



सत्यमेव जयते

MINISTRY OF RURAL DEVELOPMENT

RURAL ROAD MAINTENANCE TRAINING MODULES FOR FIELD ENGINEERS

Module-2 TECHNICAL CONSIDERATION AND IMPLEMENTATION ARRANGEMENTS





Ministry of Rural Development

RURAL ROAD MAINTENANCE TRAINING MODULES FOR FIELD ENGINEERS

Module-2

Technical Consideration and
Implementation Arrangements



This training module is produced through a collaborative effort between the International Labour Organization and the National Rural Road Development Agency under the technical assistance component of the World Bank supported Rural Roads Project-II of Pradhan Mantri Gram Sadak Yojana Project (PMGSY).

Contents:

- Different maintenance approaches
- Performance maintenance contracts
- Community based contracting models
- Standard maintenance contracts

Learning Objective:

At the end of this Module you are expected:

- To be able identify different forms of contracts
- To be aware of the options available under community contracting
- To understand the force account system

Acknowledgement

The following publications were also used as reference materials:

- Managing Maintenance of Rural Roads in India, ILO/NRRDA, January 2015

Foreword

Pradhan Mantri Gram Sadak Yojana (PMGSY), was launched in December, 2000 as a special intervention of the Government of India with the broad objective of ensuring sustainable poverty reduction. The scheme aims to provide good quality all-weather single connectivity to every eligible habitation. Rural roads are a state subject under the Constitution and as such are the basic responsibility of the states. However under the PMGSY, the construction of good quality and well-engineered roads are fully funded by the central government. Maintenance of these roads is the responsibility of the states. The year 2013 saw the launch of PMGSY-II with the objectives of consolidating the existing rural road network and upgrading existing rural roads that provide connectivity to rural growth centres. PMGSY-II envisages sharing of construction costs between the Centre and the states with maintenance costs continuing to be funded fully by the states.

Over the last 14 years, the PMGSY has carved out a place for itself as a programme characterised by creation of good quality assets, effective management and technical proficiency by the National Rural Road Development Agency (NRRDA), along with capable state road agencies. For implementation and operations, the involved agencies have been supported with detailed documentation in the form of programme guidelines, an operations manual, standard bidding documents, specifications, a standard data book, a procurement and contracts management manual and the Quality Assurance Hand Book with support from the Indian Roads Congress. These documents have also contributed significantly towards effective implementation of PMGSY and even for mainstreaming good practices in other rural roads programmes being executed by the states from their own resources.

An area of concern has been lack of regular maintenance as per the “Programme Guidelines”. However, in recent years, there has been increased awareness and commitment to maintenance by the states. The tempo needs to be sustained and further accelerated.

Under the technical assistance component of the World Bank supported Rural Roads Project-II, the International Labour Organization (ILO), in collaboration with NRRDA has prepared a manual “Managing Maintenance of Rural Roads in India”. This initiated the execution of maintenance works and the development of these training modules for engineers and contractors associated with rural road maintenance works. To strengthen such activities in the participating states of RRP-II, a series of training of trainers workshops were arranged at national and state level based on the course material developed.

The training modules broadly cover the principles for maintenance management of rural roads, planning and execution of common maintenance interventions to ensure reliable transport services and safety to users and the local communities served by the rural roads, and arrangements for monitoring the performance of contractors engaged for the task.

I would like to acknowledge the support of all those associated with the development of these training modules, especially the ILO and its technical assistance team, Mr. Htun Hlaing, Mr. Bjorn Johannessen and the project's Rural Roads Maintenance Engineers. I would also place on record the valuable suggestions of my colleagues Ms. Manju Rajpal, IAS, (ex Director – RC), Mr. R. Basavaraja, Director NRRDA, Mr. S. S. Bhatia, Deputy Director, NRRDA, Mr. A. K. Sharma, Consultant World Bank and senior engineers as well as secretaries from State Governments in bringing the document to its present shape.

I sincerely believe, the training modules would be found useful for the states in their efforts to secure adequate maintenance of all rural roads, not merely the PMGSY roads and improve maintenance practices so that benefits of access continue to remain available for our rural people on a sustainable basis.

