Macro-Economic Effects of Development Plan Expenditures

A Framework for Analysis, with Special Reference to Uganda

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Summary:

Development plans are mainly concerned with the financial aspects of development projects, while the economic aspects are often neglected. This paper constructs a methodology for converting the information given in development plans into data suitable for a real-economy model. The method deals with backward linkages in terms of the demands by the projects for products and services from the rest of the economy; and forward linkages in terms of benefits the project is expected to generate and its future demands on public budgets for operation and maintenance. The paper is focusing on Uganda as a case, while the overall aim is to illustrate general principles.

Sammendrag:

Utviklingsplanene i mange utviklingsland er i hovedsak opptatt av de finansielle sider ved utviklingsprosjekter, mens de økonomiske aspekter ofte blir neglisjert. Dette arbeidsnotatet utvikler en metode for å konvertere informasjon fra utviklingsplanene til data som passer inn i en modell for den totale realøkonomien. Metoden tar hensyn både til hvordan prosjektene skaper etterspørsel etter innsatsfaktorer fra resten av økonomien, og hvorvidt prosjektene vil generere produkter og tjenester og eventuelt legge beslag på offentlige budsjetter til drift og vedlikehold. Arbeidsnotatet bruker Uganda som konkret eksempel, men formålet er samtidig å illustrere noen generelle prinsipper.

Indexing terms:

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To be ordered from Chr. Michelsen Institute, Fantoftvegen 38, N-5036 Fantoft, Bergen, Norway. Telephone:+47 5 574000. Telefax:+47 5 574166

Contents

Tables

Annexes

General introduction

Development plans have traditionally constituted important elements in the development efforts of LDC governments, as well as significant elements of their *total* economic activity. As such the development plan should provide an important input to any economy-wide planning framework related to these economies. However, the data presented in the development plan may not necessarily correspond to the data-needs of the economic framework. Often the plan may pay a great deal of attention to the *financial* aspects of the projects involved, whereas the framework may typically concentrate on the *economic* aspects. Thus, the plan may in great detail deal with the questions of how much the project will cost, and how these costs are to be financed (by donor etc.). This is understandable from an administrative point of view, funds are in most cases seen as the limiting factor; without them the project in question can not go ahead at all. And even if funds have been secured, annual disbursements remain a central concern, representing an important "tool" in the supervision of project implementation.

Factors such as these may of course be important also within the context of the planning framework, but the type of framework we presently have in mind will typically be in the form of a macro-economic model concentrating mainly on the so-called *real-side* of the economy. Thus, pertinent questions in respect of the development plan expenditures will for instance be: what kind of *products* are required for the project, and where may they be obtained?

In addition, the benefits that the projects are expected to produce in terms of future outputs will tend to be central to the model. These benefits reflect upon the basic nature and purpose of the projects in question, and as such they ought to be spelled out by the relevant project documentation. But even so, the information given may not satisfy the needs of the model. The information on these matters is often incomplete, verbal and general, representing for instance general statements of purpose rather than actual projections of results. Information of this kind is not specific enough for a modelling exercise, which typically will require quantitative estimates. And even when such estimates are given, they often leave something to be desired in terms of comparability, clarity and reliability. Hence, in many cases these documents tend to analyze the project concerned in isolation, presenting whatever micro-estimates that seems immediately appropriate or available, based on assumptions that are not always evident. The need to present a set of *comparable* estimates, based on common (and transparent) assumption about the rest of the economy, is seldom, if ever, observed in these documents, or, indeed, in the plan itself.

As often as not, the most concrete and solid data describing the projects are therefore confined to the financial variables. This can make the task of converting the information given in the development plan into data suitable for the real-economy model quite a challenging one. Nevertheless, in view of the overall economic importance of the development plan, the challenge have to be faced if the model is to be "complete". In the present paper we shall present *one* attempt at meeting this challenge. In doing so, however, we shall move from the general to the specific, adopting the concrete case of Uganda as the basis for our analysis. Hence, while the overall aim of the paper is to illustrate general principles, the concrete analysis presented is highly specific, reflecting the chosen focus on the Ugandan situation.

