in tropical countries (part 2)
Cheesbrough M (2000) Tropical Health Technology. ISBN:0 9507434 5 3

Emergency Care Research Institute (ECRI, USA) products
ECRI

Examples of equipment specifications and technical data

A number of health service providers have developed their own equipment specifications, package of inputs to purchase, national technical data, and supply contracts. For example, more information can be obtained from:

- Dr P Asman, Biomedical Engineering Unit, Ministry of Health (Room 33, MOH Building), PO Box M-44, Accra, Ghana. Email: nchtm@africaonline.com.gh
- Ministry of Health, PO Box 7272, Kampala, Uganda. Email: info@health.go.ug, website: www.health.go.ug/support_system.htm
- Dr N Forster, Under Secretary: Health and Social Welfare Policy, Ministry of Health and Social Services, Private Bag 13198, Windhoek, Namibia. Email: nforster@mhss.gov.na
- Ziken International, contact: info@ziken.co.uk

Future use of new imaging technologies in developing countries.
Report of WHO Scientific Group (1985). WHO Technical Report Series No.723. WHO, Geneva, Switzerland

Medical supplies and equipment for primary health care: A practical resource for procurement and management.
Kaur M, and S Hall (2001). ECHO International Health Services Ltd. ISBN: 0 9541799 0 0

Physical asset planning and management software (PLAMAHS)
HEART Consultancy

UNICEF supply catalogue (formerly the UNIPAC catalogue)
UNICEF
This catalogue lists products with their specifications under categories such as: immunization and cold chain; medical devices and kits; water, environment, sanitation and engineering; education, communication; etc. View it online at www.supply.unicef.dk/Catalogue.
Available from: UNICEF Denmark

Cost and Budgeting Information

This material covers issues in *Sections 5 and 6* such as resources that discuss the various costs incurred when owning equipment and how to calculate them, how to make budget estimates, how to make savings, how to undertake cost-benefit analysis. It is listed alphabetically by title.

A study into the costs of running X-ray equipment in a SCIH project in Egypt
Raab M, and G Hutton (2001). Swiss Centre for International Health, Basle, Switzerland
This paper investigates the cost and financing for a project in Egypt to provide X-ray machines. It shows how the costs incurred during the life cycle of the equipment can be calculated, estimated and summarized. The evaluation study classified costs as investment costs (money required at the start of the project), recurrent costs (money required to make the project sustainable), and incremental costs (additional costs to those covered by the Ministry of Health). The information on investment and recurrent costs gave the decision makers a picture of (potential) impact on budgets, and how much budgets should be adjusted to accommodate the project.
Available from: SCIH

Better health in Africa: Experience and lessons learned
World Bank (1994). Development in Practice Series, World Bank, Washington, USA,
ISBN: 0 8213 2817 4

Cost-benefit calculation models for optimizing technology management in healthcare facilities
Raab M (1999). Swiss Centre for International Health
This paper presents a set of tools for evaluating the costs related to clinical engineering services (whether in-house, externally contracted, or a mixture of both). These costs are balanced against the benefits reaped by the health service provider. The method of analysis used has been tested in a number of countries (mainly those in transition).
Available from: SCIH

Engineering and maintenance services in developing countries
Mehta, J.C. (1983) in *Approaches to planning and design of health care facilities in developing areas: Vol 4,* B.M. Kleczkowski, R. Pibouleau. (eds), WHO Offset publication No 72
This document is based on over 8 years of experience of the maintenance system in a government hospital in India. The document discusses maintenance for the hospital as a whole including buildings, plant, and equipment. There are sections on maintenance management, activities of the hospital engineering and maintenance department, planning the maintenance program, personnel, services to offer, and tables of estimated costs of maintenance for different types of equipment as a percentage of capital cost.
Available from: WHO

Estimated useful lives of depreciable hospital assets (revised 2004 edition)
American Society for Hospital Engineering (2004). American Hospital Association.
ISBN: 1 55648 319 8
One of the organizations which have tried to estimate typical equipment lifetimes for healthcare technology. The AHA's extensive list reflects how equipment lasts within the United States' health care system whether it was manufactured in the US or abroad. It covers buildings, estate, fixed equipment, and individual items of movable equipment. The list was compiled after discussions with manufacturers of healthcare equipment, discussions with various hospital department managers, and analysis of actual retirement practices for actual hospital assets.
Available from: AHA

Healthcare equipment management
Halbwachs H. (1994). pp 14-20 in *Health Estate Journal*, December 1994, Portsmouth UK

Health economics for developing countries: A practical guide
Witter S et al (2000). Macmillan, UK, ISBN: 0 333 75205 8
This book is an introduction to health economics and finance for low-income countries, which is easy to read and does not assume previous training in economics. It explains health economics in an accessible lively way using material from, and relevant to, developing countries. The focus is on practical use with worked examples and practice exercises. There are sections covering many topics, including health and development, financing health care, the value of cost information for allocating resources, organizational issues such as decentralization, public/private provision, and improving efficiency.
Available from: major internet bookshops

International seminar for hospital technicians/engineers: February 1998, Moshi, Tanzania
Clauss J (ed) (1998). FAKT

Maintenance and the life expectancy of healthcare equipment in developing economies
Hans Halbwachs, GTZ. In *Health Estate Journal* (March 2000) pp 26-31
This article comes from one of the organizations that have tried to estimate typical equipment lifetimes for healthcare technology. The GTZ estimates are for 16 types of medical equipment and plant, and tries to more closely reflect the realities in developing countries. The article describes the Delphi survey used to obtain feedback from 23 experts from 16 different country backgrounds. Rather than providing exact lifetimes, this approach provides a range for the lifetime that depends on the quality of the initial equipment and how well it has been maintained.
Available from: GTZ

Medical equipment in developing countries: Two neglected issues – planning and financing
Berg H (1992). WHO Document WHO/SHS/CC/92.2
This document is aimed primarily at health planners. It describes planning problems, and outlines the procedures that should occur before equipment is purchased in order to ensure that the implications of ownership are known. It looks at the recurrent cost implications of equipment, and presents a method for unit costing and shows the consequences through examples.
Available from: WHO

Medical technology management
David Y, and T Judd. (1993) BioPhysical Measurement Series, SpaceLabs Medical Inc.
ISBN: 0 9627449 6 4

Physical assets management and maintenance in district health management
Halbwachs H (2000). GTZ document

Reflections on the economy of maintenance: Presentation at the summit conference of the African Federation for Technology in Healthcare, Harare, Zimbabwe, 1998
Riha J, Mangenot L, Halbwachs H, and G Attemené. (1998). GTZ
This paper aims to provide convenient quantitative guidelines for engineers, administrators and decision makers on the cost implications of maintenance approaches. It explores how to define an annual maintenance cost ceiling by relating maintenance cost to the expected increase in equipment lifetime. This is achieved though the use of various equations with worked examples.
Available from: GTZ

The right equipment... in working order
Bloom GH et al (1989). Reprinted from *World Health Forum*, Vol 10, No. 1, pp 3 – 27. WHO, Geneva, Switzerland
This document contains a series of papers that discuss planning and budgeting issues for healthcare technology in developing countries. They contain cost estimates (as a percentage of the capital stock value), financial planning implications, constraints and strategies.
Available from: WHO

The technical and financial impact of systematic maintenance and repair services within health systems of developing economies or 'How good is my maintenance service?'
Halbwachs H (1998).pp57-60 in *Proceedings of the IFHE 15th International Congress, Edinburgh, June 1998*, International Federation of Hospital Engineering
This paper describes, with country examples, the consequences of a lack of maintenance and repair, and how the introduction of planned preventive maintenance and repair services can benefit the health service by providing a positive economic impact. It covers how to measure the quality of maintenance services using process, impact, and cost indicators, including savings calculations. It reports on the results of studies in three countries on the cost-effectiveness of maintenance services. It also describes a suitable national body through which donors could provide financial contributions to maintenance services.
Available from: GTZ, IFHE

World development report 1993: Investing in health
World Bank (1993). Oxford University Press, New York, USA. ISBN: 0 19 520889 7

See *Guide 6* for more information and resources covering financial management, running Healthcare Technology Management Services as businesses that can generate profits, and preparing budgets for HTM Services.

Developing Skills and an Equipment Training Plan, and Managing Change

This material covers issues in *Section 2.1* on managing change, and *Section 7.2* on developing an equipment training plan. It is listed alphabetically by title.

A book for midwives
Klein, S (1996). Hesperian Foundation. ISBN: 0 942364 23 6
This book provides practical information on antenatal care, labour, birth and post-partum care. It also includes a section on making teaching materials and low-cost equipment.
Available from: TALC

District health care: Challenges for planning, organization and evaluation in developing countries (2nd edition)
Amonoo-Larston R, Ebrahim G, Lovel H, and J Rankeen (1996). MacMillan. ISBN: 0 333 57349 8

Healthcare technology: Training skills for hospital technicians and engineers
FAKT (1999). FAKT Technical Library Data Sheet
This paper discusses the major objectives of training both on- and off-the-job. It then provides practical guidance on how to undertake on-the-job training effectively by using the PESOS procedures (prepare, explain, show, observe, supervise). It explains each step in detail. Although written for maintenance staff, its advice is just as useful for any other types of staff.
Available from: FAKT

Hospital engineering in developing countries
Dammann V, and H Pfeiff (eds) (1986). GTZ, Eschborn, Germany. ISBN: 3 88085 293 6

Hospital technology: Communication – a vital skill for successful healthcare technical service management
FAKT (1999). FAKT Technical Library Data Sheet
This paper discusses the importance of communication for both working in a team and working in an organization/network. It provides advice on how to communicate effectively, its importance, the barriers that exist, how to promote effective communication, the role of the head of department, methods to use, and related reading. Although written for maintenance staff, its advice is just as useful for any other types of staff.
Available from: FAKT

How to make and use visual aids
Harford, N and N Baird (1997). VSO. ISBN: 043592317X
This booklet describes a number of useful and practical methods for making visual aids quickly and easily, using low cost materials.
Available from: TALC, VSO

Maintenance strategies for public health facilities in developing countries: Report of a workshop held in March 1989 in Nairobi by GTZ
Halbwachs H, and R Korte (1990). WHO/SHS/NHP/90.2
This report presents the results of a workshop attended by 60 participants from 18 countries including project staff and counterparts from GTZ projects in various countries, representatives of various donor agencies, and resource persons. The papers included address the different types of personnel required in maintenance services, the training they require, experiences of establishing national training courses in hospital maintenance, and ways to monitor progress with maintenance and training.
Available from: GTZ, WHO

Management support for primary health care: A practical guide to management for health centres and local projects
Johnstone, P, and J Ranken, (1994). FSG Communications Ltd, Cambridge, UK. ISBN: 1 87118 02 4
This practical user-friendly book gives support and guidance to leaders in health centres and other local projects to help stimulate and maintain primary health care (PHC) in their surrounding communities. Aid workers, and others unfamiliar with PHC and basic management techniques may also benefit. Includes sections which will assist with staff motivation, such as teamwork and team effectiveness; managing oneself, others and tasks; and managing change, as well as sections on planning and monitoring progress.
Available from: TALC

Medical administration for frontline doctors: A practical guide to the management of district-level hospitals in the public service or in the private sector (2nd edition)
Pearson C (1990). FSG Communications Ltd, Cambridge, UK. ISBN: 1 871188 03 2

Medical equipment in Botswana: A framework for management development
Temple-Bird C L, Mhiti R, and G H Bloom (1995), WHO publication WHO/SHS/NHP/95.1

