

MULTI-SECTOR PLANNING APPROACHES

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INDEVELOPMENT

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Table of Contents:

1	Introduction	4
2	Urban Planning.....	6
2.1	Specific plans for slums.....	10
3	Integrated Transport Systems.....	12
4	Integrated Rural Accessibility Planning.....	14
4.1	IRAP indicator.....	14
4.2	Effect assessments.....	21
5	Integrated Development Plans	25
	APPENDIX 1: Sector Policies.....	27

1 INTRODUCTION

Coordination of interventions

As described in the Coordination of Interventions¹, organisations of all kinds make efforts to coordinate their interventions. First of all organisations want to avoid that different interventions are pulling the ship in different directions, resulting in a minimum progress. Ideally the interventions would strengthen each other and enhance progress. Coordination enhances synergies between interventions and increases the efficiency of the operations of the organisation(s). There are different coordination approaches, but all have elements of dialogue, communication, finding mutual interest and management. This paper focuses on one approach: Multi-Sector Planning.

Multi-sector planning

Identification, screening, ranking & programming of project proposals

Multi-Sector Planning Approaches have the objective to enhance synergies between different kind of objectives through identification, formulation, screening, ranking and programming of interventions. In addition some multi-sector planning approaches facilitate a decision taking process where projects with different kind of objectives compete with each other for funds from the same budget. These multi-sector planning approaches have converted the units of each indicator of every objective in a mutual unit. This mutual unit is often money (financial and socio-economic analysis) or points (Multi-Criteria Analysis).

Financial sources

Usually all the interventions contributing to the objectives covered by the multi-sector planning approach are financed from the same source. However there are a few exceptions.

Other requirements to facilitate coordination

It should be noted that a multi-sector planning approach only facilitates coordination. Without the technical and managerial capacity, the organisation will not be able to coordinate its interventions. The technicians, administrators and managers need to have sufficient understanding of the conceptual frameworks. If they do not understand the relationship between water quality, water quantity, hygiene, sanitation disposal & treatment and health, it is unlikely that the most effective and efficient intervention will be applied.

Often when an organisation decides to change from sector-wise planning to multi-sector planning, it needs to synchronise budget structures, organisation structures, and staff allocations with the planning approach.

Decentralisation

Decentralisation is a process in which responsibilities from sector ministries and departments are transferred to local government. Ideally these local governments also receive the technical and financial capacity to carry out these tasks. The local government would receive a budget that can be allocated for interventions inside its area of jurisdiction. The local government has to decide how the budget will be divided over the different kind of objectives. It may develop specific budget lines for each government objective and

¹ Coordination of Interventions can be downloaded from website

create sector-planning tools or it may combine several government objectives into one budget line or it may just keep one budget line for all projects.

The last form gives the organisation the highest degree of freedom to allocate money between the competing projects. In year one it may spend all its funds on road projects and in year two it may spend all its money on health projects. However such an allocation pattern is a disaster for the implementing units. Organisations do not want to under utilise units and at the same time burden, other units with too high workloads.

Finding synergies

The second form is obviously also suitable for multi-sector planning approaches. Typical interventions of different nature are grouped together whenever they contribute to a certain objective and there are synergies between the interventions to achieve certain objectives. For example;

- Supply of water and sewerage service to reduce water-borne and related diseases
- Optimal location of infrastructure² in order to reduce the travel time or transport costs for the people (IRAP³)
- Improving access to social needs through all kinds of interventions
- Stimulating enterprise development through infrastructure interventions
- Stimulating enterprise development through all kinds of interventions
- Urban Planning
- Slum upgrading through provision of water supply, storm water drainage, sewerage collection & treatment, road construction, land entitlement registration, electricity, solid waste collection and saving facilities
- Participatory Rural Appraisals
- Livelihoods approach⁴

Livelihoods approach

These examples show that complete different kind of interventions together have proven to contribute to improving the livelihoods of the population. The livelihoods approach, as promoted by DFID, UNDP and CARE includes the highest degree of freedom in selecting interventions. The interventions are often a mix belonging of different sectors. An excellent description of the livelihoods approach is presented on www.livelihoods.org

Water supply and Sanitation

The document Planning of Water Supply and Sewer Systems⁵ provide guidelines for the development of integrated water and sanitation networks.

Basics in Planning⁵ provide a description of Participatory Rural Appraisal tools and links to other documents about this subject.

² Roads, transportation, buildings, water supply, etc

³ Integrated Rural Accessibility Planning

⁴ www.livelihoods.org

⁵ Downloadable from this website

2 URBAN PLANNING

Proactive planning	All planning have a degree in which it is pro-active and reactive. Plans may be developed as a reaction to current problems or be pro-active, tackling future problems. When it is relatively easy/cheap to correct or modify problems a reactive approach is usually preferred. However when such reactions result in major rehabilitations and thus major costs, pro-active planning is preferred. Urban plans are typical pro-active plans. It is very expensive both in financial and social terms to rehabilitate existing cities. It is still relatively easy to supply electricity in urban environments, but the construction of undergrounds, sewer systems, highways in build-up areas cost considerable more than in unexploited areas.
Multi-sector	Because of its pro-active character, urban plans are usually so-called multi-sector plans. This means that the plans contain a package of different interventions. The city is a multitude of interrelated units. A change in any part affects other parts. A new house means more traffic, more children going to school, more people requiring health services, another vehicle in the street, more water consumption, more tax revenues etc.
Varying concreteness	Plans also vary in concreteness. Plans for the near future are detailed and should provide answers on all possible questions. Plans for the far future are usually less defined and need to be filled in with details. Urban planning is characterised because it creates long-, middle long and short term plans. The short-term plan is basically a technical design and budget proposal. The long-term plan is called the comprehensive plan. Middle-long term plans are the specific plans. Specific plans should at least show how the comprehensive plan would apply to a specific parcel of land and indicate the basic engineering and economic activities involved to realise the comprehensive plan. Both the specific and comprehensive plans can be presented in sketch designs of respectively the neighbourhood or city.
Objectives comprehensive plan	The comprehensive plan of a city or region has two main objectives: <ol style="list-style-type: none"> 1. Gradually improve the build-up areas of the city/region 2. Plan for physical expansion/growth of the city
Contents comprehensive plan	The comprehensive plan allocates land for certain purposes, like housing, commercial and industrial activities, recreation, transport of goods and services, parking of vehicles, conservation of buildings and other valuable assets, reduction of noise pollution, ventilation, etc. But is also provide instructions for more detailed designs of the parcels. Among others, it prescribes the minimum space that needs to be allocated to education and health facilities in the neighbourhood. In addition it provides an outline for cost recovery of the investments.
Specific and zoning plan	The specific plan is designed on basis of the comprehensive plan. The land use plan of the specific plan is often translated into a

zoning plan. The zoning plan is a legal ordinance, establishing the specific limitations that apply to land use. The specific plans among others locate the schools, health services, parks and playgrounds in the neighbourhood and determine the requirements of local shopping centres.

If somebody wants to change a zoning plan and thus indirectly may affect the comprehensive plan, he or she often has to develop a specific plan. If the specific plan is acceptable the comprehensive plan is adjusted and the revised zoning plan adopted.

Reasons for multi-sector planning

A multi-sector approach is required to avoid problems in the future. For example, the government of the Netherlands wants to discourage people to use cars or purchase cars to reduce congestion problems. New suburbs in the Netherlands tend to be occupied by young couples. These couples often have not invested in a vehicle, but due to inadequate public transport to the new suburbs many of the new residents invest quickly in a car. It has been recognised that the provision of adequate public transport is necessary from day one after the first inhabitants occupy the suburbs.