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Introduction to Training Modules

The purpose of this training manual is to provide technical management staff and contractors with appropriate guidelines for the effective management of road maintenance works. The training modules are based on the manual “Managing Maintenance of Rural Roads in India”. These modules broadly cover the principles for maintenance management of rural roads, planning and execution of common maintenance interventions to ensure reliable transport services and safety to users and the local communities served by the rural roads. The arrangements for monitoring the performance of contractors engaged for the task are also covered in these modules.

This manual is broken down into the following categories composed of different modules:

Module 1: INTRODUCTION

Module 2: TECHNICAL CONSIDERATIONS AND IMPLEMENTATION ARRANGEMENTS

Module 3: FINANCING RURAL ROAD MAINTENANCE

Module 4: PLANNING, INSPECTION, REPORTING AND MONITORING

Module 5: APPROPRIATE SETTING OUT TECHNIQUES

Module 6: HAND TOOLS, EQUIPMENT & CONSTRUCTION MATERIALS

Module 7: ROUTINE MAINTENANCE WORK METHODS

Module 8: OCCUPATIONAL HEALTH & SAFETY, ENVIRONMENTAL ISSUES AND DECENT WORK

Module 9: CONTRACT MANAGEMENT

The trainer may decide to conduct a full course consisting of all the nine modules or may selectively conduct specific modules depending on the needs of the target group.

As a general advice the trainer should:

- **Encourage active participation**

There is sometimes a tendency of the trainer to act like a teacher in school and to read or lecture directly from the course material. This behaviour should be avoided. Trainees remember information better if they participate actively in discussions and if there is a free exchange of views and of questions between everyone participating in the course.

- **Guiding the discussion**

There are times during a discussion when everyone wants to speak at the same time. When such situations arise, the trainer should insist that the group listen to one person at the time. If one speaker hijacks the floor too long, the trainer needs to interrupt, pointing out that other participants may also want to speak.

- **Listen attentively**

Equal attention should be paid to each speaker. Listen attentively and let the speaker understand that ideas and opinions expressed are both interesting and relevant. It is sometimes useful to take a brief note of participants' suggestions while they are speaking, noting them down on a flipchart or blackboard. A summary of these notes may prove useful for later discussions.

- **Emphasise important points**

Each time the participants make an important point or expresses an interesting opinion, the trainer should draw the group's attention to it by repeating the idea in simple terms which are understood by the majority of the trainees.

- **Preparing the sessions**

When trainees only listen to a description of how a particular job should be done, they are likely to forget what they heard. If however, they actually carry out the task concerned, they will remember how to do it. For this reason, every effort should be made to include as many practical exercises and demonstrations as possible, be they carried out on the worksite or in the training room. Practical sessions should always be carefully planned in advance.

- **Recapping**

A discussion is more than just a conversation. A subject is discussed with an aim in mind. It may occasionally be worthwhile recapping the topic considered and recalling the aim of the discussion by intervening from time to time to give a brief summary of the main points dealt with so far.

- **Questioning**

An important role of the trainer is to ensure that the atmosphere during training is sufficiently relaxed to allow participants to feel at ease to speak freely. Questions set by the trainer should not be regarded by the trainees as tests. Often there is no strict "right or wrong" answer to a question, except for mathematics. Questions should simply give your trainees the opportunity to put forward their individual points of view.

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Technical Consideration and Implementation Arrangements

2.1 INTRODUCTION

The provision and maintenance of public roads are governed by a legal framework in which the responsibilities for various parts of the road network are set out. The National Highway Authority of India Act, 1988 sets out the mandate for the highway authorities. Similarly, the states have enacted legislation which describes who is in charge of the state road network. Finally, there is national legislation outlining the responsibilities of the PRI in terms of local infrastructure.

This legislation normally forms the legal basis for how road works are organised. In addition, there is a comprehensive regulating framework detailing how work should be implemented, including regulations on financing of road works, procurement, safety and environmental concerns.

The maintenance and operation of roads are closely linked to the ownership of such assets. The mentioned legislation defines who the legal owner of roads is and the assets surrounding the road network and also provides direction on who is in charge of managing and implementation of maintenance and improvement of the assets. The regulations provide the necessary mechanisms for the acquisition of land for the improvement of the road network, setting out the procedures and guidelines on valuation, voluntary acquisition, etc. A general conclusion which can be drawn from this legal framework is that the government, at central and local level, through its relevant agencies, holds the ownership of and responsibility for the maintenance and operation of the public road network.