On being in charge: A guide to management in primary health care (2nd edition)
McMahon R, Barton E, and M Piot (1992). ISBN: 9241544260
This practical guide aims to improve the managerial skills of middle level health workers. The text is reinforced with practical examples, questionnaires and illustrations that help relate the information to health workers' own experiences. Topics include identifying health problems, assigning priorities to their solution, planning and implementing programmes, and evaluating results. Also serves both as a training and reference guide, covering all aspects of primary health care management including equipment and drugs.
Available from: WHO

Setting up community health programmes: A practical manual for use in developing countries (2nd edition)
Lankester, T. (2000). ISBN: 0333679334
A practical 'how-to' manual designed for a wide range of health workers working with community health programmes. With revised and updated material on planning, management and evaluation of health programmes ranging from choosing and training a team through the setting up of clinics and advising village health workers. Includes new information on community-based approaches to safe motherhood, immunisation, malaria and TB based on WHO guidelines.
Available from: TALC

Training health personnel to operate health-care equipment: How to plan, prepare and conduct user training – A guide for planners and implementors
Halbwachs H, and R Werlein, (1993). GTZ, Eschborn
The aim of this book is to ensure that users are in a position to operate equipment and plant without causing failure or malfunction. Part one addresses the planner/administrator developing user courses and gives information about methods, course organization, finances, etc. Part two discusses interesting issues for the implementers i.e. how to design a course, teaching methods and teaching aids, conducting a course, etc. This practical guide provides sample checklists, questionnaires, worksheets, tests, certificates, etc.
Available from: GTZ

Transfer of learning: A guide for strengthening the performance of health care workers
Intrah/PRIME II/JHPIEGO (March 2002)
This book is for health care workers involved in training and learning interventions and enables them to transfer their newly acquired knowledge and skills to their jobs, resulting in a higher level of performance and sustained improvement in the quality of services at their facilities.
Available from: free online at http://www.prime2.org/prime2/section/70.html

WHO Interregional meeting on manpower development and training for health care equipment management, maintenance and repair: Campinas, Brazil, November 1989
WHO (1989). WHO document WHO/SHS/NHP/90.4
This document provides a comprehensive discussion of the complexities of manpower development and training for healthcare technology maintenance and management, as well as proposed strategies. It uses reports from countries, participating institutions and organizations regarding skill development for healthcare technical services. It discusses the needs, professional development, use of an equipment survey to determine manpower requirements, certification, and job descriptions.
Available from: WHO

See all other Guides in the Series for information on the training requirements specific to the topics covered by each Guide.

Equipment Development Plans, Budgets, and Monitoring Progress

This material covers issues in *Sections 7 and 8* on equipment development plans, income and expenditure plans (budgets), and *Section 8* on target-setting and monitoring progress. It is listed alphabetically by title.

District health care: Challenges for planning, organization and evaluation in developing countries (2nd edition)
Amonoo-Larston R, Ebrahim G, Lovel H, and J Rankeen (1996). MacMillan. ISBN: 0 333 57349 8

Maintenance strategies for public health facilities in developing countries: Report of a workshop held in March 1989 in Nairobi by GTZ
Halbwachs H, and R Korte (1990). WHO/SHS/NHP/90.2

Management support for primary health care: A practical guide to management for health centres and local projects
Johnstone, P, and J Ranken, (1994). FSG Communications Ltd, Cambridge, UK. ISBN: 1 87118 02 4

Medical technology management
David Y, and T Judd. (1993) BioPhysical Measurement Series, SpaceLabs Medical Inc.
ISBN: 0 9627449 6 4

On being in charge: A guide to management in primary health care (2nd edition)
McMahon R, Barton E, and M Piot (1992). ISBN: 9241544260

Planning and budgeting software
Preparation of equipment development plans, expenditure plans, and budgets is an area where simple computer software programs can be of assistance once you have mastered a manual paper system, have a large enough stock (several hundred items of major equipment), and can obtain sufficient training of staff. The software should be a spreadsheet application, in which you can enter formulae to manipulate the data in each column. There are a variety of products available with different advantages, for example:

- OpenOffice software is free to download and use. It includes typical desktop applications: word processor, spreadsheet, presentation manager, and drawing program. It works with a variety of file formats and platforms, and various languages. It is run by a community of developers and end-users. Website: www.openoffice.org, and look for the latest stable release to download.
- Any commercially available spreadsheet software can be purchased. Excel (the spreadsheet application part of Microsoft Office) is readily available from any computer distributor, is commonly available on health service provider's computer systems, but is a more expensive option. Website: www.microsoft.com/office/excel for information, viewing, and download possibilities. Although many other products are available.
- Tailor-made budgeting software products have many features, however they are often more complex and expensive than required, and than a straightforward spreadsheet. These products can be found by searching for budgeting software on the internet.

- The 'Health Manager's Toolkit' is a product produced by Management Sciences for Health that includes spreadsheet templates, forms for gathering and analyzing data, checklists, guidelines for improving organizational performance, and self-assessment tools that allow managers to evaluate their organizations. Tools cover areas such as strategic planning, developing information systems, cost and revenue analysis, and sustainability. Website: http://erc.msh.org/toolkit.

Setting up community health programmes: A practical manual for use in developing countries (2nd edition)
Lankester, T. (2000). ISBN: 0333679334

Strategic medical technology planning and policy development
Raab M (1999). Swiss Centre for International Health. August 1999

The division for the supply of medical spare parts in the health system of Kenya
Paton J, Green B, and J Nyamu (1996). Ministry of Health, Nairobi/GTZ, Eschborn, Germany
This paper describes how a Division for the Supply of Medical Spare Parts was set up and is run in the health system of Kenya, financed through the use of a revolving fund.
Available from: GTZ

The technical and financial impact of systematic maintenance and repair services within health systems of developing economies or 'How good is my maintenance service?'
Halbwachs H (1998). pp 57-60 in *Proceedings of the IFHE 15th International Congress, Edinburgh, June 1998*, International Federation of Hospital Engineering

Accessing Information

These websites are sources of information concerning many aspects of health service delivery. They are locations where there is, or may be, information about healthcare technology management and the planning and budgeting requirements for equipment.

Africa online: Health website: http://bamako.africaonline.com/afol/index.php
Provides links to health information sites related to Africa. The links are organized into the following categories: health information, health news, events, African organizations, international organizations, schools and hospitals in Africa, projects, publications and health services

AFRO-NETS (African networks for health research and development)
website: www.afronets.org
Forum for exchanging health research information in and between East and Southern Africa.

AJOL (African journals online) website: www.inasp.org.uk/ajol
Offers free online access to tables of contents and abstracts of over 70 journals published in Africa.

British medical journal website: http://bmj.bmjjournals.com/
Free worldwide access to BMJ and the student BMJ and a wide range of specialist journals to users in low-income countries.

Eurasia health knowledge network (EHKN) website: www.eurasiahealth.org
Specialises in the health information needs of the Former Soviet Union (FSU) and Central and Eastern Europe (CEE). Site links to clinical practical guidelines, medical textbooks, and other educational materials, many in Russian and other regional languages

FIN: Free international newsletters: www.healthlink.org.uk
Healthlink produces this publication that lists over 130 print and electronic health-related newsletters and magazines which are available free to readers in developing countries.

Free medical journals website: www.freemedicaljournals.com
This site is a comprehensive, up to date list of medical journals available free on the internet.

GATE (German Appropriate Technology Exchange): www5.gtz.de/gate/
The GATE Information Service seeks to improve the technological knowledge of organizations and individuals involved in poverty alleviation projects and to develop information and knowledge management systems of organizations.

Global Medical Devices Nomenclature (GMDN) website: www.gmdn.org/index.xalter
The GMDN is a collection of internationally recognized terms used to accurately describe and catalogue medical devices. It is a classification system developed to allow for the classification of all medical devices put onto the market as defined by the European Standards body (CEN). It is intended to replace the older national device nomenclatures such as UMDNS (USA), CNMD (Canada), NKKN (Norway), JFMDA (Japan), in order to promote consistency in terminology around the world. The system has been accepted by the International Organization for Standardization (ISO).

Health exchange website: www.healthcomms.org
Explores issues, ideas and practical approaches to health improvement in developing countries and provides a forum for health workers and others to share viewpoints and experiences in this area.

HealthNet news website: www.healthnet.org/medpub
Weekly newsletter distributed to health professionals in Africa, Asia and Latin America. Features current, practical, clinical and public health information.

HIF-net at WHO discussion group
Discussion list dedicated to issues of improving access to reliable health information in resource-poor settings. To join, email your name, affiliation and professional interests to: health@inasp.info

HINARI (Health inter-network access to research initiative) website:
www.healthinternetwork.net
WHO initiative offering free/discounted access to journals from six leading publishers.

HNP flash website: www.worldbank.org/hnpflash
A free monthly electronic newsletter dedicated to sharing knowledge regarding the latest technical developments in the fields of health, nutrition, population, and reproductive health.

ID21 health website: www.id21.org/health
An internet based development research reporting service for health policy makers and development practitioners on global health issues. Latest research summaries are provided on a searchable website, by email and in a quarterly publication.

IEC website: www.iec.ch
International Electrotechnical Committee, which sets standards for the safe manufacture of electrical healthcare technology. There is a wide range of specific standards for medical electrical equipment falling under the standard numbers IEC 60101–1,2, and 3.

IEE healthcare technologies professional network website: www.iee.org/pn/healthtech
The Institution of Electrical Engineers of the UK provides internet sites for a wide variety of engineering professions, with the aim of enabling people to communicate with their peers around the world and access the latest global industry news and key information sources. One of their professional networks focuses on healthcare technologies. It has also hosted a series of seminars on **Appropriate medical technology for developing countries**, and their reports can be obtained from the IEE.

INFRATECH discussion group
WHO forum for global exchange of information on infrastructure and health care technology issues
To subscribe send an email to LISTSERV@LISTSERV.PAHO.ORG enter in text: subscribe infratech 'your full name'.

International health exchange website: www.ihe.org.uk
Provides training, information and advice to health workers in emergency aid and development situations. This site also provides information about jobs and health development issues.

International journal of technology assessment in health care website:
www.cambridge.org/uk/journals/journal_catalogue.asp?historylinks=ALPHA&mnemonic=THC
This journal serves as a forum for professionals interested in the assessment of medical technology, its consequences for patients, and its impact on society. It covers the generation, evaluation, diffusion, and use of health care technology through essays, research notes, regular columns on technology assessment reports, and sections devoted to particular topics. Sometimes there are articles with particular relevance to developing countries. In 1994, the Cambridge University Press produced a book of reprints called **Technology assessment in health care for developing countries**.
Email: journals-subscription@cambridge.org.

KAR (Knowledge and research programme on disability and healthcare technology) website:
www.kar-dht.org, and for the latest projects being funded use website: www.disabilitykar.net/
This is the Knowledge and Research Programme on disability and healthcare technology of the UK governments's Department for International Development (DFID). It supports a range of projects on development and use of appropriate disability and healthcare technologies in developing countries. The website also provides links to:

- **Disability and healthcare technology newsletter** produced every six months describing the progress and findings of the projects funded;
- **KaR global database** on healthcare technology publications, organizations, manufacturers, training institutions, etc.

NICE (National Institute of Clinical Excellence) website: www.nice.org.uk
Provides guidance to the UK National Health Service (NHS) on current best practice covering both health technologies (from medicines to diagnostic techniques) and the clinical management of specific conditions.