Cities and towns want to attract outside investments. The attraction power of city is a combination of many factors, among others of availability of public goods and services, low land costs, low transportation costs, recreation opportunities, etc. If one of these conditions is missing, businesses may invest elsewhere.

Congestion in and around cities and town are basically caused by high population and economic activity densities. Congestion free cities not only invest heavily in public transport and bicycle lanes that have the right of way but also try to lower the population and economic activities densities and reducing transport demands. For example cities can regulate exporting mass-producers to locate themselves near waterways, railway station, airport or national highway and preferably away from the city centre and its suburbs. They also can limit housing capacities through limiting building heights and regulating distances between buildings.

Slums develop on land allocated for future highways etc. Of course the slum dwellers can be removed from these locations. However modern governments prefer to relocate slums at convenient locations. Common relocation strategies are the provision of basic utilities, public services (education, health) and protected land entitlements. Furthermore the slums are connected with their economic base with transportation facilities (infrastructure and vehicles).

Data

Prior designing of the plans it is necessary to collect all relevant data. The data describe geological structure of the soil, the climate conditions, prevailing sun and wind directions, previous, existing and potential land use, change of natural calamities, etc. It also provides estimates for future growth, in terms of both demands and cost recovery capacities.

Land classification

Land use is usually classified in five main categories:

1. Open space
2. Agriculture
3. Residential
4. Commercial
5. Industrial

Each of these groups is subdivided from intensive to less intensive use or from the restricted to less restricted use, like heavy and light industries.

Questions related to land use which have to be addressed in the comprehensive plan are:

- What changes in the pattern of land use is needed
- How much growth can be accommodated within the existing area of urban development
- Options to expand the area of urban development

Location of markets

Cities and towns always have been the locations of markets. In the old days, they were the locations of exchanges of goods (barter) and nowadays they have become the location of trade of documents representing these goods and their values.

It is possible to distinguish a hierarchy between the commercial centres. In every neighbourhood or settlement, there are centres that cater for the daily needs, like food, medicine, barbers etc. Downtown the cities and towns with a regional function are often shopping centres, where it is possible to purchase all kinds of consumer goods and services. Wholesale markets and financial markets are usually located in the larger cities of the country. The comprehensive plan needs to specify locations for the larger markets and indicate the conditions of land use inside the neighbourhoods with regard to the provision of day-by-day commodities.

Industries

Industries provide employment to the inhabitants of the city. Cities therefore have to attract industries and allocate sufficient land for this purpose. The location of industries and markets influences the location and dimensions of the transport infrastructure. Industries are also the big polluters of our environment and can be a risk (explosions) to the population. Therefore industries are usually located outside residential areas. Some cities use special devices, e.g. greenbelts to separate industrial and residential areas.

Transport

Transport circulation should be a major consideration in the plans. The plan should indicate how residents travel to employment areas, markets and recreation areas. As cars are the norm in modern life, the plan should also indicate where the people would park their cars. Cities need corridors, which allow quick transportation and at the same time residential areas may want to reduce the traffic load in their neighbourhood.

It is easy to estimate the traffic load in the streets of the neighbourhood, that are non-conductive to through traffic, and

therefore it is easy to determine the required pavement width. The pavement width partly depends on the allocation of parking places. To determine the maximum pavement width of the highways is on the other hand not so easy. It depends to a large extent on future traffic growth. As cities are basically permanent structures it is necessary to make long-term predictions (50 to 100 years). Future traffic volumes depend on the population growth of the city, the future income levels of the city and the regional importance of the city. The population may double in a decade. The income levels in cities usually rise and providing more people with opportunity to purchase vehicles. The status of the city, town may change, attracting more traffic. This does not mean that it is necessary to construct the full pavement width, but enough space should be allocated for future (gradual) expansions. Encroachment by houses on this land and establishment of markets and shops along these routes has serious negative drawbacks on the future of the traffic circulation in the city. The illegal houses prevent future expansion of the pavement width and the shops along the route change the traffic behaviour. Instead of a steady moving traffic flow, the highway becomes a parking place, resulting in traffic jams due to reduced pavement width and irregular velocity (breaking and accelerating vehicles).

It is difficult to separate different traffic streams in residential areas, where motorised vehicles and pedestrians are common. The streets should therefore be aligned in such a way to reduce traffic accidents and reduce traffic speeds.

The highways on the other hand are designed to facilitate motorised vehicles and ideally non-motorised transport is prevented from entering it.

This does not mean that non-motorised transport does not need the same access opportunities in the city. If the city intends to motivate people to use the bicycles to transport themselves, it has to provide bicycle lanes that provide quick access to all major locations in the city and preferably have the right of way. Furthermore the construction costs of sky trains and undergrounds are considerable cheaper in unexploited soils than in build-up areas.

Conservation

The comprehensive plan and specific plan also need to include solutions to

- Prevent natural calamities (floods, earthquakes)
- Preserve the environment, e.g. watersheds
- Provide fresh air
- Protect against noise hazards
- Provide access to historic sites
- Dispose of solid waste and sewage
- Recreation

The next paragraph describes a particular approach of development of specific plans for slums.

2.1 SPECIFIC PLANS FOR SLUMS

Slum networking approach	Himanshu Parikh developed an approach for developing specific plans for slums, the slum networking approach. This approach is known for its application of an intervention mix that includes among others supply of water, electricity, waste collection and treatment, roads, registration of land properties, landscaping and access to saving facilities.
Location of slums	Most slums are located in the natural drainage path of the cities, the streams, rivers and lakes. This is not only the case in many cities in low and middle-income countries but also in cities like New York and London.
Standard slum upgrading approaches	Standard slum upgrading approaches are based on assumptions that only the lowest standard of infrastructure is affordable. Many slum-upgrading projects provide stand posts for the provision of water, open storm water drains and community latrines. Many of these slum-upgrading projects have negative impacts. Community latrines are not popular. They get dirty and often are not properly maintained. Water theft with stand post connection is high and storm water drains clog up.
Intentions	The slum networking approach intends to provide sewer house connectivity to the slum dwellers at a cost that is less than the standard slum upgrading approach. The alignment of the sewers follow the alignment of the rivers, stay pretty shallow along the slopes, but steep enough to transport black or grey waste water. Such an alignment does not require expensive, energy consuming and maintenance sensitive pumping systems and is thus desirable for the whole city. The approach also provides water and roads/foot path access to every house. The roads are sometimes surfaced and positioned below the surface to act as storm water drainage. The alignment of the roads therefore followed the natural drainage paths. The excavated earth is used to fill up low spots, clearing local water logging areas and the attendant health hazards of mosquitoes and malaria.
Integration inside utilities	Ideally the utilities would be integrated in the existing utility companies. Unlike the traditional slum upgrading approaches, the proposed technical designs are not a constraint for the existing utility companies to accept the schemes inside their company.
Sanitation & culture	It should be noted that sanitation solutions are cultural sensitive. Not all sanitation habits are suitable to sewer solutions. In areas where solid materials like clay or sand is used for cleaning the bottoms, sewer systems may clog up.
Land value & poverty impacts	It has been recognised that slum upgrading approaches may result in an increase of land value. When the slum dwellers rent the land, they may face an increase of their monthly expenditures due to rising lease prices. Some may even have to move out from their premises and search for new "cheaper" accommodation. Only when

the slum dwellers have ownership of the land, they will benefit from the increase of land value. Many slums are built on barren land. Land that was never used by any one, except for dumping waste. Most slum dwellers do not register their occupation of the land and after the completion of the project they may face the risk to be removed from their premises or that somebody else register ownership over their premises. Most slum upgrading projects therefore include efforts to provide slum dwellers with formal land entitlements.