The government also assumes responsibility for planning and implementation of road works. However, the actual planning and design of road improvements and maintenance can be outsourced to other players such as private consultants, contracting firms and community groups.

The government, at central and local level, through its relevant agencies, holds the ownership of and responsibility for the maintenance and operation of the public road network. Within this context there are a number of arrangements that can be used for implementing the actual maintenance works as shown in Table 1.

Table 1: *Possible implementation arrangements for road maintenance*

Implementation Arrangements	
1	Paid permanent staff supported by equipment (force account)
2	Paid casual workers for defined tasks
3	Direct contracts with individuals or groups (payment by result)
4	Contracts with small, medium and large scale contractors
5	Agreements with communities
6	Agreements with defined village level organisations
7	Self-help: (i) voluntary (ii) collect funds and hire people or contractors (iii) collect funds and combine self-help with rented equipment

The combination of approaches 1 and 2 was normally used in the past by the technical agencies in charge of road maintenance. Some states still have a significant departmental labour force which maintains a significant portion of their respective road networks. Most states however, have disbanded their force account units and instead rely to a large degree on the private sector for the execution of maintenance works. When road works are carried out as a force account operation, equipment, materials and labour are provided directly by the agency. The effectiveness of these approaches is largely dependent on the availability equipment, materials and adequate supervision.

The third approach covers the lengthman system, which has been applied with reasonable success in other countries. Although this arrangement in principle relies on a contract in which the workers are paid on the basis of outputs, it is often experienced that due to limited supervision resources, the payments instead end up being based on attendance – and in effect resembling previous force account arrangements. The drawback with these systems is that, (i) due to the lack of production related incentives, productivity rates can be low, and (ii) with the limited supervision provided to the individual workers, the work performed is often ineffective or not addressing the real maintenance priorities.

There has been a drive in recent years to move away from public sector execution of civil works and instead relying more on the services of the private sector. Contracting out maintenance may not necessarily follow conventional contracting procedures. Certainly for routine maintenance it has been possible to contract out work to petty contractors and community groups. Since many maintenance activities can be effectively carried out using manual labour, such works can also be integrated into employment generation schemes.



The alternative approaches 3 to 7 as shown in Table 1 are likely to require more technical and managerial inputs, certainly in the development phase. Despite this initial organisation requirement, it is often the experience that contracts with specific groups eventually demand less supervision, are more transparent and by basing payments entirely on work outputs, become more cost effective. When engaging contractors, communities or other local organisations, agreements are made based on work outputs or performance indicators. The actual supervision of the individual workers is then delegated to the contractors, and is no longer the concern of the technical agency.

To effectively apply any of these approaches, the key elements are (i) the establishment of a performance or output based system, and (ii) proper guidance and motivation of the workers and their supervisors.

Despite the fact that the use of departmental labour is no longer “in fashion”, it is important to acknowledge that some of these agencies actually contained all the prerequisites for a successful road maintenance programme, such as a clear mandate, available financial and human resources, technical and administrative procedures, planning and resource management systems, work procedures and standards and progress monitoring. A common argument used in favour of force account operations is that such organisations are more easily mobilised for emergency works as compared to relying on contractors for such activities.

Rural roads need to be maintained at a minimum level of acceptable serviceability. Lack of adequate and timely maintenance is bound to accelerate the process of deterioration of the roads which in turn results in loss of time to agriculture output access and eventually the asset itself. The method of execution, thus, have a profound impact on the requirement of resources, skill levels involved with road agency, as also impact on the local communities living near the roads.

Before, the decision to choose a particular form of execution of maintenance is finalized, the implementing road agency should package the maintenance work into appropriate quantities and sizes that match the resources available for the execution.

Some of the most important aspects to consider while selecting the method of execution by the road agency are:

- Type and quantity of maintenance to be carried out
- Budget available for execution
- Availability of personnel, tools and plants available with the road agency
- Availability of local resources including labour, skilled and unskilled and
- Availability of contractors and their capabilities in terms of manpower, equipment, and finances

Different options available with road agencies for executing the maintenance are:

- contracts based on bill of quantities,
- performance based contracts,
- community contracting,
- retainer contracts, and
- force account.

Each method is discussed in detail in the subsequent sections.