Programme for appropriate technology in health (PATH) website: www.path.org
PATH identifies, develops and applies appropriate technologies to public health problems in developing countries.

Public health care laboratory website: www.phclab.com
Global forum of information exchange and resource centre for laboratory personnel and those concerned with PHC laboratory services in developing countries.

TechNet (Technical network for strengthening immunisation services) website:
www.technet21.org
Forum focusing on improving management and operational logistics for health service delivery in developing countries, in particular, immunisation services.

The manager's electronic resource center website: http://erc.msh.org
The ERC website is an electronic information resource and communication service for health managers, containing more than 150 ready-to-use management tools in various languages. A key feature is **The health manager's toolkit** – see the discussion on planning and budgeting software in the section above.

WHO: Health technology and pharmaceuticals website: www. who.int/technology
This WHO site provides information on pharmaceutical and health technology developments with a particular focus on developing countries. It includes links to blood transfusion safety and clinical technology, essential drugs, medicines, vaccines and biologicals.

WHO: Management of health services (MAKER) website: www. who.int/management
This WHO site provides information, publications, and country experiences on all types of management issues for health services, such as facility management, resource management, and district management.

World Bank website: www.worldbank.org
This site should provide access to World Bank guidelines for equipping health facilities.

ii. Organizations, Sources of Publications in Part i, Resource and Information Centres

For the following institutions we have included the name, address, contact details, a brief description of the various services they offer, and additional contact details for further relevant activities.

AfriAfya
AMREF Building, PO Box 30125, Nairobi, Kenya
Tel: 254 2 609520, fax: 254 2 609518, email: info@afriafya.org, website: www.afriafya.org
Established by Kenya-based health agencies, AfriAfya provides community access to relevant and appropriate health knowledge and information in an interactive manner. As well as a section on HIV/AIDS there is a news centre, message board and discussion forum on their website.

Amazon Bookshop
PO Box 81226, Seattle, Washington 98108-1226, USA
Website: www.amazon.com or www.amazon.co.uk
Internet bookshop

American Hospital Association
Clinical Engineering Section, 840 North Lake Shore Drive, Chicago, Illinois 60611, USA
Website: http://aharc.library.net/
They produce a wide range of documents which are published by HealthForum, use website:www.ahaonlinestore.com

AMREF International (African Medical and Research Foundation)
Resource Centre, AMREF Headquarters, Langata Road, PO Box 00506 – 27691, Nairobi, Kenya
Tel: 254 2 501301/2/3, fax: 254 2 609518, e-mail: amref.info@amref.org, website: www.amref.org
Publishes practical books, journals and other literature for health workers, and provides advice on primary health care. Runs training courses and seminars.

BOND (British Overseas NGO's for Development)
Website: www.bond.org.uk
A network of more than 260 UK based voluntary organisations working in international development and development education. BOND works to promote the exchange of experience, ideas and information by acting as a broker for a variety of relationships and by collating and distributing information.

Commonwealth Secretariat
Marlborough House, Pall Mall, London, SW1Y 5HX, UK
Tel: 44 207 747 6500, fax: 44 207 930 0827, website:
www.thecommonwealth.org/publications/html/contactus.asp
This website provides access to the publications produced by the Commonwealth Sectretariat.

De Montfort medical waste incinerators
Website: www.mw-incinerator.info/en/101_welcome.html
This website provides information on De Montfort University incinerators designed by Prof. DJ Picken. It contains copies of drawings and instructions for the building, operation and maintenance of various incinerator models. The range of DMU incinerators has been developed for use by rural PHC facilities, and designed to be constructed on site using local materials. There may be a small charge to cover the cost of printing and postage of the plans.

DFID (Department for international development)
Website: www.dfid.gov.uk
UK government's department for international development assistance.

ECHO International Health Services Ltd
ECHO International Health Services is no longer trading as it used to. Its services can be accessed as follows:

i. the charitable foundation can be contacted at:
ECHO, Ullswater Crescent, Coulsdon, Surrey, CR5 2HR, UK
Tel: 44 208 6602220, fax: 44 208 6680751, website: www.echohealth.org.uk/intro2.html
ii. the trading branch of the business (wholesale providers of medical supplies and equipment) is now:
Durbin PLC, 180 Northholt Road, South Harrow, Middlesex, HA2 0LT, UK
Tel: 44 208 8696500, fax: 44 208 8696565, email: cataloguesales@durbin.co.uk, website: www.durbin.co.uk
iii. ECHO publications are still available from TALC (see below).

ECRI (Emergency Care Research Institute)
5200 Butler Pike, Plymouth Meeting, Pennslyvania 19462-1298, USA
Tel: 1 610 825 6000 ext 5368, fax: 1 610 834 1275, website: www.ecri.org
Offers guidance and advice on health care technology, planning, procurement and management; and health technology assessment and assistance.

Elsevier Health Science
Elsevier Books Customer Services, Linacre House, Jordan Hill, Oxford, OX2 8DP, UK
Tel: 44 1865 474110, fax: 44 1865 474111, email: eurobkinfo@elsevier.com,
website: www.us.elsevierhealth.com
Books published by WB Saunders, Mosby, Churchill Livingstone, and Butterworth-Heinemann are now all members of the Elsevier Science, Health Sciences Division.

European Union (EU)
http://europa.eu.int/comm/development/index_en.htm
EU site for international development and aid.

FAKT (Consultancy for Management, Training, and Technologies)
Gansheidestrasse 43, D-70184 Stuttgart, Germany
Tel: 49 711 21095/0, fax: 49 711 21095/55, email: fakt@fakt-consult.de, website: www.fakt-consult.de
Non-profit consultancy firm, that provides information on appropriate hospital and medical equipment and training in healthcare technologies. FAKT is not a supply organisation.

Global Directory of Health Information Resource Centres.
Health Information for Development (HID) Project, PO Box 40, Petersfield, Hants, GU32 2YH, UK
Tel: 44 1730 301297, fax: 44 1730 265398, email: iwsp@payson.tulane.edu,
website: www.iwsp.org/directory.htm
This is a directory of health information resource centres that is arranged alphabetically by country. Between January 2000 and May 2001, Health Information for Development (HID) compiled a Global Directory of Health Information Resource Centres (HIRCs). This is available from their website. The Directory is updated on an ongoing basis.

GTZ (Deutsche Gesellschaft für Technische Zusammenarbeit – German government technical aid agency)
Division of Health and Education, PO Box 5180, D-6236, Eschborn, Germany
Tel: 49 6196 791265, fax: 49 6196 797104, email: Friedeger.Stierle@gtz.de
Website: http://www.gtz.de/de/4030.htm
Friedeger Stierle is the contact for the GTZ's healthcare technology management programme, and any articles or documents on HTM.

Healthlink Worldwide
Cityside, 40 Adler Street, London, E1 1EE, UK
Tel: 44 20 7539 1570, fax: 44 20 7539 1580, email: info@healthlink.org.uk, website: www.healthlink.org.uk
Publishes a range of free and low-cost newsletters, resource lists, briefing papers and manuals about health and disability. Publications include **HIV testing: a practical approach** which is a briefing paper on HIV counselling and laboratory testing.

HEART Consultancy
Quadenoord 2, 6871 NG Renkum, The Netherlands
Tel: 31 317 450468, fax: 31 317 450469, email: jh@heartware.nl, website: http://www.heartware.nl
Consultancy firm working in all aspects of healthcare technology management in developing countries. It also produces and supplies the PLAMAHS software package for managing the inventory, model lists, maintenance, and procurement needs for your healthcare technology stock. HEART also undertakes research and training, and produces publications on many aspects of sterilization for developing countries. It has developed a basic testkit for performance testing of sterilizers, and can identify suppliers that still manufacture basic sterilizers (manually operated/fuel heated).

HMSO (Her Majesty's Stationery Office)
Website: www.hmso.gov.uk
Publishers of material produced by departments of the UK government.

Humanitarian Information for All
c/o Human Info NGO vzw and Humanity CD Ltd, Oosterveldlaan 196, B-2610 Antwerp, Belgium
Fax: 32 3 449 75 74, email: humanity@humaninfo.org, website:
http://media.payson.tulane.edu:8086/cgi-bin/gw?e=t1c11copyrigh-mhl-1-T.1.B.21.1-500-50-00e&q=&a=p&p=home
The goal of this organization is to disseminate health care information free-of-charge in developing countries. Thus, their Medical and Health Library makes publications available on the internet. Refer to their homepage to find the large list of publications available.

Institution of Electrical Engineers (IEE)
Savoy Place, London, WC2R 0BL, UK
Tel: 44 207 240 1871, Fax: 44 207 240 7735, email: postmaster@iee.org, website: www.iee.org.uk
Largest professional engineering society in Europe with worldwide membership for those working in electronics, electrical, manufacturing and IT professions. Produces a wide range of publications, is a source of a wide range of information, and has a Healthcare Technologies Professional Network. Copies of their publications are available from IEE Publication Sales Department, Michael Faraday House, Six Mills Way, Stevenage, Herts, SG1 2AY, UK
Tel: 44 1438 767 328, fax: 44 1438 742 792, email: sales@iee.org.uk

Intermediate Technology Development Group (ITDG) and **ITDG Publishing**
The Schumacher Centre for Technology and Development, Bourton Hall, Bourton-on-Dunsmore, Rugby, CV23 9QZ, UK
Tel: 44 1926 634400, fax: 44 1926 634401, email: enquiries@itdg.org.uk, website: www.itdg.org
The Development Group is a charity concerned with the research and development of 'appropriate' technologies for application in developing countries. It has worked on topics such as alternative electrical supplies, access to water, disability aids, medical supplies. It also undertakes consultancies. The Publication Division produces and disseminates books and journals covering aspects of health, development, and appropriate technology. It can be contacted at:
Tel: 44 1926 634501, fax: 44 1926 634502, email: itpubs@itpubs.org.uk,
website: www.itdgpublishing.org.uk.

International Centre for Eye Health (ICEH)
International Resource Centre, Institute of Opthalmology, University College London, 11-43 Bath Street, London, EC1V 9EL, UK
Tel: 44 20 7608 69 23/10/06, fax: 44 20 7250 3207, email: eyeresource@ucl.ac.uk, website:
www.ucl.ac.uk/ioo
Advises and publishes information on all aspects of eye care including prevention of blindness. Produces the **Community eye health journal** distributed free to developing countries, an annual standard list of medicines, equipment, instruments and optical supplies for eye care for developing countries, and teaching slides/text sets and videos.

International Federation of Hospital Engineering (IFHE)
Website: http://home.enter.vg/ifhe/main.html
This body enables national engineering professional organizations to join in a world-wide federation. It encourages and facilitates exchange of information and experience in the broad field of hospital and healthcare facility design, construction, engineering, commissioning, maintenance, and estate management. It arranges an International Congress every two years at different locations, in conjunction with a healthcare trade exhibition. The reports of the papers presented at these congresses are sources of information on the changing requirements for many topics, such as sterilization, air flow control, waste management, equipment safety, etc. It publishes a newsletter.

International Society for Technology Assessment in Health Care (ISTAHC)
c/o Institute of Health Economics, 1200, 10405 Jasper Avenue, Edmonton, Alberta, Canada T5J 3N4
Tel: 780 448 4881, fax: 780 448 0018, email: info@HTAi.org, website: http://www.htai.org/
International non-profit body with regional branches, it researches and disseminates information concerning health technology assessment. It produces the International Journal of Technology Assessment in Health Care, and has a Special Interest Group on developing countries' issues:
International Society for Technology Assessment in Health Care – Special Interest Group (ISTAHC-SPIG), Health Technology Research Group, Medical Research Council (MRC), PO Box 19070, Tygerberg 7505, Cape Town, South Africa. Tel: 27 21 938 04 13, fax: 27 21 938 03 85.