Location of employment

Most slum dwellers find employment or own unregistered companies, the so-called informal economy. Except for access to roads and water these companies often lack access to electricity, hampering their production. Slum upgrading projects therefore often include provision of electricity.

Financing plan

Special arrangements for slum dwellers to pay their utility bills are usually necessary to facilitate the financial sustainability of the schemes. Their income is in general low and irregular. Furthermore they do not want to keep money in the house, being afraid of thieves, inflation and claims for loans from relatives and friends. Some projects include special arrangements, where dwellers can save money at their utility companies. Other projects set up small saving schemes, allowing the slum dwellers to save enough money during the month to pay their utility- and other bills.

More information

To learn more about the Slum Networking Approach, contact Buro Happold of which Himanshu Parikh is a partner at email address: [id@burohappold.com](mailto:hd@burohappold.com)

3 INTEGRATED TRANSPORT SYSTEMS

Integrated transport system

Many countries have developed specialised agencies that take care of different transport infrastructure and different transport modes. Like the national road agency, railway corporation, harbour authority, airport authority, public transport authority, etc. All these agencies have developed specific expertise with regard to their form of transport infrastructure and are surely best equipped to address problems with regard to the infrastructure itself.

However the interest of the society is in transport and not in the transport infrastructure. Transport infrastructure is merely a means to an end. The society requires a coordinated transport system that enables efficient, safe and comfortable movement of persons and freight. Large projects on separate transport systems will have spillover effects to other transport systems. And often more effective and efficient solutions to transport problems can be found when a coordinated transport system is developed.

People in Bangkok are champions in using various mode of transport to move as fast as possible through the clogged city. Many combine transport modes like water transport, taxis, motor taxis and rail during one single trip.



Spillover effects

Critical congestion of the road network often results in the perception that it is desirable to invest heavily in road capacity enhancing projects. However after studying transport needs more closely, the transport agencies may conclude that investments in public transport and railways, for freight, may be more effective and efficient investments. Transport planners also should keep in mind that the demand for certain transport system is not influenced by its own performance but also by the performance of the other transport system. Although car ownership adds prestige to many of the upper and middle-class in Bangkok, many have started to travel with the underground and the sky train to save time.

Key projects in the transport sector aim at reducing traffic jams at the various transport infrastructure links. Typical interventions that provide additional capacity may include capital outlay, regulating traffic flows, establish effective and efficient organisations, reduction of administration (at ports). Reduction in traffic jams at on a link in the coordinated transport system is likely to have effects on other links.

Transport and trade

The most obvious example is the contribution of the transport sector to international trade. Improvements in the road sector to allow for faster distribution of domestic products to trading harbours are of little use when these ports do not have the capacity to transit the freight or even worse not even have the capacity to store the freight. Visa versa, when the capacity of ports is larger than the capacity of the infrastructure to transport imported goods to the markets, imports need to be stored. Such consideration may be in particular important to provide food supplies in famine affected areas. Imported food supplies at the ports may be ineffective when the trucks and other transport means can not enter these areas.

Transport and area development plans

Transport infrastructure is a facilitator of economic and social development. Transport demand is mainly the result of activities and developments that take place outside the transport sector. A road by itself does not create a demand to travel, nor does it result in economic or social development. However in many cases transport infrastructure is an important prerequisite for development. Transport projects and systems should be judged on their ability to contribute the national and local development goals. Infrastructure planners therefore should estimate transport demands on basis of economic and social activities and development plans in addition to developing project proposals addressing existing problems on their transport networks.

Because transport is an important facilitator for economic and social development, transport planners should participate in the development of area development plans. An important task of all service providers in the development of these integrated area development plans is to assess the implications (financial, social, economical and environmental) of their contribution in the development of the area plan. Additional infrastructure claim investment, operation and maintenance budgets. The responsible agency has to question itself if the investments will result in sufficient returns, or alternatively if it can afford these expenditures. In case the answers are negative it needs additional subsidies from the treasury. During these assessments the negotiator has to keep in mind that the projects in the area of development also may have implications on other parts of its system.

4 INTEGRATED RURAL ACCESSIBILITY PLANNING

IRAP = toolkit

The Integrated Rural Accessibility Planning (IRAP) toolkit was developed by the International Labour Organisation (ILO) to facilitate the planning of transport infrastructure, transportation and the location of basic infrastructure in rural areas. Typical examples of basic infrastructure are schools, health facilities and water supply.

Focus on travel requirements rural population

The original IRAP toolkit tries to improve the physical access to basic services and goods of the rural population. However it only focuses on those goods and services for which the rural population has to travel. The IRAP toolkit enhances the synergy between transport, transport infrastructure and the location of these goods and services. After all it is possible to reduce the travel time to these goods of service through all these kind of interventions.

Three ways of reducing travel time and costs

The construction of a new road, bridge or other transport infrastructure may create a short cut to the goods and services. But locating the goods and services inside the village also reduces the distance to the respective goods and service. Furthermore it is possible to reduce the travel time by speeding up the transportation itself. Among others the availability of bus transport may facilitate the reduction of travel time.

Benefits of IRAP

The main advantage of IRAP is that it improves the efficiency of public service delivery in rural areas. A typical IRAP plan combines interventions in the transport infrastructure, locating of facilities and transport to maximise the effects. For example, it may locate one-classroom schools in villages; build connect the villages to road network and through bus services collect pupils for secondary education.

4.1 IRAP INDICATOR

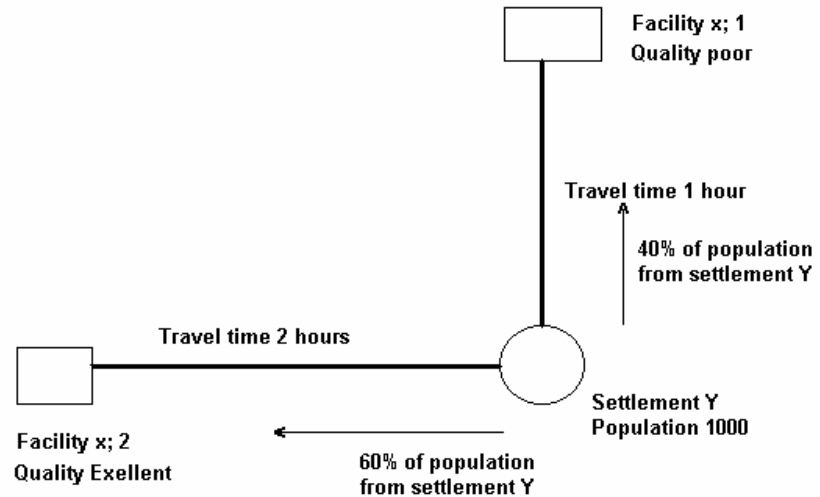
Indicators

One of the most important and most discussed tools is the design of the indicators. The indicators are used to describe the size and severity of problems related to physical access to goods and services and to describe the effects of certain project interventions.

Physical access condition and settlement

The IRAP tools concentrate on the physical access conditions of rural settlements in a district or province. Its indicator therefore has to describe the physical access condition of each settlement but also include some elements of the settlements itself. After all not all settlements are the same. In particular the size of the population or number of households is important. The effectiveness of the intervention partly depends on the number of people benefiting of it.