2.2 BILL OF QUANTITIES CONTRACT

The most common form of engaging a contractor for a civil works project is to enter into a contract based on bill of quantities, which is also called an “ad-measure contract” or a “standard contract”. In this contract, works are split up into a comprehensive list of work activities. The quantities of activities under each is carefully estimated and entered into a Bill of Quantities (BoQ). Payment of works in BoQ contract is based on unit rates agreed for each work activity by the road agency and the contractor. The contractor, at any given time, is paid only for the quantity of completed works.

Periodic maintenance of rural roads involves works of a certain quantity and require similar equipment and technical skills as when carrying out road construction and rehabilitation works. For this reason, it is logical to use similar contract documents and procedures when engaging contractors for periodic maintenance works.

The advantage and disadvantage of this type of contract is shown in Table 2.

Table 2: *Advantages and disadvantages of BoQ contracts*

ADVANTAGES	DISADVANTAGES
<ul style="list-style-type: none"> • They are simple and easily prepared • Progress of work can be done through financial control as contractor is paid for only the work completed • Cost comparison is easier with standard schedule of rates or other similar contracts 	<ul style="list-style-type: none"> • It compounds labour and material costs by combining them into a single rate that is then adjusted in regards to material quantities • Some of the costs such as construction plant and temporary works not included and thus it may prevent contractors from developing effective cost control systems • It is very difficult to trace the effect of changes in quantities on the changes and costs



2.3 PERFORMANCE BASED CONTRACT

Performance Based Maintenance Contract (PBMC) is to pay a contractor based on the results achieved, not on the methods for performing the work. PBMC is an approach to contracting that provides disincentives, incentives or both to the contractor to achieve performance standards or targets for measurable outcomes and sometimes outputs. Measures of performance are often expressed in terms of levels of service (LoS) represented by specific rating scales corresponding to the condition of different assets achieved or to the outcomes of a particular type of maintenance service. Measures also may be expressed in response times. The disincentives or incentives can consist of reductions or increases in payments for respectively falling short or exceeding the desired targets. Some disincentives or incentives are not directly tied to measurable outcomes and outputs. These disincentives or incentives include liquidated damages for failing to satisfy a contract provision, an award fee for satisfying qualitative criteria, and a contract extension if the contractor performs well.

Hence Performance contracts have in recent years become an increasingly popular approach to road maintenance. The basic principle is to define a desired condition to which the road needs to be maintained during a certain period of time instead of specifying a contract based on quantified volumes of work. The duration of the contracts can span from several months, i.e. throughout a rainy season, to several years.

The contracts are awarded to established road contractors who in turn may sublet some of the works to smaller contractors, operating in the area where the road is located. Alternatively, the road authorities may choose to let performance contracts directly to smaller local contractors.

The advantage and disadvantage of this type of contract is shown in Table 3.

Table 3: Advantages and disadvantages of performance based contracts

ADVANTAGES	DISADVANTAGES
<ul style="list-style-type: none"> ● Potential reduction in costs ● Improved level of service (could cost more) ● The transfer of risk to the contractor ● More innovation ● More integrated services ● Enhanced asset management ● Ability to reap the benefits of partnering ● Building a new industry ● Achieving economies of scale 	<ul style="list-style-type: none"> ● A more costly procurement process ● A reduction in competition ● Uncertainty associated with long-term contracting relationships ● Challenges in mobilizing ● Loss of agency control and flexibility (e.g. to reallocate funds when there are large long-term commitments)

2.4 COMMUNITY CONTRACTING

Community contracting has become a popular arrangement for minor works that are targeted towards a limited group of beneficiaries such as rural village or a particular neighbourhood in an urban setting. It is an approach often championed by development agencies in order to secure a high level of local participation by the end users in all stages of the project from conception, planning to works implementation.

A common feature in community contracting is that there are normally no formal contracting firms involved in the works. Instead, the role of the contractor is replaced by the community, which takes the charge of the works, relying on local labour and individuals who possess the necessary trade skills. In some instances these groups are later recognized as a “contractor” and also utilized during the maintenance operation phase of a project.

The client is often the same group of people which have a common interest, often identified as the end users. These groups have normally no prior experiences in the world of contracting and may need considerable external technical and managerial support in order to implement the works. Community contracting can also be used for works under the management of a technical agency, such as maintenance of rural roads.