Management Sciences for Health (MSH)
Development Office, and/or Publications Office, 165 Allandale Road, Boston MA 02130-3400, USA
Tel: 1 617 524 7799, fax: 1 617 524 2825, email: development@msh.org, website: www.msh.org
MSH undertakes consultancies with health care policy-makers, managers, providers, and clients to seek to increase the effectiveness, efficiency, and sustainability of health services by improving their management. MSH also publishes and distributes practical, experience-based books and tools in multiple languages for health and development professionals, managers and policy makers. Email: bookstore@msh.org, website: www.msh.org/publications

Medical Research Council South Africa (MRC-SA)
PO Box 19070, 7505 Tygerberg, South Africa
Tel: 27 21 9380911, fax: 27 21 9380200, email:info@mrc.ac.za, website: www.mrc.ac.za
The MRC-SA's mission is to improve the nation's health status and quality of life through relevant and excellent health research aimed at promoting equity and development. They have a WHO Collaborating Centre for Essential Technologies in Health, at website: www.mrc.ac.za/innovation/whocollaborating.htm

Medicines and Healthcare Regulatory Agency (MHRA)
Hannibal House, Elephant and Castle, London, SE1 6TQ, UK
Tel: 44 0207 972 8000, email: devices@mhra.gsi.gov.uk, website: www.mhra.gov.uk
Offers guidance, advice, and regulations on medical device quality, safety, performance, use, and standards.

MSc Envirohealth Products
25 Reedbuck Crescent, Corporate Park, PO Box 506, 15 Randjesfontein, Midrand 683, South Africa
Tel: 27 11 314 7540, fax: 27 11 314 7535, email: scaine@mweb.co.za
Contact for further information about the Medcin 400 Gas Incinerator, a pre-assembled incinerator designed for rural and small-scale health care waste management.

PAHO (Pan American Health Organization)
Pan American Sanitary Bureau, Regional Office of the World Health Organization, 525 Twenty-third Street, N.W. Washington, D.C. 20037, USA
Tel: 1 202 974-3000, fax: 1 202 974-3663, website: www.paho.org/
The Pan American Health Organization (PAHO) is an international public health agency working to improve health and living standards of the countries of the Americas. It also serves as the Regional Office for the Americas of the World Health Organization.Antonio Hernandez is the contact for healthcare technology issues, email: 1hernana@paho.org

Quality Assurance Research and Policy Development Group (QARPDG)
Philippine Health Insurance Corporation (PhilHealth), CityState Center, 709 Shaw Blvd., Brgy. Oranbo, 1600 Pasig City, Philippines
Fax: 632 637 9693, emailmadz_valera@yahoo.com, contact: Dr. Madeleine Valera (Vice President)
PhilHealth is a government owned and controlled corporation that was the main organizer of the 3rd Asian Regional Health Technology Assessment Conference in 2004, and is the source for the conference proceedings.

RS Components Ltd.
Birchington Road, Corby, Northants, NN17 9RS, UK
Tel: 44 1536 201234, fax: 44 1536 405678, email: general@rs-components.com, website: rswww.com
Supplier of equipment, supplies, parts, and components for a wide range of engineering professions such as electrical, electronic, mechanical, heating, ventilation, air-conditioning, plumbing, welding, pneumatics, computing, automotive. Also a source of textbooks, technical data books, technical literature, and training videos for all these engineering fields.

Source (International Information Support Centre)
The Wellcome Trust Building, Institute of Child Health, 30 Guildford Street, London, WC1N 1EH, UK
Tel: 44 20 7242 9789 ext 8698, fax: 44 20 7404 2062, email: source@ich.ucl.ac.uk,
website: www.asksource.info
The Source Centre has a unique collection of over 20,000 health and disability related information resources. These include books, manuals, reports, posters, videos, and CD-Roms. Many materials are from developing countries and include both published and unpublished literature.

SpaceLabs Medical Inc
15220 N.E. 40th Street, Redmond, WA 98052, USA
Tel: 1 206 882 3700, website: www.spacelabs.com/
Spacelabs Medical is a leading global provider of patient monitoring and clinical information systems. Their educational service produces a Biophysical Measurement Book Series for biomedical and clinical professionals

Swiss Centre for Development Cooperation in Technology and Management (SKAT).
Website: www.skat.ch/dc/publ/publ.htm
SKAT works internationally in the areas of water and sanitation, architecture and building, transport infrastructure, and urban development. They also publish the **SKAT newsletter**

Swiss Centre for International Health (SCIH)
Swiss Tropical Institute, Socinstrasse 57, PO Box, CH-4002 Basle, Switzerland
Tel: 41 61 284 82 79, fax: 41 61 271 86 54, email: martin.raab@unibas.ch,
website: www.sti.ch/francais/scih/scih.htm
Undertakes consultancies in healthcare technology management in developing countries and countries in transition.

TALC (Teaching Aids at Low Cost)
PO Box 49, St. Albans, Herts, AL1 5TX, UK
Tel: 44 1727 853869, fax: 44 1727 846852, email: talc@talcuk.org website: www.talcuk.org/
UK registered non-profit charity specialising in supplying affordable books, slides and teaching aids on health and community issues in developing countries, with a particular focus on materials for PHC and district levels.

Third World Network
email: twnet@po.jaring.my, website: www.twnside.org.sg
The Third World Network is an independent non-profit international network of organizations and individuals involved in development issues. Its website offers articles and position papers on a variety of subjects related to developing countries, including trade, health, biotechnology and bio-safety.

Transaid (Transport for Life)
137 Euston Road, London, NW1 2AA, UK
Tel: 44 20 7387 8136, fax: 44 20 7287 2669, email: info@transaid.org website: www.transaid.org
A charity working in the field of international transport management. Thus unique organization works with many sectors, including health, to ensure that transport resources are efficiently and effectively used. Their aim is to develop local capacity in transport and logistics management. They produce a newsletter **Hub and spoke**, and have developed the **Transaid transport management handbook**.

Tropical Health Technology (THT)
14 Bevills Close, Doddington, March, Cambridgeshire PE15 OTT, UK
Tel: 44 1354 740825, fax: 44 1354 740013, email: thtbooks@tht.ndirect.co.uk, website: www.tht.ndirect.co.uk
Charity concerned with supporting and improving laboratory services in the developing world. Primary focus is laboratory services, information and technology. Specializes in supply of laboratory equipment, books, bench aids, slide sets and microscopes.

UNICEF (United Nations Children's Fund)
UNICEF House, 3 UN Plaza, New York 10017, USA
Tel: 1 212 326 7000, fax: 1 212 887 7454, email: jando@unicef.org, website: www.unicef.org
It provides a wide range or resource materials, journals, books and videos, games and posters for children's programmes. Your regional or field office will offer advice on all aspects of child health care and UNICEF materials – contact details are on the website. The goods contained in UNICEF's **Supply catalogue** are supplied by the UNICEF Supply Division, UNICEF Plads, Freeport, 2100 Copenhagen OE, Denmark. Tel: 45 3527 3527, fax: 45 3526 9421, email: supply@unicef.org.

World Bank (WB)
www.worldbank.org
One of the world's largest sources of development assistance including health, nutrition and population projects

World Council of Churches (WCC)
PO Box 2100, 1211 Geneva, Switzerland
Tel: 41 22 791 6111, fax: 41 22 791 0361, email: info@wcc-coe.org, website: www.wcc-coe.org
International fellowship of churches that produces publications and newsletters. Recent publications include **Guidelines on medical equipment donations**.

World Health Organization (WHO)
20 Avenue Appia, CH-1211 Geneva 27, Switzerland
Tel: 41 22 791 2476 or 2477, fax: 41 22 791 4857, website: www.who.int/en/
WHO offers advice, and undertakes programmes, on all aspects of health care. Contact your regional or field office for advice on all aspects of health care and WHO materials - the addresses of the regional offices worldwide are available on the website.

i. WHO has programmes and literature on many aspects of healthcare technology management. Andrei Issakov, Coordinator of Health Technology and Facilities Planning and Management, is the contact, and source of WHO literature on healthcare technology management that is not available as published documents, email: issakova@who.int.
ii. WHO produces and distributes books, manuals, journals, practical guidelines and technical documents, several include aspects of healthcare technology management. The Distribution and Sales Office is the contact point for information on WHO publications, email: publications@who.ch, website: www.who.int/publications/en/. To order WHO publications use email: bookorders@who.int.
iii. WHO has a comprehensive library and information service on international public health literature. Contact email: library@who.int. The WHO library catalogue has electronic access to more than 4000 technical documents, use website: www.who.int/library.
iv. WHO produces many newsletters, for a list contact website: www.who.int/library/reference/information/newsletters/index.en.shtml

Ziken International Consultants Ltd
Causeway House, 46 Malling Street, Lewes, E.Sussex, BN7 2RH, UK
Tel: 44 1273 477474, fax: 44 1273 478466, email: info@ziken.co.uk, website: www.ziken.co.uk
A consultancy organization working worldwide in many aspects of health care development, including healthcare technology management.

See *Guide 1 or 5* for information on training institutes and international professional bodies for different aspects of clinical and hospital engineering. Also see all other Guides in the Series for journals and training resources specific to the topics covered by each Guide.

ANNEX 3: TYPICAL EQUIPMENT LIFETIMES

Different organizations have tried to estimate typical equipment lifetimes for healthcare technology. This annex contains the results from two different sources – the American Hospital Association, and the GTZ (German Government Technical Aid Agency).

LIST 1: The American Hospital Association (AHA)

Source: American Hospital Asso.ciation, 1998, 'Estimated Useful Lives of Depreciable Hospital Assets', American Hospital Association, Chicago, USA

The AHA's extensive list reflects how equipment lasts within the United States' healthcare system, whether it was manufactured in the US or abroad.

Their list was compiled following:

- discussions with manufacturers of healthcare equipment
- discussions with various hospital department managers
- analysis of actual retirement practices for actual hospital assets.

Their list is made up of a series of tables of different categories of equipment determined by the equipment's role in the health facility.

Part One: Estimated Useful Lives of Land Improvements, Buildings, and Fixed Equipment

Table 1: Land Improvements

Land improvements are assets of an above-ground or below-ground nature, found in the land area contiguous to and designed for serving a health care facility. The asset cost would include a proportionate share of architectural, consulting, and interest expense for newly constructed or renovated facilities.

Item	Years
Bumpers	5
Culverts	18
Fencing	
Brick or stone	25
Chain-link	15
Wire	5
Wood	8
Flagpole	20
Guard rails	15
Heated pavement	10
Landscaping	10
Lawn sprinkler system	15
Parking lot, open-wall	20
Parking lot gate/s	3
Parking lot striping	2
Paving (including roadways, walks,and parking)	
Asphalt	8
Paving (including roadways, walks, and parking) (continued)	
Brick	20
Concrete	15
Gravel	5
Retaining wall	20
Shrubs and lawns	5
Signs, metal or electric	10
Snow-melting system	5
Trees	20
Turf, artificial	5
Underground utilities	
Sewer lines	25
Water lines	25
Waste water treatment system	20
Water wells	25
Yard lighting	15

Table 2: Buildings

Buildings are structures consisting of building shell, exterior walls, interior framings, walls, floors, and ceilings. The asset cost would include a proportionate share of architectural, consulting, and interest expense for newly constructed or renovated facilities. In assigning the estimated useful lives in this table, the following factors were considered: the type of construction, the functional utility of the structure, recent regulatory or environmental changes, and the general volatility of the health care field.