Basic outline of indicator	<p>The basic outline of the IRAP indicator to identify projects has the following components:</p> <ul style="list-style-type: none"> • Number of households or population in a settlement (HH) • Travel time to specific goods/services exceeding the norm (TT) • Weight factor expressing the relative importance of the different goods and services (W)
Setting norms	<p>If the travel time is short enough, the situation is not considered to be a problem. The maximum acceptable travel time is called the norm. This norm may be based on scientific research, e.g. the 30 minutes norm for collection of water, on political preferences or analysis of the common situation. In the last case, a study is conducted to find the average travel time to particular goods or services. This average travel time is set as the acceptable norm for the moment.</p>
Frequency of travel	<p>Unlike what is often expected the frequency of travel is not part of the indicator, analysis. It is opportunity of obtaining goods and services that is important. After all, nobody wants to travel to a hospital or at least we want to minimise our travel to the hospitals, but when necessary we want to be able to reach the hospital as quickly, safely and comfortable as possible.</p>
Weight factors	<p>Not all goods and services (i) are considered equally important. Weight factors differentiate between these goods and services. The weight factors are often a ratio and the total sum of the ratio is "1".</p> <p>In formula the indicator is expressed as:</p> $HH * \sum(W_i * TT_i)$ <p>Or</p> $HH * (W_1 * TT_1 + W_2 * TT_2 + \dots + W_n * TT_n)$ <p>However this formula is a simplification of the reality. It assumes that the households in a settlement only travel to one destination to obtain the goods and services. In rural areas with high population densities it is likely that there are more destinations that will provide the same goods and services. The population of a settlement may actually visit all these places. Households usually have a preference for one or the other destination. Often the preference relate to the perceived quality and available quantity of the goods and services.</p>



The weight factor for each good/service remains the same, regardless where the goods/services are obtained. The main difference is that a part of the population travels to destination (a) and another part travels to destination (b) to obtain the same service/good.

Thus in formula:

$$W_1 * (HH_{1;a} * TT_{1;a} + HH_{1;b} * TT_{1;b}) + W_2 * (HH_{2;a} * TT_{2;a} + HH_{2;b} * TT_{2;b}) + \dots$$

etc.

W_1 and W_2 represent the weight factors for goods/services 1 and 2
 $HH_{1;a}$ $HH_{1;b}$ $HH_{2;a}$ $HH_{2;b}$ are the number of households that want to obtain goods/services 1 or 2 at location a or b
 $TT_{1;a}$ $TT_{1;b}$ $TT_{2;a}$ $TT_{2;b}$ are the respective travel times to location a or b to obtain services/goods 1 or 2.

Quality and quantity of goods and services

Unfortunately the indicator does not differentiate between the quality and quantity of the services and goods. It only measures the travel time to a location where the goods/service are of sufficient quality and quantity. Other locations are excluded from the analysis.

Many line departments and ministries will consider this as shortcoming. They usually have a set of indicators describing the quality and quantity of the services and goods.

Later versions of the IRAP tools (Orissa and Nepal) have included some quality and quantity indicators in the IRAP indicator. The IRAP indicator transformed into a Multi-Criteria Analysis (MCA)⁶. The multi-criteria analysis included indicators describing the conditions of the infrastructure and operations affecting the quality of the goods and services. For example, in Nepal many girls do not go to school because they lack separate “lady” toilets. The Department of

⁶ To learn about designing MCA, read “Basics in Planning”

Education therefore stressed that the availability of “lady” toilets had to be incorporated in the IRAP indicator. This is a typical infrastructure component affecting the quality/access of the school. Equally important is that the school has sufficient qualified teachers, a typical operation condition affecting the quality of education.

Non-travel related access needs Because the IRAP indicator transformed into a MCA, it was possible to address another comment from district/provincial governments and rural development projects; “the exclusion of infrastructure that is not travel related, like electricity”.

Efficiency of planning With the exception of the IRAP tools developed for Orissa, the tools were developed on basis of the assumption that everybody has an equal right to access certain goods and services. Furthermore they are based on the assumption that the government has the responsibility to ensure that everybody has equal access to the services and goods.

A very sensible approach for the more social and basic services and goods like health, education and water. However the approach may be very costly and ineffective for other matters. Note that MCA are merely a reflection of the objectives and the hierarchy between them, as set by the government. The objectives and their hierarchies of the population and the government may be different. When the government only wants to facilitate the development of a certain community, identification of projects on basis of an MCA, may not be the best answer.

If the demand is low, the plan will be ineffective

In Orissa, the IRAP tools differentiate between goods and services for which the government feels it is responsible to provide them (regardless the demand) and the goods and services that are in demand of a particular community but may of no value to another. Governments need to avoid inefficient interventions. Most interventions for which there is a low or no demand, tend to be ineffective. A typical example is the construction of irrigation schemes on Pemba (Tanzania), where the dominant economic activity is fishing. Farming is only a support activity. As irrigation is labour intensive, it intends to compete with other (more important) activities for human resources. Nonetheless there are goods and services of which the government feels that they have to ensure that they are provided even when the demand is low. An example is the construction of primary schools to facilitate the compulsory education policy.

Common denominator

Often governments finance these operations from different budget lines. But if they do finance them from the same source, it is necessary to find a common denominator to express all possible effects of the interventions, like an MCA.

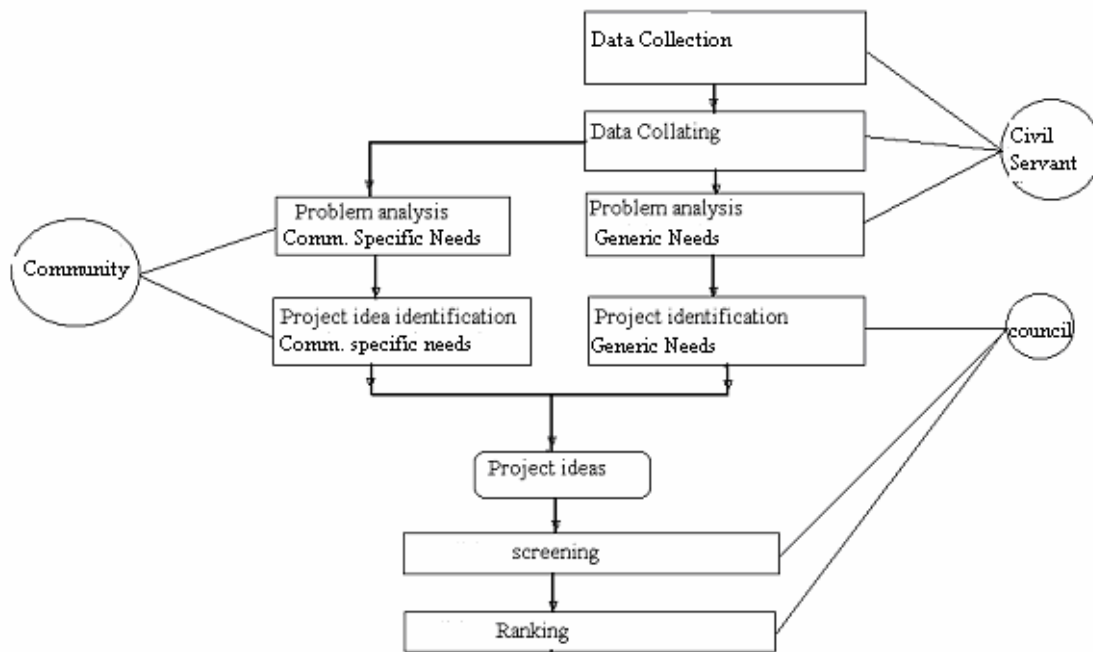
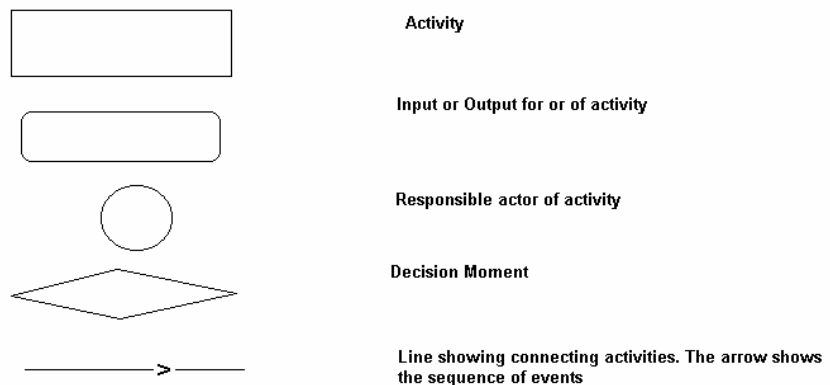
Mismatch of objectives