While acknowledging the limited technical skills and capacity of local communities operating as a contractor, there is still a need to follow the basic concepts of contracting. This includes establishing a contract agreement in which the works are properly quantified and priced. Equally, this agreement also requires clearly defined procedures for supervision, measurements and payments of works- similar to conventional contracting of civil works.

A key prerequisite for this form of local involvement in the implementation of maintenance works is that there is a demand for employment in the local communities. It needs to be acknowledged that some rural areas have a labour shortage and in such places there will be limited interest in this type of maintenance arrangements. On the other hand, employment generation often forms an essential part of many rural development programmes. In areas where there is a shortage of jobs or a significant degree of under-employment, there is considerable scope for using community contracting- in particular for routine maintenance works.

2.4.1 Community Contracting Options

There are various types of community contracting that has been tried out and used in various countries. A few are shown in the followings.

The examples provided below assume that the contract authority is a government department. In practice, the contract authority may be a project or programme with its own legal and administrative system. All contracts

are signed with communities, groups or individuals living along the roads to be maintained. In some examples the contracts have been used to create community assets rather than carrying out routine maintenance works.

In this case the village leadership sign the contract and organise the labour to carry out the works. They are provided an advanced payment on signing the contract and thereafter paid based on the work progress.

The relevant government department signs a contract directly with the community representatives. The community is the contractor

The community take the responsibility of organising and implementing the works as would a contractor. The community needs to be organised and may have to be legally registered to be able to sign contracts. As part of the community organisation, roles and responsibilities among the community representatives need to be properly defined. In some cases the village Panchayat may option out to set up a construction committee to organise the implementation.

This approach demands a considerable change of approach for the roads engineers and contract managers.

The contractor in this instance is either an already established small enterprise (local builder or group (such as a cooperative group). Alternatively, the maintenance group can be especially formed and registered to carry out the routine maintenance work. The contract will be signed directly with the group. The community leadership may be required to counter-sign as to ensure that the community are in agreement with the choice of group and the work to be carried out. Depending on the community contract, there may be no requirement for the community leadership to sign.

The relevant government department signs a contract with a small enterprise (SE) - existing or newly created - from within the community. The Small Enterprise is the contractor

This type of arrangement has been used successfully in several Latin America countries and in Nepal for routine road maintenance.

In this case, the community leadership sign a Memorandum of Understanding (MOU) with the Government Department to manage the project. In turn they then choose the best method of implementation. They can either directly employ and manage the labour, shop for materials and tools or issue sub-contracts to groups or enterprises within the community.

The relevant government department signs an agreement with the community where the community act as a joint client with the department and signs contracts with groups within the community

Funds are provided directly to the community based on work estimates. The funds are released in tranches based on progress. This approach is most commonly used for the construction of community facilities.

This type of agreement is used in many World Bank supported Community Driven Development Programmes as part of safety net arrangements in a wide number of countries. Considerable time is devoted to training for the community in management of the project and in procurement and record keeping. Technical assistance is provided through special programme staff.

Programmes are on-going in Asia, Africa and the Americas, specifically in Asia-Pacific countries: Cambodia, Indonesia, Laos, Myanmar, The Philippines, Thailand, and Vietnam plus Afghanistan, Papua New Guinea, Solomon Islands etc.

In this option, an established contractor signs the main contract with government but then sub-contracts part of the work to the local community / communities. This approach can only work where there is pre-agreement on wage rates and on the price for the delivery of local materials. For the government agency, this is easy to administer as it is based on existing contractual arrangements. For the contractor, it places the responsibility for the performance of the community on his shoulders.

A registered contractor receives a contract from the relevant government authority in which he is obliged to sub-contract the more labour-intensive parts of the work to the local community

The positive aspect of this approach is that the technical knowledge and specialised skills and equipment can be provided by the contractor while the employment is maximised within the communities living alongside the road. This type of contract does place the performance risks entirely with the contractor not with the government department or the community.

The appointed agent will be responsible for all aspects of the planning and implementation of the activities. The agent will create awareness within the target communities and assist the community to organise and legally register themselves.

Government does not manage the community contracts directly but appoints a Management Agency – a non-government organisation (NGO), consultant, or contractor who administers the contracts with the villages

They will be responsible for explaining the contract and the roles and responsibilities of each party to the contract. They will support the community in the implementation.