Item	Years
Boiler house	30
Garage	
Masonry	25
Wood frame	15
Guardhouse	15
Masonry building, reinforced concrete frame	40
Masonry building, steel frame	
Fireproofed	40
Nonfireproofed	30
Masonry building, wood/metal frame	25
Metal-clad building	20
Multilevel parking structure	25
Reinforced concrete building, common design	40
Residence	
Masonry	25
Wood frame	25
Storage building	
Masonry	25
Metal garden-type	10
Wood frame	20

Table 3: Building Components

Building components are assets that are a part of the building shell or interior construction. The asset cost would include a proportionate share of architectural, consulting, and interest expense.

Item	Years
Canopies	15
Carpentry work	15
Caulking	5
Sealants	5
Ceiling finishes	
Acoustical	8
Gypsum	10
Plaster	12
Computer flooring	10
Corner guards	10
Cubicle tracks	10
Designation signs	5
Doors and frames	
Automatic	10
Hollow metal	20
Wood	15
Drapery tracks	10
Drilled piers	40
Floor finishes	
Carpet	5
Ceramic	20
Concrete	20
Hardwood	10
Floor finishes (continued)	
Quarry	20
Sealer	5
Terrazzo	15
Vinyl	10
Folding partitions	10
Loading dock bumpers and levelers	10
Magnetic/MRI shielding	10
Millwork	15
Overhead doors	10
Partitions, interior	15
Partitions, toilet	15
Railings	
Freestanding (exterior)	15
Handrails (interior)	15
Roof covering	10
Skylights	20
Storefront construction	20
Wall covering	
Paint	5
Wallpaper	5
X-ray protection	10

Table 4: Fixed Equipment

Fixed equipment includes assets that are permanently affixed to the building structure and are not subject to movement but have shorter useful lives than that of the building. The asset cost would include a proportionate share of architectural, consulting, and interest expense.

Item	Years	Item	Years
Benches, bins, cabinets, counters, and shelving, built-in	15	Laminar flow system	15
Cabinet, biological safety	15	Lockers, built-in	15
Canopy-ventilating for laundry ironer	15	Mailboxes, built-in	20
Central dictation system	10	Medicine preparation station	15
Coat rack	20	Mirrors, traffic and/or wall mounted	10
Conveyor system, laundry	10	Narcotics safe	20
Cooler, walk-in	15	Nurses' counter, built-in	15
Curtains and drapes	5	Pass-through boxes	15
Emergency generator set	20	Patients' consoles	15
Generator controls	12	Patients' wardrobes and vanities, built-in	15
Hood, fume	15	Projection screens	10
Fire protection in hoods	10	Sink and drainboard	20
ICU and CCU counters	15	Sterilizer, built-in	15
Illuminator		Telephone enclosure	10
Multifilm	10		
Single	10		

Table 5: Building Services Equipment (overleaf)

Building services equipment refers to mechanical components or systems designed for the building(s), including air conditioning, electrical elevators, heating lighting plumbing sprinklers, and ventilating. The asset cost would include a proportionate share of architectural, consulting and interest expense for newly constructed or renovated facilities.

Item	Years
Air-condition equipment	
Centrifugal chiller	15
Compressor, air	15
Condensate tank	10
Condenser	15
Controls	10
Cooler and dehumidifier	10
Cooling tower, concrete	20
Wood	10
Duct work	20
Fan, air-handling and ventilating	20
Metal	20
Piping	20
Precipitator	10
Pump	10
Air-conditioning system	
Large (over 20 tons)	10
Medium (5-20 tons)	10
Small (under 5 tons)	5
Air curtain	15
Antenna system	10
Boiler	20
Deaerator system	15
Boiler smokestack, metal	20
Clean-air equipment	15
Clock system, central	15
Co-generation plant, generator powered	15
Door alarm	10
Door-closing devices, for fire alarm system	15
Electric lighting and power	
Composite	18
Conduit and wiring	20
Emergency lighting system	15
Feed wiring	20
Fixtures	10
Switch gear	15
Transformer	30
Elevator	
Dumbwaiter	20
Freight	20
Passenger, high-speed automatic	20
Passenger, other	20
Emergency generator	20
Controls	12
Energy management system, computer based	10
Escalator	20
Fans, ceiling-mounted	10

Item	Years
Fire protection system	
Fire alarm system	10
Fire pump	20
Smoke and heat detectors	10
Sprinkler system	25
Tank and tower	25
Furnace, domestic	15
Heating, ventilating, and air conditioning (composite system)	15
Heat pump system	10
Humidifier	15
Incinerator, indoor	10
Insulation, pipe	15
Intercom system	10
Laboratory plumbing, piping	20
Magnetic door holders	10
Medical gas system (composite system)	15
Nurse call system	10
Oil storage tank	20
Oxygen, gas, and air piping	20
Paging system	20
Physicians' in-and-out register, built-in	10
Plumbing, composite	20
Fixtures	20
Piping	25
Pump	15
Pneumatic tube system	15
Radiator	
Cast-iron	25
Finned tube	15
Sewerage, composite	25
Piping	20
Sump pump and sewerage ejector	10
Solar heating equipment	10
Surge suppression system	15
Telephone system	10
Television antenna system	10
Television satellite dish	10
Temperature controls, computerised	10
Unit heater	10
Vacuum cleaning system	15
Water fountain	10
Water heater, commercial	10
Water purifier	10
Water softener	10
Water storage tank	20
Water wells	25

Part Two: Estimated Useful Lives of Major Movable Equipment

Major movable equipment is defined as assets that are generally assigned to a specific department within the health care facility, but with the capacity of being relocated. The assets have a minimum useful life of at least three years and a unit cost sufficiently large to justify the expense of maintaining an equipment ledger.

Note: Included within the departmental listings are assets that may be considered to be minor equipment (for example, surgical instruments with a three-year life assignment). Minor equipment may be defined as assets that are relatively small in size and unit cost and have high usage. They are generally found in the obstetrics, surgery, and dietary departments.

Table 6: Administrative Departments

Administrative Departments consist of administration, barber shop, board room, admitting, business office, communications, data processing, education, facilities management, finance, foundation, graphics, home health, human resources infection control, library, lobby, marketing, medical education, medical records, medical staff facilities, nursing administration, pastoral care, patient education, physician on-call rooms, public relations, quality assessment and improvement, social services, and volunteer services departments.

Item	Years
Beepers, paging	3
Bench, metal or wood	15
Binder, punch machine	10
Bookcase, metal or wood	20
Bulletin board	10
Cabinet file, metal or wood	15
Camera	5
Cathode-ray tube (CRT)	3
Chair	
Arm	15
Conference	15
Executive	15
Folding	10
Guest	15
Side	15
Check signer	10
Clock	10
Collator, electric	10
Computer	
Laptop	3
Large	5
Micro	5
Mini (personal)	3
Computer disk drive	5
Computer networking equipment	
Controller	5
Hub	5
Modem	5
Mux unit	5
Server	5
Token ring	5
Computer printer	5
Computer software	3
Computer terminal	5
Credenza	15
Data printing unit	5
Data storage unit	
Mechanical	10
Nonmechanical	15
Data tape processing unit (including controller, drive, and tape deck)	5
Desk, metal or wood	20
Dictating equipment	5
Display cases	20
Duplicator	5
Facsimile transmitter	3
Files	15
Electric rotary	15
Legal	15
Regular	15
Filing system, portable	20
Imprinter	
Address	5
Embossed plate	10
Integrator	10
Intercom	10
Label maker	10
Library furniture	20
Mailing machine	10
Microfilm unit	10

Continued overleaf

Table 6: Administrative Departments (continued)

Item	Years
Microphone	5
Microprojector	10
Organ	10
Paper burster	8
Paper cutter	10
Paper shredder	5
Paper shredder	5
Partitions, movable office	10
Photocopier	
Small	3
Large	5
Piano	20
Projector	
Overhead	10
Slide	10
Video	5
Recorder, tape	5
Safe	20
Scale, postal	10
Screen, projector	10
Settee	12
Shelving, portable, steel	20
Sofa	12
Stamp Machine	10
Stapler, electric or air	10
Stencil machine	10
Stereo equipment	5
Table	
Folding	10
Metal or wood	15
Television receiver	5
Time recording equipment	10
Transcribing equipment	5
Typewriter, electric	5
Valet, office	15
Video cassette recorder/player	5
Walkie-talkie	5
Water cooler, bottle	10
Word processor	
Large	5
Small	5
Work station	10

Table 7: Nursing Departments

Nursing departments consist of cardiac care, chemical dependency, intensive care, medical/surgical care, neonatal intensive care, nursery, pediatrics, pediatric developmental disabilities, and psychiatric units.

Item	Years
Bassinet	15
Bath	
Sitz	10
Whirlpool	10
Bed	
Birthing	15
Electric	12
Flotation therapy	10
Hydraulic	15
Labor	15
Manual	15
Orthopedic	15
Bench, metal or wood	15
Bin, metal or wood	15
Blood pressure device, electronic	6
Bookcase, metal	20
Cabinet	
Bedside	15
File	15
Instrument	15
Metal or wood	15
Pharmacy	15
Solution	15
X-ray	15
Central supply furniture	15
Chair	
Blood drawing	10
Dental	15
Executive	15
Folding	10
Geriatric	10
Hydraulic, surgeon's	15

Continued opposite

Table 7: Nursing Departments (continued)

Item	Years
Chair (continued	
Kinetron	15
Podiatric	15
Shower/bath	10
Specialist's	15
Chart rack	20
Chart recorder	10
Clothes locker	
Fibreglass or metal	15
Liminate or wood	12
Computer, caridial output	5
Credenza	15
Crib	15
Croupette	10
Defibrillator	5
Desk, metal or wood	20
Doppler	5
Dresser	15
Food service furniture	15
Frame, turning	15
Housekeeping furniture	15
ICU and CCU furniture	15
Infant care center	10
In-service education furniture	15
Insufflator	5
Labor and delivery furniture	15
Laboratory furniture	15
Lamp	
Bilirubin	10
Emergency	10
Lawn and patio furniture	5
Light	
Delivery	15
Examining	10
Portable, emergency	10
Natural childbirth backrest	10
Nursing service furniture	15
Operating room furniture	15
Operating stool	15
Ophthalmoscope	10
Osmometer	7
Otoscope	7
Ottoman	10
Patient monitoring equipment	10
Phototherapy unit	10
Physicians' in-and-out register, portable	10
Physiological monitor	7
Pump, breast	10
Scale, baby	15
Settee	12
Shelving, portable, steel	20
Sofa	12
Stall Bars	15
Table	
Anesthetic	15
Autopsy	20
Electrohydraulic tilt	10
Examining	15
Folding	10
Food preparation	15
Fracture	15
Instrument	15
Light	15
Metal	15
Obstetrical	20
Operating	15
Orthopedic	10
Overbed	15
Pool	10
Refrigerated	10
Therapy	15
Traction	10
Urological	15
Wood	15
Telemetry unit, cardiac	5
Thermometer, electric	5
Ultrasonic fetal heart monitor	7
Work station	10

Table 8: Diagnostic and Treatment Departments

Diagnostic and treatment departments consist of ambulatory surgery, anesthesia, cardiac rehabilitation, catheterization laboratory, CT scan, ECT, EEG/EMG, emergency, employee health, enterostomal therapy, GI laboratory, hemodialysis, hyperbaric medicine, in vitro medicine, IV therapy, inpatient pharmacy, laboratory, lithotripsy, mobile air care, medical oncology, MRI, noninvasive cardiology, obstetrics, occupational therapy, physical therapy, postanesthesia care unit, radiation therapy, radiology, respiratory therapy, speech therapy, and surgery departments.