This means that the government sets the objectives and the hierarchies between these objectives. This may be considered to be a problem because their objectives may not match those of the beneficiaries. The government can opt to study the objectives of the beneficiaries and adopt them in the design of the MCA. However this often a time and budget consuming process. In most cases a process is developed in which involves the benefiting community in identifying and initial prioritisation of interventions and subsequently

the government screens, ranks and programs the project proposals. Such an approach is often acceptable. Although governments want to facilitate proposals from communities they also want to match them with their own development objectives. Community proposals may contradict economic, social and environmental development plans of the government. Thus the government need to screen the proposals. In addition the government may want to evaluate the project proposals against their plans and rank them accordingly.

The figure below presents a simplified process developed for the Gram Panchayats in Orissa (India).

Legend



Data collection, mapping and collating

The first activity is the collection of data with regard to access problems of the settlements. Usually a civil servant goes to every settlement and interviews key persons about the access situation in the settlement. The civil servant uses a standard, structured

Developing project proposals	<p>questionnaire. The multi-criteria analysis or other indicators is the basis for the design of the questionnaire. Usually the questionnaire ends with an open question about problem and project priorities. After the data of every settlement is collected, the data is collated on special forms.</p> <p>Only after the data is collated, the methodology differentiates between community specific and generic needs.</p> <p>In case of the community specific needs, the specific community meets to analyse the collected data. An important activity during this meeting is to present the data on a map. On basis of the data, the community decides which problems have the highest priority and formulates project proposals to address these problems. Because the district council needs to screen and rank the proposals, a civil servant has to calculate the access profiles for the without and with project situations. The access profiles are based on the IRAP indicator. The IRAP indicator for the community specific projects does not have to include the weight factors, when the community specific and generic needs projects are funded from different sources (budget lines). When the projects are financed from the same source, the IRAP indicators for both the generic needs and community specific needs should include the weight factors.</p>
Acts	<p>After data collating a civil servant will convert the data into an access profile for the current (without project) situation for all the generic needs. The access profile is based on the IRAP indicator and is polluted with the weight factors. Subsequently these polluted access profiles are presented on the map, which is used for the analysis of the problems and projects.</p> <p>Usually a decentralisation or local governance act describes the exact procedure for identification of projects. In India and Nepal, the population of every settlement gathers together in meetings to identify project ideas. In the Netherlands, municipal councils identify the project ideas, often spoon-fed by their civil servants. In any case the access profiles and the maps help the responsible actor with the identification of project ideas.</p>
Access profiles	<p>Finally a civil servant calculates the access profiles with project for the generated project ideas, using the IRAP indicators.</p> <p>A basic outline of an IRAP indicator integrating all these aspects and allows projects that improve the infrastructure or the operations using it, is:</p> $\sum_i^Z W_i * SUBPOP * [W_{TT(i)} * TT + W_{TC(i)} * TC + W_{IC(i)} * IC + W_{OC(i)} * OC]$ <p>Where:</p> <p>SUBPOP is the sub population of the settlement affected by the access situation to goods/services (i) obtaining the goods and services at location (Z)</p> <p>TT is the travel time beyond the norm to goods/services (i) at location (Z)</p> <p>TC are the conditions under which the subpopulation has to travel to goods/service beyond the norm (i) at location (Z)</p> <p>IC are the infrastructure conditions beyond the norm affecting the quality of the goods and services (i) at location (Z)</p> <p>OC are the operation conditions beyond the norm affecting the</p>

quality of the goods and services (i) at location (Z)

W_i is the weight factor representing the relative importance of the specific goods/services

$W_{TT(i)}$; $W_{TC(i)}$; $W_{IC(i)}$; $W_{OC(i)}$ are the respective weight factors, representing the relative importance of travel time, travel conditions, infrastructure conditions and operation conditions with regard to accessing goods/services (i)

Setting weight factors

IRAP tools are usually used by the lowest (effective) level of government in rural areas, like districts. Effective means that this level has sufficient autonomy to allocate funds to projects. The district council usually has its preferences with regard to developments in its district and may therefore want to set the weight factors representing the relative importance between specific goods and services.

These weight factors are based on political preferences, unlike the weight factors differentiating between the more technical criteria. They are usually based on science or scientific analysis and therefore usually determined at a more central level.

The words "beyond the norm" refer to the norms and target values as set by the line departments, or others line ministries. They are often the minimum conditions the service/good providers have to meet, like the number of classrooms, and teachers for recognition of a primary school.

Often there are subpopulations in settlements with specific access needs. Only fisher families require jetties to shore their boats. Jetties have no or little value to the farming community in the settlement.

The travel conditions may affect the accessibility. Girls may not avoid tracks and roads through dense forests. It may be necessary to close roads during the monsoon. Porters will get quicker exhausted on steep roads and tracks, etc.

Because of the MCA set up it is possible to include other infrastructure related services and goods, e.g. electricity and irrigation. However there are few conditions the MCA for these non-transport goods/services must include a subpopulation and the maximum possible score of the phenomena of interest between the brackets [] should always be the same.

4.2 EFFECT ASSESSMENTS

Labour-intensive

Because of the synergies between the transport, transport infrastructure and the location and quality of the other infrastructure it might be labour intensive to assess the effects of the interventions.

For example if a settlement is connected to a district capital with a motorable road, it can certainly access many goods and services, of which it was previously deprived. It is likely that the settlement has links with other settlements (through tracks, trails other transport infrastructure), it might therefore be possible that these other settlements benefit from the intervention as well. During the ex-ante evaluation the planners have make estimates of future travel time reductions in neighbouring settlements.

Transport interventions have similar effects.

A road from the district capital connects a several settlements in series. The proposal is to construct a health centre in one the settlements somewhere halfway the road. The travel time to health services is not only reduced in the settlement where the health centre is proposed to be located but also in other settlements, certainly at the tail end of the road.

The table below presents a format for analysing the effects or benefits of the interventions. This format was developed for an IRAP project in Orissa (India). The first step is to identify the settlements that benefit of a possible intervention. This analysis concentrates on the available transport infrastructure and transport services. After all only connected settlements benefit from each other. Second step is the identification of which sectors (goods/services) will benefit from the interventions. In particular transport infrastructure and transport service interventions have multiple effects. Subsequently the values for the current and future (after the project is completed) situation have to be calculated, applying the indicators. The value for the current situation of irrigation projects is often set as zero (0), because irrigation is usually seen as a potential to grow and lack of irrigation is not considered a problem. However there are exceptions to this rule, when irrigation is considered the key solution to food deficits.