The government department can choose if it remains the client and issues the contract, or if the management agent may prepare and issue the contract. In either case, the government department always retains responsible for quality control and monitoring.

This approach works best where an NGO has been working for several years in an area and has gained the trust of the communities. If the NGO is a social-based organisation it will need to procure technical support to be able to carry out the agreement for supporting the community in creating or maintaining infrastructure works.

This approach requires trust between the government department and the NGO/Agent and trust between the NGO/Agent and the community.

2.5 RETAINER CONTRACTS

Retainer contracts with agreed schedule of rates are sometimes used for establishing a standby arrangements for dealing with emergency maintenance works. Incidences such as major landslides and washouts can render roads impassable and therefore require immediate action in order to reinstate access as well as limiting the extent of damages. When serious damage takes place as a result of freak weather, there is a need to quickly mobilize resources to reopen the road. In the past, force account units in the public



works departments took care of emergency works. In recent years, these units have often been disbanded and the agencies totally rely on private contractors to carry out maintenance.

In such instances, it may take too long time to secure agreements with contractors through the standard tendering process. Instead, the technical agencies can call for tenders on work activities that are commonly required in order to deal with emergency situations. These tenders essentially consist of priced unit rates for the activities normally require in order to repair road section that has become impassable as a result of sudden severe damages. Retainer contracts are only utilized when an emergency occurs and are normally organized once in a year, preferably in advance of the season during which major damages are likely to occur.

When a major incidence has occurred, the road agency can then quickly mobilize a contractor who have already submitted unit prices for emergency works. Technical staff from the road agency then carries out a rapid assessment of the works required and estimates the quantities of work. The total cost of work is then calculated on the basis of these quantities together with the already agreed unit prices.

2.6 FORCE ACCOUNT

Force account is where the maintenance activities both equipment-based and labour-based are undertaken by the road agency itself using direct labour. Traditionally, road maintenance was organized through pure force account operations under the responsibility of the public works departments. These institutions would have strategically located road depots in charge of maintaining the road network under their jurisdiction.

The government has decided to phase out the use of force account to the preference of contracting out works to the private construction industry. Some States do however still operate sizable force account units with a larger labour force and an extensive fleet of equipment.

The work through force account may be organized as an area system or patrol gang system¹.

2.6.1 Area System

- Area system concentrates all the maintenance resources at one location.
- Areas usually include 100 to 300 km of road and employs a maintenance force of approximately 10 men.
- Area is inspected regularly and crews are made up daily to handle various maintenance tasks as determined by the inspections.

¹Thagesen, B. 2003. Highway and traffic engineering in developing countries CRC Press.

- System is most suitable for a close network of roads within a relatively limited area. It is easy to administer because the crew is based at one site only.

2.6.2 Patrol Gang System

- Patrol gang system includes several units, each consisting of three or more men and a motor truck.
- Each patrol inspects and maintains up to 150km of road.
- A field supervisor directs a number of units and allocate tasks to combined mobile gangs, once one patrol unit has localized difficulties.

Table 4: *Advantages and disadvantages of force account*

ADVANTAGES	DISADVANTAGES
<ul style="list-style-type: none"> • Contains many of the prerequisites for a successful road maintenance programme such as: <ul style="list-style-type: none"> – clear mandate – available human resources – technical and administrative procedures – sound planning and resource management system. • Easily mobilized at short notices for emergency works than executing them through contractors since force account operations do not require a full description of the activities and works quantities and time consuming contract procedures in advance of commencement of works. 	<ul style="list-style-type: none"> • Maintenance of large work force by the road agency may be additional administrative burden on the executives and may prove to be uneconomical if not used optimally. • Lack of supervision may lead to inefficiency of the workforce in the long run. • Legal provisions may lead to litigation by the labour for permanence in the government thus affecting the downsizing of the agencies.

2.7 CONCLUSION

Several options are available with the road agencies for method of implementation of road maintenance which are discussed in detail in the module. Determining the best option is more often based on experience and careful planning founded on robust data than based on a templated solution. It is for the agency to decide which is the best option suitable for the particular type and quantity of maintenance depending on the available resources and the expertise, with the ultimate objective of achieving the best “value for money”.



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