Item	Years
Accelerator	7
Alternating pressure pad	10
Amino acid analyzer	7
Amplifier	10
Anaerobe chamber	15
Analyzer, haematology	7
Anatomical model	10
Anesthesia unit	7
Ankle exerciser	15
Apnea monitor	7
Apron, lead-lined	47
Arthroscope	5
Arthroscopy instrumentation	3
Aspirator	10
Audiometer	10
Autoclave	10
Autoscaler, ionic	10
Bacteriology analyzer	8
Baci incinerator	5
Balance	
Analytical	10
Electronic	7
Precision mechanical	10
Basal metabolism unit	8
Bath	
Fluidotherapy	7
Paraffin	7
Serological	7
Water	7
Biochemical analysis unit	7
Biochromatic analyzer	7
Biofeedback machine	8
Biomagnetometer	7
Bipolar coagulator	7
Blood cell counter	5
Blood chemistry analyzer, automated	5
Blood culture analyzer	8
Blood gas analyzer	5
Blood gas apparatus, volumetrics	8
Blood transfusion apparatus	6
Blood warmer	7
Blood warmer coil	7
Bone surgery apparatus	3
Breathing unit, positive-pressure	8
Bronchoscope	
Flexible	3
Rigid	3
Carbon monoxide recorder/detector	10
Cardiac monitor	5
Cardioscope	8
Cart	
Emergency-isolation	10
Medicine	10
Caspar ACF instrument and plate system	7
Cassette changer	8
Cautery unit	
Dermatology	7
Gynecology	7
Cell freezer	7
Cell washer	5
Centrifuge	7
Centrifuge, refrigerated	5
Cerebral function monitor	7
Child immobilizer	15
Chloridiometer	10
Chromatograph, gas	7
Clinical analyzer	5
Clopay wrapping machine	10
Coagulation analyzer	5
Cold-pack unit, floor	10
Colonoscope	3
Colorimeter	7
Colposcope, with floor stand	8
Computer, clinical	5

Continued opposite

Table 8: Diagnostic and Treatment Departments (continued)

Item	Years
Computer-assisted tomography (CT) scanner	5
Conductivity tester	5
CO-oximeter	10
Cryoopthalmic unit, with probes	7
Cryostat	7
Cryosurgical unit	10
Cyclotron	7
Cystic fibrosis treatment system	10
Cystometer	10
Cystometrogram unit	10
Cystoscope	3
Decalcifier	10
Deionized water system	7
Densitometer, recording	5
Dental drill, with syringe	3
Dermatome	10
Diagnostic set	10
Diathermy unit	10
Digital fluoroscopy unit	5
Digital radiography unit	5
Diluter	10
Dispenser, alcohol	10
Distilling apparatus	15
Doppler	5
Dose calibrator	5
Dryer, sonic	10
Duodenoscope	3
Echocardiograph system	5
Echoview system	5
Electrocardiograph	7
Electrocardioscanner (Holter monitor scanner)	7
Electroencephalograph	7
Electrolyte analyzer	5
Electromyograph	7
Electrophoresis unit	7
Electrosurgical unit	7
Ergometer	10
Evacuator	10
Evoked potential unit	10
Exercise apparatus	15
Exercise equipment, outdoor	10
Exercise system, computer assisted	5
Exerciser, orthotron	10
Eye surgery equipment (phacoemulsifier)	7
Fiberoptic equipment	5
Fibrometer	7
Film changer	8
Film viewer	10
Flow cytometer	5
Fluid sample handler	5
Fluorimeter	10
Fluoroscope	8
Frame, turning	15
Furnace, laboratory	10
Gamma camera	5
Gamma counter	7
Gamma knife	10
Gamma well system	7
Gas analyzer	8
Gastroscope	3
Geiger counter	10
Generator	5
Gloves, lead-lined	3
Hand dynamometer	10
Heart-lung system	8
Heat sealer	5
Hemodialysis unit	5
Hemoglobinometer	7
Hemophotometer	10
High-density mobile film system	10
Holter	
Electrocardiograph	7
Electroencephalograph	7
Homogenizer	10
Hood, exhaust or Bacti	10
Hydrocollator	10
Hydrotherapy equipment	15
Hyfrecator	10
Hyperbaric chamber	15
Hypothermia apparatus	10
Image analyzer	5

Continued overleaf

Table 8: Diagnostic and Treatment Departments (continued)

Item	Years
Image intensifier	5
Immunodiffusion equipment	10
IMX analyzer	7
Incubator, laboratory	10
Inhalator	10
Intraarterial shaver	10
Iontophoresis unit	8
Isodensitometer	7
Isolation chamber	12
Isotope equipment	7
Isotope scanner	7
Kiln	10
K-pads	5
Kymograph	10
Lamp	
Deep-therapy	10
Infrared	10
Mercury quartz	10
Slit	10
Laparoscope	3
Laryngoscope	3
Laser, coronary	2
Laser, surgical	5
Laser positioner	5
Laser smoke evacuator	5
Lifter, patient	10
Linac scalpel	5
Linear accelerator	7
Lithotripter, extracorporeal shock-wave (ESWL)	5
Magnetic resonance imaging (MRI) equipment	5
Mammography unit	
Fixed	5
Mobile (van)	8
Marograph	7
Mass spectrophotometer	7
Microbiology analyzer	8
Microscope	7
Microtome	7
Microtron power system	7
Mirror, therapy	15
Muscle stimulator	10
Nebulizer	
Pneumatic	10
Ultrasonic	10
Nephroscope	7
Neurological surgical table headrest	10
Neutron beam accelerator	8
Noninvasive CO2 monitor	7
Optical readers	5
Orthotron system	10
Orthourological instruments	10
Oscilloscope	7
Oven	
Paraffin	10
Sterilizing	10
Oximeter	10
Oxygen analyzer	7
Oxygen tank, motor, and truck	8
Pacemaker, cardiac (external)	5
Pacing system analyzer	7
Panendoscope	10
Parallel bars	15
Pelviscope	7
Percussor	5
Perforator	10
Peripheral analyzer	10
pH gas analyzer	10
pH meter	10
Phonocardiograph	8
Photocoagulator	10
Photography apparatus, gross pathology	10
Photometer	8
Physioscope	10
Pipette, automatic	10
Plasma freezer	10
Platelet rotator	20
Positron emission tomography (PET) scanner	5
Proctoscope	3
Prothrombin timer, automated	8
Proton beam accelerator	7
Pulmonary function analyzer	8

Continued opposite

Table 8: Diagnostic and Treatment Departments (continued)

Item	Years
Pulmonary function equipment	8
Pulsed oxygen chamber	10
Pulse oxymeter	7
Pump	
Infusion	10
Stomach	10
Suction	10
Surgical	10
Vacuum	10
Radiation meter	8
Radioactive source, cobalt	5
Radiographic duplicating printer	8
Radiographic-fluoroscopic combination	5
Radiographic head unit	5
Rate meter, dual	10
Refractometer	10
Refrigerator, blood bank	10
Resuscitator	10
Retractor	5
Rhinoscope	3
Rinser, sonic	10
Rotoosteotome unit	10
Saw	
Autopsy	10
Neurosurgical	10
Surgical, electric	10
Scale	
Bed	10
Chair	10
Clinical	10
Scale, metabolic	10
Scintillation scaler	8
Sensitometer	10
Seriograph, automatic	8
Shaking machine (vortexer)	8
Sharpener, microtome knife	10
Sigmoidoscope	3
Signal-averaged EKG	5
Simulator	5
Single-photon emission computed tomography (SPECT) Scanner	5
Sinuscope	7
Skelton	10
Slide stainer, laboratory	7
Spectrophotometer	8
Spectroscope	10
Sphygmomanometer	10
Spirometer	8
Stand	
Basin	15
Intravenous	15
Irrigating	15
Mayo	15
Steam-pack equipment	10
Stereo tactic frame	5
Sterilizer, movable	12
Steris sterilization system	7
Stethoscope	5
Stress tester	10
Stretcher	10
Hydraulic	7
Surgical shaver	5
Tank	
Cleaning	10
Full-body	15
Hot-water	10
Therapy	15
TDX analyzer	7
Telemetry unit, cardiac	5
Telescope, microlens	10
Telescopic shoulder wheel	15
Telethermometer	10
Tent	
Aerosol	8
Oxygen	8
Thyroid uptake system	5
Tissue-embedding center	8
Tissue processor	7
Titrator, automatic	10
Tonometer	10
Totalap	10
Tourniquet, automatic	10
Tourniquet system	7
Traction unit	10
Transcutaneous nerve stimulator system	5
Transesophageal transducer	5

Continued overleaf

Table 8: Diagnostic and Treatment Departments (continued)

Item	Years
Treadmill, electric	8
Tube dryer	10
Tube tester	10
Ultrasound, diagnostic	5
Ultrasound unit, therapeutic	7
Vacuvette	10
Ventilator, respiratory	10
Vial filler	10
Vibrator	10
Video	
Camera	5
Light source	5
Monitor	5
Printer	5
Wheelchair	5
X-ray equipment	
Developing tank	10
Film dryer	8
Film processor	8
Furniture	15
Image intensifier	5
Intensifying screens	5
Silver recovery unit	7
X-ray unit	
Fluoroscopic	5
Mobile	5
Radiographic	5
Superficial therapy	5
Tomographic	5
Wiring	5

Table 9: Support Departments

Support departments consist of biomedical engineering, central sterile supply, dietary, engineering/maintenance, housekeeping/environmental services, laundry, materials management, security, and staff facilities departments.