Benefiting settlements													Total Benefits
	Before	After	Benefits	Before	After	Benefits	Before	After	Benefits	Before	After	Benefits	
Primary School													
Upper Primary School													
Secondary School													
Upper Secondary School													
Vocational Training Centre													
Library													
Drinking Water													
Health care subcentre													
Primary Health care													
Community health care													
GP headquarter													
Block Headquarter													
District Headquarter													
Road condition													
Savings													
Credit													
Other banking services													
Post office													
Telephone													
Electricity													
retail Market													
Whole sale market													
Cyclone centre													
Drainage													
Forest													
Minor Forest produce centre													
Livestock centre													
Milk Route													
Ice factory													
Jetty & Harbour													
Common Facility Centre													
Agricultre service centre													
Irrigation													
Agricultural input centre													
Cold storage													
Paddy collection Centre													

Many local governments (districts, provinces) in low and middle-income countries lack the technical capacity to carry out such assessments. Therefore often the assessment tool of the IRAP toolkit is simplified.

A typical simplification is to limit the number of synergies in the analysis of transport infrastructure and transport services interventions. The format, presented below was presented for the same IRAP project in Orissa after tests provided feedback that extensive analysis resulted in low response from the Gram Panchayat (the lowest level of government in India).

Benefiting settlements													Total Benefits
	Before	After	Benefits	Before	After	Benefits	Before	After	Benefits	Before	After	Benefits	
Primary Health care													
Community health care													
Block Headquarter													
District Headquarter													
Road condition													

Christaller theory

It concentrated on those goods/services that rely heavily on transport services, e.g. ambulances for health care. Furthermore the simplification was based on the location theory of Christaller.

Christaller was interested in the relationship between market functions and the spatial patterns of settlements. Firms producing consumer products depend for their sales on the location, size and income of these settlements. Everybody will recognize this typical spatial pattern. Village with limited goods and services. Towns and cities with many more available goods and services. The companies in the cities tend to serve larger areas and many shops or service providers have developed themselves in specialized organizations. According to Christaller, larger settlements accommodate companies and organizations of higher order than smaller settlements. Supermarkets are considered of a higher order than a grocery shop. A college is also considered to be of a higher order than primary or secondary schools.

In rural India, the Block and District headquarters provide the additional services that are not available in every village. Most of the Indian government services and goods are arranged according the Christaller theory.

Thus the Block and District Headquarters represent a number of goods/services that are likely to be available at these locations. Its weight factor W_i should therefore the sum of all weight factors of all the goods and services that are likely to be located at these locations.

A major comment on this approach is that not all block and district headquarters provide the same services/goods and certainly do not have the same capacity to meet the demands from neighbouring settlements and its own population.

The Christaller theory has been translated into strategies to locate certain (government) services and goods at specific locations. The different levels of hierarchy would correlate the hierarchy between the settlements, e.g. a primary school for every village, secondary school for every town, a college for every city, etc. The location of every city, town village would be arranged in such a way that more or less every village has equal access (travel time or distance) to all government services and goods. The hierarchy of the specific services relates to the needs of the population, income of the government and technical options. For example, governments may want to provide primary education within half an hour walking distance and secondary education within one hour distance. With regard to the secondary education, the government may consider to use school busses that collect scholars, in order to reduce the cost of secondary education provision.

Countries in the process of industrialisation and mechanisation of agricultural production have used successfully developed so-called growth poles, in which non-agricultural economic activities are stimulated. The main argument in favour of the growth centres is to limit population growth in metropolises and reduction of costs of public service delivery through economics of scale. Mechanisation of agricultural production and industrialisation result in large rural-urban migration. Uncontrolled growth of the cities often results in congestion and environmental problems that can only be reversed at great expense.

The growth pole approach is less appropriate when the country is still pursuing labour-intensive agricultural development and wants to improve the attractiveness of the rural areas through improved public service delivery.

5 INTEGRATED DEVELOPMENT PLANS

Integrated development plans.

Integrated development plans are coherent action programs that address an integrated vision for the future. In addition different government sectors and/or layers prepared this coherent action program together.

Vision

Governments have to formulate a long term vision for their area of jurisdiction. This vision describes how the governments want the society to look like in ten to twenty years time. This relates to the physical environment in which the society operates and lives, but also to the behaviour of consumers, producers and the government itself. Thus the vision is a description of the development objectives. Because governments have many different objectives which are often conflicting, the vision ideally would include priorities and weight factors. With aid of these priorities and weight factors designers are able to make trade offs between design characteristics.

Each government layer develop a vision; whereby lower governments make sure that there vision respect the vision of higher level governments. This means that visions also include regulations, i.e. national governments may restrict growth of urban areas, limit location of industries or specifically allocate certain land parcels for certain developments. Because specific characteristics of particular areas, target groups it is often necessary to prepare special visions to address the needs of these special groups. Tribes in remote rural areas are likely to have different development needs than the urban elite. The visions should accommodate these demands as best they can.

Visions of governments are likely to change over time and after elections, it is therefore important to update visions on a regular basis, i.e. in the first year after elections.

Sector policies

In standard sectoral approaches, each government sector will convert this vision in sector development objectives and methodologies to develop sectoral Masterplans. Often the methodology is based on a Multi-criteria analysis. It should be clear that the sector development objectives and the methodology for developing sector Masterplans have to be adapted every time when new visions are presented.

Action program

In the Integrated Development Plan context, a multi-disciplinary project team designs a series of actions to realise the vision. The members of this team can originate from different public sectors, different government layers and even private developers. The coherent action program enables synergies between sector actions. During the development of the action program, the team carries out surveys, pilot test interventions and constantly feedback results into the project team. The team members are also the first entry point for negotiations with regard to financing the interventions

(investments, maintenance and operations).

Interventions

The action program consist of a coherent package of government and private sector interventions, that may include regulations, capital investments, publicity campaigns and many other activities.

Relevance of coherent action programs

This approach is in particular relevant when spillover effects can be expected from government activities or when other sectors are better equipped to counter problems in the society. Industrialisation requires supporting government policies concerning trade, industry, technology, education, finance, transport, agriculture, health, labour and many other sectors. Each policy affects industrialisation but also affect many of the other policy areas.

Relatively cheap regulations prevent expensive problems, like congestion around and in urban areas. This congestion is the result of too many people and economic activity in one place. Transport infrastructure projects addressing congestion problems are extremely expensive and seldom generate the benefits. This type of congestion can easily be prevented through regulation of population densities, economic activities and land use arrangements.

National governments develop policies to limit urban population growth, zone industrial activities, and invest in transport corridors. But these policies only work when executed in coherence and when provincial and municipal governments adopt similar policies to limit unnecessary transport through zoning and investment projects.

It is in theory possible to translate this development goal in specific goals for each sector individually. For example the development goal to stimulate productivity in the agriculture sector can be translated to the development objective in the transport sector to make more land accessible. But roads opening new land; may have little impact when the land is not fertile, farmers can not obtain land titles or the farmers have no financial means to invest in fertilizers. Area development often requires governments to provide all public services and even invest in irrigation projects. Private investors may be involved to serve the new population with goods and services, like food and banking.

A good coherent action program contains not only information about subprojects and their costs, but also contains information about budget suppliers and their limitations, sets deadlines for implementation, assigns responsibilities for implementation and describe risk spillovers to other subprojects, in case of budget or time overruns.