Item	Years
Air conditioner, window	5
Ambulance	4
Automobile	
Delivery	4
Passenger	4
Battery charger	5
Bedpan washer	15
Blanket dryer	15
Blanket warmer	15
Bottle washer	10
Broiler	10
Burnisher, silverware	15
Cage, animal	10
Camera, identification	5
Camera, surgical	5
Camera, television monitoring, color or black-and-white	5
Camera, videotape, color or black-and-white	5
Can opener, electric	10
Capsule machine	10
Cart	
Food/tray, heated-refrigerated	10
Linen	10
Maid	10
Supply	10
Utility	10
Cash register	5
Central data processing unit	10
Clock	10
Coffee maker	5
Compactor, waste	10
Compressor, air	12
Conveyor, tray	10
Cooker, pressure, for food	10
Cooler, walk-in, freestanding	15
Cutter, cloth, electric	10
Cutter, food	10
Dish sterilizer	10
Dishwasher	10
Disinfector	15

Continued opposite

Table 9: Support Departments (continued)

Item	Years
Dispenser	
Butter, refrigerated	10
Milk or cream	10
Drill press	20
Dryer	
Clothes	10
Hair	5
Drying oven, paint shop	10
Enlarger	10
Extractor, laundry	15
Floor-buffing and polishing machine	5
Floor-scrubbing machine	5
Floor-waxing machine	5
Folder, flatwork	15
Food chopper	10
Freezer, ultracold	10
Fryer, deep-fat	10
Garbage disposal, commercial	5
Glassware washer	8
Griddle	10
Grinder, food waste	10
Helicopter	4
Hoist, chain or cable	15
Hot-food box	15
Hotplate	5
Humidifier	8
Ice cream freezer	10
Ice cream (soft) machine	10
Ice cream storage cabinet	10
Ice cube-making equipment	10
Indicator, remote	10
Intercom	10
Ironer, flatwork	15
Kettle, steam-jacketed	15
Key machine	10
Laminator	10
Lathe	15
Lawn mower, power	3
Linen press	15
Linen table	15
Linen washer	15
Lint collector	15
Loom	15
Lowerator	10
Mannequin	10
Marking machine	10
Meat chopper	10
Mixer, commercial	10
Nourishment ice station	8
Oven	
Baking	10
Microwave	5
Roasting	10
Packaging machine	10
Platform	12
Paint spray booth	15
Paint-spraying machine	10
Paper baler	15
Parking lot sweeper	5
Pipe cutter-threader	10
Planer and shaper, electric	10
Plate-bending press	10
Platemaker	
Computerized	5
Noncomputerized	10
Popcorn machine	8
Power supply	10
Press, laundry	15
Printing press	10
Range, domestic	10
Refrigerator	
Domestic	8
Commercial	10
Undercounter	10
Remote control receiver	10
Rotary tiller	10
Sanitizer	10
Saw	
Band	10
Bench, electric	10
Meat-cutting	10
Scaffold	10
Scale, laundry	
Movable	10
Platform	15

Continued overleaf

Table 9: Support Departments (continued)

Item	Years
Sewing machine	15
Shears, squaring, floor	12
Shoulder wheel	20
Simulator	5
Slicer	
Bread	10
Meat	10
Snowblower	5
Steamer, vegetable	10
Telephone, cordless	5
Telephone equipment for deaf	5
Telephone monitors	10
Telephone system	10
Television monitor	5
Television receiver	5
Toaster, commercial	10
Tractor	10
Truck (automotive)	
Forklift	10
Multipurpose filling	15
Pickup	4
Van	4
Truck (hand)	
Hot-food	10
Tray	12
Ultrasonic cleaner	10
Urn, coffee	10
Vacuum cleaner	8
Vegetable peeler, electric	10
Vending machine	10
Vise, large bench	20
Warmer	
Dish	10
Food	10
Washing machine	
Commercial, small	10
Domestic	10
Linen, large	15
Welder	10
Wire tightener-twister	10

LIST 2: The GTZ (German Government Technical Aid Agency)

Source: Halbwachs, H (GTZ), 2000, 'Maintenance and the Life Expectancy of Healthcare Equipment in Developing Economies', in Health Estate Journal, March 2000, pp 26-31

The GTZ list contains estimates for fewer equipment items, but it more closely reflects the realities in developing countries.

The GTZ used a particular research method (a Delphi survey – see source paper) to obtain and analyze feedback from 23 experts from 16 different country backgrounds. The experts were made up of hospital engineers, bio-medical engineers, a public health doctor/manager, health physicists, and a health economist. Rather than providing exact lifetimes, this approach provides a range for the lifetime that depends on the quality of the initial equipment and how well it has been maintained.

Reproduced here is a table containing a summary of their findings.

Table Summarizing GTZ's Findings

Equipment type	Lifetime in years			
	Poor quality makes		Good quality makes	
	Poorly maintained	Well maintained	Poorly maintained	Well maintained
Air-conditioner (window type)	3	5 – 7	5 – 6	10 – 12
Anaesthetic machine (Boyles)	2 – 5	5 – 10	5 – 10	10 – 15
Centrifuge	3 – 4	7 – 8	6 – 9	10 – 12
Generator (diesel)	3 – 6	9 – 10	10 – 12	18 – 20
Generator (petrol)	2 – 5	5 – 10	6 – 15	10 – 20
Microscope	3 – 6	5 – 10	6 – 10	10 – 20
Oven, hot air (laboratory)	2 – 6	5 – 8	6 – 10	10 – 15
Refrigerator (electrical)	3 – 5	5 – 8	5 – 8	10 – 15
Refrigerator (kerosene)	4	4 – 8	5 – 10	10 – 17
Sphygmomanometer (aneroid)	1 – 3	2 – 3	2 – 5	5 – 10
Sphygmomanometer (mercury)	1 – 2	3 – 5	3 - 5	8 – 10
Sterilizer, bench-top (horizontal)	3 – 5	5 – 8	6 – 10	10 – 14
Sterilizer, floor-standing (vertical)	3 – 6	5 – 12	8	14 – 15
Suction pump (electrical)	1 – 3	5 – 7	5 – 8	10 – 15
Truck, pick-up	2 – 4	3 – 6	4 – 8	7 – 12
Washing machine (electrical)	2 – 4	5	6	8 – 11

ANNEX 4: SAMPLE LONG GENERIC EQUIPMENT SPECIFICATION

This annex contains an example of a long generic specification. In *Guide 3* there is an example of a shorter one, for an operating table.

SPECIFICATION FOR AN INFANT INCUBATOR

1. APPLICABLE DOCUMENTS

The specification should be read in conjunction with the 'Technical and Environmental Data Sheet', and all goods offered must conform to the details specified in it and be able to function in the prevailing conditions described.

2. REQUIREMENTS

2.1 GENERAL DESCRIPTION

To supply: ONE x unit to provide a suitable environment conducive for nursing ill, premature, and under weight babies.

2.2 OPERATIONAL REQUIREMENTS

Note: supplier to complete 'Reply' and 'Remarks' sections.

		Reply	Remarks
2.2.1	There shall be a trolley base with four swivel wheels, at least two lockable.		
2.2.2	The incubator shall fit securely onto the trolley.		
2.2.3	The incubator base shall house the power compartment, fan and humidifier tank.		
2.2.4	The infant compartment shall have a base, mounted above the humidifier tank and fan, which is large enough to allow the unimpeded handling of the infant. Base shall have smooth, easy to clean surfaces		
2.2.5	The baby tray shall be mounted on the infant compartment base and shall be tilt-able, (Trendelenburg and reverse).		
2.26	The baby tray shall be graduated along its length for measuring the infant		
2.2.7	The mattress will fit onto the baby tray, be approximately 20mm thick, be not less than 64cm x 36cm and have a removable cover.		
2.2.8	The infant compartment shall have a transparent canopy that forms four sides and the roof.		

Continued opposite

2.2 OPERATIONAL REQUIREMENTS (continued)

2.2.9	The canopy shall be hinged along one side so that it can be swung up to provide free access to the bed.		
2.2.10	The canopy shall be designed or secured so that it is prevented from falling accidentally from the open position		
2.2.11	The canopy shall be sealed to the frame by means of a non-porous rubber or plastic gasket.		
2.2.12	The canopy shall be fitted with a drop down (or swivel) access panel to allow the mattress to be brought forward.		
2.2.13	The canopy shall have five port doors, two on each side and one at the front. They shall be hinged doors or fitted with an iris-diaphragm type plastic cover. All hand ports shall not be less than 127mm in diameter.		
2.2.14	All openings with hinged doors shall have closing latches.		
2.2.15	The air shall be drawn into the incubator through an easily removable bacteria filter capable of removing, with an efficiency of 99%, particles of the size down to 0.5 micron diameter		
2.2.16	The air shall be circulated by means of a fan.		
2.2.17	The circulated air shall maintain slight positive pressure in the infant compartment such that enough stale air escapes from the hood to prevent an undesirable and dangerous carbon dioxide accumulation inside blood.		
2.2.18	The hood shall have inlet holes for access by oxygen and feeding tubes.		
2.2.19	The power compartment shall be of modular construction and such that it can be withdrawn for maintenance.		
2.2.20	The power compartment will house a control panel containing: - On/off switch Temperature display (digital) Temperature display knob (manual) High temperature alarm Power failure alarm Air flow alarm Heat out-put indicator, "heat is on".		

Continued overleaf

2.2 OPERATIONAL REQUIREMENTS (continued)

2.2.21	There will be an air temperature sensor mounted on the inside of the canopy.		
2.2.22	The incubator shall be equipped with heating elements of the totally enclosed metal-clad type and a thermostat capable of controlling the temperature in the infant compartment over a specific temperature range.		
2.2.23	The incubator shall be equipped with a reliable pre-set high temperature cut-out that operates completely independently from the thermostat and that disconnects the heating circuit from the electricity supply if, as a result of heating from any source (including direct sunlight or nearby heaters), the temperature in the infant compartment exceeds 39 degrees Celsius. Any relay forming part of this circuit shall be arranged to be fail-safe.		
2.2.24	Temperature range of 34-39 degrees Celsius, in increments of 0.1 degree.		
2.2.25	At any setting of the thermostat, the temperature overshoot during the warming-up period, relative to the steady temperature reached, shall not exceed 1 degree Celsius.		
2.2.26	The airflow alarm shall be activated if the airflow is obstructed (due to fan failure or total air circulation failure). The activation of the alarm shall cause a cut off of the heating elements. It shall be mains operated audible and visual.		
2.2.27	The high temperature alarm shall be activated if air temperature in the canopy exceeds 39 degrees Celsius. It shall be mains operated audible and visual.		
2.2.28	The power failure alarm shall give warning of any interruption of the electric power supply to the incubator. The alarm shall be operated from a battery of the nickel cadmium type that is housed in the power compartment and is continuously trickle charged when the power is switched on. The alarm shall be audible and visual.		
2.2.29	Single phase power supply of 220-240 Vac, 50Hz.		
2.2.30	To be able to withstand mains supply voltage fluctuations of +/- 10%, and mains supply frequency fluctuations of +/- 10%.		

Continued opposite

2.2 OPERATIONAL REQUIREMENTS (continued)

2.2.31	The incubator shall be equipped with a 3 metre non-kinking type flexible mains lead, fitted with a 3 (square) pin 13A plug. The mains connector to be detachable locking type.		
2.2.32	The humidifier tank will consist of a water reservoir, water inlet port, and water outlet drain constructed in such a way that once drained a residue puddle of water cannot remain sitting in the reservoir.		

2.3 PHYSICAL CHARACTERISTICS

		Reply	Remarks
2.3.1	The trolley to be of metallic tubular frame of such dimensions and wall thickness as to give acceptable strength and rigidity. It shall have a polyester powder coating finish.		
2.3.2	The casters will be of a minimum size of 100mm.		
2.3.3	The incubator base shall be of metal construction with a polyester powder coating finish.		
2.3.4	The power compartment shall be of metal and so designed that the mechanical and electrical equipment within it is adequately protected against mechanical damage and the ingress if water and cleaning fluids.		
2.3.5	There shall be an ignition proof barrier between the infant compartment and the heating element and other electrical components.		
2.3.6	The canopy shall be of robust clear Perspex.		
2.3.7	The bed tray and support shall be of corrosion resistant material.		
2.3.8	The mattress shall be of polyurethane (or other acceptable) material.		
2.3.9	Any metal attachments shall be chromium plated.		
2.3.10	It should be possible to fully dismantle the equipment for cleaning purposes; and all parts will be easily cleaned.		

2.4 SAFETY FEATURES

		Reply	Remarks
2.4.1	The unit must be manufactured to conform to the IEC safety standard 60101 for medical electrical equipment		
2.4.2	Safety Classification: Type B		

3. ACCESSORIES AND CONSUMABLES

		Reply	Remarks
3.1	The trolley base to contain a storage compartment with latching doors.		
3.2	An IV pole shall be attached to the trolley		
3.3	An oxygen cylinder holder shall be attached to the trolley		
3.4	A shelf or holder will be attached to the trolley for storage of baby feed.		
3.5	A psychrometer will be attached to the canopy for humidity measurement together with dry thermometers and wet thermometers		
3.6	Supply all necessaries for the unit to function as described.		
3.7	A list of each accessory and its cost must be stated.		
3.8	State all consumables necessary for the unit to function for two years.		
3.9	A list of each consumable and its cost must be stated.		

4. DOCUMENTATION

		Reply	Remarks
4.1	Supply an operating manual in English for the machine.		
4.2	Supply a service manual in English for the machine.		
4.3	Supply a list of recommended spare parts required for the maintenance of the machine, in English.		

5. SPARE PARTS

		Reply	Remarks
5.1	Supply a set of only the recommended essential spare parts for 24 months for maintenance and repair.		
5.2	A list of each part and its price must be attached to this bid.		

6. DELIVERY

		Reply	Remarks
6.1	Package the machine with its accessories, consumables, manuals and spare parts together in one load.		
6.2	Crate the goods for transport, and label it as follows: 1 x machine for health facility X.		
6.3	• The cost of freighting the goods by sea and road DDP to health facility X in country Y must be stated. • The cost of freighting the goods by air and road DDP to health facility X in country Y must be stated.		
6.4	The cost of insuring the shipment for the full journey must be stated.		

7. INSTALLATION/COMMISSIONING/TRAINING

		Reply	Remarks
7.1	Full assembly and commissioning instructions must be provided for assembly and commissioning by the client, in a written format and as a video if available.		
7.2	The cost of commissioning by the supplier or representative must be stated.		
7.3	State the cost of the supplier or representative undertaking training and providing written guidelines: in operation – for users in care and cleaning – for users in PPM – for maintenance technicians in repair – for maintenance technicians		
7.4	Travel, accommodation and subsistence requirements for undertaking the contract must be stated.		

8. WARRANTY

		Reply	Remarks
8.1	A guarantee period must be stated (a minimum of 12 months from the date of commissioning).		

9. AFTER SALES SUPPORT

		Reply	Remarks
9.1	After sales support must be available in country Y or in the region, with maintenance capabilities and facilities, and spare parts stock holdings.		
9.2	Details of the availability and location of spare parts must be stated.		
9.3	Details of the availability and location of maintenance facilities must be stated.		
9.4	The cost of the annual maintenance contract must be stated, detailing the range/scope of such maintenance work.		

10. SUMMARY OF PRICES (detailed as follows:)

		Reply (total prices)	Remarks (showing options and alternatives)
1.	Basic unit		
2.	Accessories as detailed		
3.	Optional accessories		
4.	Consumables		
5.	Documentation		
6.	Spare parts for maintenance and repair for 24 months		
7.1	Crating		
7.2	Delivery		
7.3	Insurance		
8.1	Commissioning		
8.2	Training		
9.	Annual maintenance contract.		

Note: supplier to attach to this summary:

- *the lists of all accessories, consumables, spare parts, and manuals in the offer, showing their unit and total prices.*
- *the lists showing the breakdown of travel, accommodation, labour, subsistence, materials, and any other costs for the installation/commissioning/training offered.*
- *the list showing the breakdown of the rates and costs of travel, accommodation, labour, subsistence, parts, and any other items that apply to the maintenance contract during the warranty period, and post-warranty.*
- *the details describing after-sales support availability.*

ANNEX 5: SAMPLE TECHNICAL AND ENVIRONMENTAL DATA SHEET FOR SUPPLIERS

You can provide all tenderers, bidders, or suppliers with Technical and Environmental Information in order to ensure that the equipment they are offering to supply conforms to the prevailing national or local climate and conditions. The sample sheet in *Box 56* contains examples of the sort of entries you could include, which you can modify according to your own situation. Such a data sheet can be developed for a country, a district, or a facility.

BOX 56: Sample Technical and Environmental Data Sheet for Suppliers

	Example Entries for Health Facility X
Electricity Supply	
Source:	Mains / generating set / solar panels / none
Type:	three-phase 550V, 50Hz / 380V, 50Hz single phase 220V, 50Hz etc
Fluctuation:	There is some problem with: a) mains fluctuation, approximately ± 10 per cent in both the voltage and frequency supplied b) mains cut-off (black out) c) spikes, not necessarily on the mains supply but when large plant items cut in such as lift motors d) power only available for 2 hours a day etc. Suppliers should check/modify their power supply units if necessary, or state if voltage stabilisers or a UPS is required alongside their products.
Water Supply	
Quality:	Hard water (high mineral or salt content) / soft water / sediment in water/ etc Suppliers should check/modify their equipment with filters, softeners, or descalers if necessary, or state if such units will be required alongside their products.
Pressure:	48psi, mains supply close at hand / pressure unknown – borehole supply / pressure unknown – mains supply to subterranean tank
Problems:	◆ water supplies are frequently cut-off, or the electricity supply to the water pumps is cut off ◆ very low pressure, or machines suddenly being without any water at all. Suppliers should state if a back-up water storage tank or water pump is required with their products

Continued overleaf

BOX 56: Sample Technical and Environmental Data Sheet for Suppliers (continued)

	Example Entries for Health Facility X
Environment	
Height above sea-level:	4,500 – 5,000 feet where the health facility is located. Suppliers should check whether this will affect motors, pressure vessels, etc.
Temperature:	◆ Average temperature in winter inside health facility 16°C ◆ Average temperature in summer inside health facility 32°C ◆ There is no air-conditioning, even in the operating theatres. Suppliers should state if air-conditioning is essential for the correct operation of their products.
Humidity:	High at 80 per cent. / very low and arid Suppliers should check their products and, if necessary, carry out the following actions: ◆ tropicalize their printed circuit boards (provide them with a polymerized coating) ◆ replace rubber components which will perish with metal ones ◆ enclose silica gel or use other drying strategies ◆ use cotton not plastic ◆ use stainless steel or epoxy-coated metals which will not rust etc.
Dust:	There are problems with: ◆ dust getting into equipment and clogging up filters. Suppliers should consider checking/modifying their equipment with additional course filter protection.
Vermin:	There are problems with: ◆ rats chewing through wiring Suppliers should consider checking/modifying their equipment with metal vermin guards.
Manufacturing Quality	
Standards:	Equipment to conform to the relevant International Standards (IEC, ISO), or otherwise to the relevant National Standards, which relate to the safe manufacture of quality medical and hospital equipment.
Language	
Language:	All documents and manuals to be in English / French / Spanish or appropriate language All labels and markings on machines to be in English / French / Spanish or appropriate language.
Level of Technology of Equipment	
Preferences	◆ more manual, less automatic ◆ more electro-mechanical, and less micro-processor controlled ◆ easily used and maintained ◆ robust ◆ to withstand the climate and conditions described above ◆ with technically-skilled after sales support available locally etc.

ANNEX 6: SHORT-CUT PLANNING AND BUDGETING WHEN STARTING OUT

Perhaps you:

- have a small health facility
- are short of managers or management skills
- have limited or no technical staff
- cannot cope with this whole Guide yet.

If so, you may want to try a shortened version of planning and budgeting for equipment. Box 57 shows the bare minimum requirements you need to put in place when you are first starting out.
It assumes you will not be undertaking long-term forward planning, but will initially concentrate on planning and budgeting on a yearly basis. As you progress, you can add in the other elements for forward planning.

BOX 57: Bare Minimum Planning and Budgeting Requirements

Planning and budgeting element	If you are just starting out
◆ Equipment inventory (*Section 3.1*)	◆ essential to have
◆ Stock value estimates (*Section 3.2*)	◆ useful to carry out this exercise later on when you need rough estimates for long-term forward planning
◆ Budget lines for equipment expenditures (*Section 3.3*)	◆ this alteration to your budget layout can be done later, but it will help with analysis
◆ Usage rates for equipment-related consumable items (*Section 3.4*)	◆ useful to do this exercise as it helps you calculate specific (annual) estimates
◆ Reference materials (*Section 4.1*)	◆ these can be developed over time
◆ Developing the Vision of service delivery for each facility type (*Section 4.2*)	◆ you should have an understanding of this, even if you do not undertake a full exercise
◆ Model Equipment Lists (*Section 4.3*)	◆ initially, use a list of urgent equipment needs drawn up by departments. Later on, learn from other people's Model Equipment Lists
◆ Purchasing, donations, replacement, and disposal policies (*Section 4.4*)	◆ essential to have
◆ Generic equipment specifications and technical data (*Section 4.5*)	◆ initially learn from others. Later, develop your own
◆ Capital budget calculations (*Section 5*)	◆ initially learn how to make specific (annual) estimates; only learn the rough estimation methods when undertaking long-term planning
◆ Recurrent budget calculations (*Section 6*)	◆ initially learn how to make specific (annual) estimates. Only learn the rough estimation methods when undertaking long-term planning
◆ Equipment development plan (*Section 7.1*)	◆ use the basic equipment development planning process only, and only apply it to the short-term
◆ Equipment training plan (*Section 7.2*)	◆ develop a straightforward one for the short-term
◆ Core equipment expenditure plan (*Section 7.3.1*)	◆ initially only plan annually (see below)
◆ Core equipment financing plan (*Section 7.3.2*)	◆ initially only plan annually (see below)
◆ Annual equipment planning and budgeting (*Section 8.1*)	◆ create annual actions plans and an equipment budget showing income and expenditure
◆ Monitoring progress (Section 8.2)	◆ undertake the basic elements only – progress with annual plans and tools, coping with emergencies, providing feedback.

Figure 38 shows the suggested steps for a shortened version of planning and budgeting for equipment.

Figure 38: Shortened Version of Planning and Budgeting

Steps	People Responsible	Activity
Establish your equipment inventory	HTM Team	Use *Box 7* (*Section 3.1*)
Undertake the exercise to calculate your consumable usage rates	HTM Working Group (HTMWG)	Use *Figure 10* (*Section 3.4*)
Ensure you understand what the vision is for your facility	Health Management Team	Write down your health delivery goals and your place in the health service. For the technology implications of your vision, ask yourself the questions in *Box 15* (*Section 4.2*)
Use a substitute for a model equipment list	HTMWG	Gather departmental requests of urgent needs for replacement and new equipment. In time, try to obtain other peoples' model equipment lists to learn from (*Section 4.3*).
Develop your purchasing, donations, replacement, and disposal policies	Health Management Team	Try to follow the advice in *Boxes 17–19* (*Section 4.4*) and apply them to the departmental requests for equipment
Develop basic generic equipment specifications and a technical data sheet	HTMWG	Try not to fall into the typical traps when specifying equipment (Section 4.5). Learn from other people's specifications. Write simple specifications as you need them (see *Figure 11*), and a simple technical data sheet (*see Figure 12*).
Ensure you understand how to make capital budget calculations for specific (annual) estimates.	HTMWG	See *Boxes 24 and 25 (Section 5.2), Figures 15 – 18 (Sections 5.3 – 5.5)*
Ensure you understand how to make recurrent budget calculations for specific (annual) estimates.	HTMWG	See *Box 29 (Section 6.1*) and *Figures 21– 24 (Sections 6.1 – 6.4)*
Use the basic equipment development planning process, for the short term	HTMWG	Use *Figure 25 (Section 7.1)*, but for the short-term only
Create a basic equipment training plan, for the short term	HTMWG	Use *Figure 27 (Section 7.2)*, but for the short-term only
Each year follow the annual process	HTMWG	Use relevant parts of *Figures 31 – 37 (Section 8.1)*
Develop expenditure and income requirements each year	HTMWG	Use *Box 47 (Section 8.1)*
Monitor progress	HTMWG	Use the basic elements of *Section 8.2*

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