APPENDIX 1: SECTOR POLICIES

Education

Most education departments and ministries use one or more of the following criteria to identify school projects:

- Travel time to school
- Sitting area per scholar
- Scholar/classroom ratio
- Scholar/toilet ratio
- Scholar/teacher ratio
- Girls/female toilet ratio
- Minimum classrooms
- Minimum Teachers
- Availability drinking water
- Furniture/scholar ratio
- Quality of classroom ratio
- Availability Library
- Availability laboratory
- Availability playground

The norm for the sitting area of the scholars depends on the age of the students. The table below presents some generic guidelines.

Age	6-12	12-15	15-18
Sitting area (M²/scholar)	0.75	1.0	1.2

The number of scholars in a classroom affects the teaching methods and therefore the quality of teaching. Ideally only 12-15 scholars would sit in one classroom, but this is very expensive. Even high-income countries allow up to 30 scholars in a classroom. In many low and middle-income countries, even this number is unrealistic.

Schools in remote areas may not generate many scholars. It is therefore considered to be inefficient to provide classrooms and teachers for every class. Often low and middle-income countries designed special curricula, teaching methods and materials to combine several classes in one classroom. Nonetheless every school needs a minimum number of teachers and classrooms to provide the full curricula.

Many overemphasize the importance of the quality of the classrooms, opting for the highest standards of building materials and also the most expensive ones. If a school has to choose between adding a teacher in substandard classroom or high standard classroom, I suggest choosing the first option.

The availability of special toilets for girls is often important. Most women have difficulties sharing toilets with men, who do not belong to their family. For example it has been recognized that Nepali girls drop out or simply never attend school because of insufficient proper sanitation facilities.

Health facilities

Health departments/ministries have access requirements to different hierarchies of standardised sets of health services. These access requirements are often expressed in terms of travel time or distance. It is assumed that higher level of health services include the lower level of health services. The level of health services is determined by the quantity and quality of the staff, available equipment and materials. Because we want to reach health services quickly when necessary, motorable access is considered to an advantage and usual an important quality of transport criteria.

Markets

Access to markets is very important for both households and businesses. It is the location where people purchase and sell. There are different kinds of markets. Daily goods are often available in every settlement/neighbourhood. Other goods are often available in the towns or cities. IRAP concentrates on the physical location of markets and the connecting transport infrastructure. Markets develop at locations convenient to both buyers and suppliers. Governments and other organisations should be cautious to create markets at new locations, without studying the demand from both buyers and suppliers. It should even be more cautious to improve the quality of the existing markets and raising the stall fees, which just may result in a cost increase of the products on that market, resulting in a lower demand. Increasing the quality of the market and raising the stall fees is only acceptable if it either results in lower transaction costs at the market, or in higher quality of the products (=higher retail value). Nonetheless access to markets can often easily be improved by connecting settlements with motorable roads, which connect with markets. Motorable roads allow larger volumes of transport, cooled transport (e.g. important for collection of milk) and important for quickly deteriorating goods (e.g. fruits) faster transport.

Electricity

Electricity is a typical intervention that is not transport related. It is not possible to take a bag or bucket and to collect electricity. Most electricity is provided through companies that sell it to its costumers.

They create electricity grids, starting from a source (e.g. power plant) to its potential (paying) costumers. Electricity companies prefer to concentrate on the urban areas and high-income rural areas, where most of their costumers are located. Depending on the legal arrangements, they may have to connect every settlement, neighbourhood or even street to a grid or provide a source in each settlement. In other arrangements, they actually have to provide electricity to every household (located in a settlement).

The consumption rate of electricity is measured in kWh. According to Bond⁷ the average consumption rate of a household of 5 to 6 persons in a low-income areas in South Africa is 80 kWh. If the consumption rate is lower it is unlikely that the family is able to operate items like refrigerators, heaters or electric stoves.

⁷ Bond, P: Cities of Gold, Townships of goal; Essays on South Africa's New Urban Crisis, 2000

- Public Telephone** Telephone companies in low and middle-income countries are often profit making organisations. They may be public, private or public-private enterprises. The demand for their services is high even in the remote rural areas. Depending on the license agreements, the company may need to connect every settlement with its communication network and provide a public phone in each settlement (of a certain size).
- Banks** Access to financial services is important to everyone living in a cash economy. We need banks to borrow, save money or to transfer money.
Most banks are commercial institutes and only provide these services against commercial rates, which should cover their expenditures. The cost for every transaction, regardless the value of the transaction, is more or less the same, but the revenue generated by the bank correlates with the transaction amount. Many banks in low and middle-income countries require high first deposits to exclude low-end costumers. Furthermore most banks are located in urban areas. Some countries and some banks have adopted policies to provide more banking services to the rural poor. They may be willing to use travel time and population densities as criteria for opening new banks. However most likely banks will have some requirements to the locations, like accessible by a motorable road, availability of electricity and telephone lines.
- Post offices & letter boxes** Unlike banking services, most postal services in rural areas are provided by public companies. Postal service companies may provide different hierarchy of services at different locations. It usually collect outgoing mail at letterboxes, provide house delivery of incoming mail and provide other services at the post offices. Usually letterboxes and post offices are only located in settlements that are connected to the main road network with a motorable road.
- Public transport** In many low and middle-income countries public transport services are operated by private enterprises. It should be obvious that these enterprises only operate on profitable routes. These routes are always motorable. Public operated transport services may also operate on loss-making routes, on condition that the overall company still generate sufficient revenue to cover its costs. The demand for public transport services is often very high in low and middle-income countries, because most people with low and middle-incomes cannot afford to buy cars. The demand also correlates with the population densities. In rural areas with high population densities (e.g. Orissa) it is likely that public transport is available on every motorable road, only the frequency of transport differs. Such assumptions are incorrect for areas with low population densities like the mountains of Nepal.
- Access to fields** When possible, farmers want to be able to access their field, directly from the motorable road. Motorable roads allow fast, easy and bulky

transport. However, this demand would result in a very high road density, which is unacceptable from different point of views, e.g. environment and finance. However in several countries attempts have been made to include access to fields in the analysis. In Laos and Cambodia it is suggested that only fields within a particular distance to the motorable road (2 and 5 km respectively) benefit from the motorable road. In Nepal the irrigation department adopted a policy to give priority to irrigation schemes that have access to a motorable road within 2 hours (measured from the centre of the scheme).

Equally, it can be argued that settlement within these ranges benefit sufficiently from the road. However most settlements prefer to be connected directly with the motorable road network for earlier mentioned reasons.

Veterinarian

Many households in the rural areas cultivate crops and livestock for their livelihoods. Livestock is for many an investment and a way of banking. A calf will grow into a cow and produce milk and meat. Vets provide services to preserve these investments. Both governments and the private sector may provide these services. The private sector prefers to locate itself in settlements that result in sufficient number of clients. Preferably that settlement is connected to main road network. Even the government engaged vets seldom locate themselves in settlements that are not connected to the road network.

It is reasonable to assume that every vet will be able to provide the same services and has obtained the same skills.

Processing plants

Processing plants (like rice mills) help farmers to add value to their produce. Governments may wish to support farmers who are deprived of such services from the private sector. Usually these farmers live in remote and isolated settlements.

Storage facilities

Storage facilities help farmers to preserve their products and stabilise the retail prices and it helps governments to preserve food for famine periods. In particular when the government wants to store food for food deficit periods, it may play an active role and purchase the food from the farmers. Farmer's cooperatives and the private sector may also purchase the goods and store them. The distance and road condition affects the transport cost to store the goods. From the farmers perspective they prefer storages to be located near their premises. Store providers want to maximise the utilisation of their stores and reduce the cost of their operations.

Protection against floods, cyclones, earthquakes and other calamities

A major need for all communities is protection against natural calamities, like floods, cyclones, earthquakes etc. Governments therefore build dykes and cyclone centres and other protective measures. The revenues of such protective measures are the reductions of the damages or compensation paid for, like loss of life, loss of livestock, crops and others. Often the government has a policy to compensate the damages. Note that the damages are seldom reduced to zero. A dyke may reduce the chance of flooding from once every ten years to once every hundred years. At the same

time the dyke facilitate monitoring of the situation and therefore it will be easier to evacuate the community and reduce the loss of life during a flood.

Cyclone centres

Where necessary, cyclone centres, bomb shelters should be build near the homes of the people. In particular near locations where large numbers of people gather, like schools and factories. These facilities should be easy accessible and have sufficient capacity to harbour the population.

Firewood

Many rural communities still depend on firewood for their source of energy. An improved road network allow settlements to access firewood easier. After all it is easier to walk longer distances on proper aligned roads and tracks than on trails. Over the years the settlement will cut all the firewood along the improved road or track and will lack their source of energy. Governments do well to designate areas for cutting of firewood and replant trees and shrubs.

Irrigation schemes

Most district governments receive requests to support the construction of irrigation schemes. Most IRAP toolkits do not contain tools that identify, screen, ranks and program irrigation projects. In theory irrigation projects are commercial projects and should generate enough financial revenues to cover all the expenditures.

Irrigation is artificial watering of crops in areas of insufficient rainfall to ensure high crop yields. The lack of water can be seasonable or the throughout the year. Depending on the climate, and growth periods and need for rotation, irrigation may facilitate the production of several crops per year. It is possible to assess the yields per year by studying climatic and soil conditions and the use of production data in similar regions. Alternatively it may be possible to obtain production data from progressive farmers or to conduct experiments. The ultimate yield per crop by the average farmer may be assessed at 75% of the experiment. Between farmers the yield differences may be as big as 50% depending on farming standards and soil conditions. From year to year yield variations of 40 and 20% are possible for respectively rain-fed and irrigated production. In good irrigation schemes, the initial yield increase due to irrigation may develop even further and double it self during a period of 25 years. The annual increase during the first 15 years is about 5% and the annual increase during the last ten years is about 2%.

Commodity	Rain-fed yield (t/ha)	Irrigated yield (t/ha)	Growth period (days)	Rotation necessary?
Rice high-yield varieties	1.5-2.5	3-5	110 (high yield)	No if pest control
Upland rice	0.8-1.2		90-210 days	Shifting cultivation
Lowland rice	1.5	2.5	90-210 days	Usually no crop rotation
Wheat	3	5	120-210 days	High-altitude 2 crops/year; low altitudes in combination with irrigated rice
Maize	1.4	4	90-150 days	Recommended
Sorghum	0.45 (India)	4-5	120 days	
Millet	0.6	4	60-90 days	Often in combination with groundnuts
Soya bean	0.6-2	3	80-160 days	Yes
Groundnuts	1.5-2	2.5-3	90-150 days	Yes
Sunflower	0.65-1.4	2	90-150 days	Not more than once every 6 years on the same field
Olive	25 kg/tree	50 kg/tree	1 per year	
Sugar cane	15-30	40	2-3 times per year	No
Sugar-beets	30	45	180-240 days	

Many governments in low and middle-income countries subsidise irrigation schemes. Irrigation is often considered a successful method to reduce food shortages, to substitute imports of rice and other staple foods and increase the GDP of the area. In addition governments may have active policies to support small farmers to improve their livelihoods. Despite all the government support many irrigation schemes collapse after a few years due to lack of maintenance. Often the management organisations of the schemes lack the technical, managerial and financial capacities or simply the incentives to operate and maintain the schemes properly. Governments do well to investigate these issues before investing in irrigation schemes. In some countries the government itself takes up the role to manage the schemes and lease out the plots to the plot holders.

Because irrigation is a commercial activity, it is common accepted that plot owners in the scheme contribute financially to show their actual interest in the scheme.

In most situations, governments will screen if irrigation projects are financially viable and subsequently rank them on basis of economic criteria. Projections of future yields and operation & maintenance requirements are needed to determine the feasibility of irrigation projects. Irrigation projects usually doubles or triples the yearly harvest periods. Even when there is insufficient water to produce two crops of rice per year, an irrigation scheme may allow farmers to produce an alternative crop (like vegetables) during the dry season. Besides these immediate effects irrigation projects also result in higher yields per harvest, on condition that all irrigation related activities are properly carried out.

In arid areas governments will also take the water requirements in consideration. They may divide the productivity with the water

requirement to establish the water efficiency of the scheme. However governments may want to rank projects on basis of other criteria and use a Multi-Criteria Analysis. A major difference with other projects is that it is not necessary to calculate the without project situation, because its value is zero (0). After all, the situation without irrigation is not considered to be a problem. Below an example of an MCA for irrigation is presented. Note that the maximum possible score for the improvements is 100 points. The division of these points are based on personal preferences and need to be adjusted to local preferences.

IRRIGATION:

Beneficiaries * (Access to road score [max 8] + Access to Market score [max 12]+ yield increase score [max 25]+ Food deficit score [max 25]+ Land holding score [max 15] + financial contribution [max 15])

Access to road score:

Travel time from nearest road to the centre of the irrigation area	Points
Less than 2 hours	8
$2 < X < 3$ hrs	6
$3 < X < 4$ hrs	4
$4 < X < 6$ hrs	2
$X > 6$ hrs	0

Access to market score:

Travel time from nearest market to the centre of the irrigation area	Points
Less than 5 hours	12
$5 < X < 6$ hrs	9
$6 < X < 7$ hrs	6
$7 < X < 8$ hours	3
$X > 8$ hrs	0

Annual yield increase score

Expected average yield increase during project life	Points
$X > 300\%$	25
$200 < X < 300\%$	20
$100 < X < 200\%$	15
$50 < X < 100\%$	10
$25 < X < 50\%$	5
$X < 25\%$	Project rejected

Food Deficit score is only calculated if the project is located in area with food deficits.

The food deficit scores depend on the value identified for the annual yield increase score. The percentage of land used in the scheme for food production is multiplied with the value identified for the annual yield increase score and divided by 100.

Landholding score:

The landholding score is the sum of the plot-holders with a particular plot size multiplied with the plot-size points belonging to that respective plot size

In formula:

$$\text{Landholding score} = \sum (\text{points plot size}_i * \% \text{ plot holders}_i)$$

Plot size	Points plot size	% plot holders	Subtotal
X < 0.7 ha	0.15		
0.7 < X < 1.2 Ha	0.12		
1.2 < X < 1.8 Ha	0.09		
1.8 < X < 2.4 Ha	0.06		
2.4 < X < 3 ha	0.03		
X > 3.0 Ha	0		
Total			

Thus if the distribution of plot owners is

Plot size	Points plot size	% plot holders	Subtotal
X < 0.7 ha	0.15	25	0.15 * 25 = 3.75
0.7 < X < 1.2 Ha	0.12	35	0.12 * 35 = 4.2
1.2 < X < 1.8 Ha	0.09	15	0.09 * 15 = 0.135
1.8 < X < 2.4 Ha	0.06	10	0.06 * 10 = 0.6
2.4 < X < 3 ha	0.03	10	0.03 * 10 = 0.3
X > 3.0 Ha	0	5	0 * 5 = 0
Total			8.985

Financial contribution:

Financial contribution	Points
X > 25%	15
20 < X < 25 %	10
15 < X < 20 %	5
X < 15%	0