The setting for the present analysis

Uganda has been through a difficult period during its recent past. Years of war and mismanagement had effectively crippled the economy by the second half of the 1980s. The Ugandan Rehabilitation and Development Plan (RDP) constitutes an important element in the current government's efforts to rebuild the national economy. Although these efforts are only part of a wider economic policy with emphasis on private sector participation, the RDP must be relied upon to account for a significant part of the national investments during the next few years. Given the present national setting, the implementation of the development plan will consequently have significant implications for the economy at large also in the specific case of Uganda, not only in terms of the expected increase in the future supply of public goods and services, but also in terms of the goods and services which are "today" consumed by the projects involved.

In the current paper we shall propose a way of analysing these aspects of the RDP, with a view to make it accessible for further analysis within the framework of an economy-wide macro-economic model. The existence of such a model consequently provides the basic rationale for the present exercise. Even so, a Ugandan model of this description does not as yet exist. It is intended, however, to build such an economy-wide model at a later stage; the present effort may be seen as the first step in this direction. This procedure may be justified on the grounds that the results of the present analysis, due to the importance of the RDP, will have important implications for the nature of the model that may eventually be constructed "around it". But the opposite is also true: the nature of the ultimate model will have important implications for the present analysis. This being the case, we shall have to assume or propose certain aspects of the future model, (limiting ourselves to those aspects which have a direct bearing on the present analysis of the RDP).

As already indicated above, the implementation of the RDP will have significant economic implications, not only in terms of stated project-objectives as such, but also in terms of its general effects upon the economy at large, ie: through its overall *linkages* to the various parts of the economy in general. Thus, questions of the following nature may be of typical relevance to a future macro-model:

- what kind of products will the RDP-projects demand, and from where,
- how will this demand affect the rest of the economy,
- what benefits will the projects produce in terms of future supply of goods and services,
- what demand will their make on future public budgets etc. (in terms of implied operation and maintenance costs).

In the next few sections of this paper we shall discuss how best to utilize the available RDP-data in terms of model-needs, with reference to above questions, as far as these can be addressed given the nature of the available data. For ease of reference we may refer to the first two questions as relating to the *backward* economic linkages, and the last two as relating to the *forward* economic linkages. Before we discuss these linkages, however, we shall describe the nature of the existing RDP-data, and introduce two initial classification concepts.

The nature of existing RDP-data

Data on anticipated/planned annual disbursements for all RDP-projects are regularly collected by the Ministry of Finance and Economic Planning (MFEP). The ministry store the data in a computerized database, from which they may be retrieved in the form of Project Profiles. The profiles are regularly published as part of the official RDP documentation.[1]

The project profiles contain the following cost categories (the definitions of the various cost categories etc are given in table 1):

- Assets
- Constructions & Buildings
- Machinery
- Roads
- Vehicle Purchase
- Trucks
- Cars
- Other
- Non-Capital Payments
- Forex Salaries & Wages
- Local Salaries & Wages
- Project Allowances
- Vehicle Operation & Maintenance
- Other expenditures

[1] Ref.: Rehabilitation and Development Plan 1991/92-1994/95, Volume II.

In addition , the project profile contain information about the origin of the cost elements, ie:

- Foreign (= Imported)
- Local (= Locally purchased)[2]

Comparing these categories to the introductory description of what type of information the plan *might* have contained, we can at once conclude that the RDP-data seems relatively well suited for an economic analysis. Hence, all costs associated with capital formation and labour are specified in great detail, both with respect to their type (roads, cars etc), and origin (foreign, local).

Assumedly, these costs represent the lion's share of the total RDP-costs. If so, the major demand-components arising from the RDP are detailed directly in the basic data in terms of the dimensions: origin and type. These dimensions will constitute important elements in the future economic model, reflecting the fact that the provision of different types of assets and inputs may have different effects in the economy. Thus: the use of locally made products will for instance not create the same Balance of Payment effects as the use of imports, the future costs of maintaining and operating vehicles will differ from those of clinics (both by value and type), etc.

Even so, it is a fact that the RDP-data only answer the first of the four question given in above chapter, and that their specification with respect to this question is not as complete as we ideally would have preferred for our present purpose. The task of converting available plan-data into relevant model-inputs consequently still have to be faced.

Two initial classification concepts

Project classification

The RDP-*projects* are sorted and presented by the MFEP according to a type of activity classification (see table 2). In order to avoid conflicting standards, unnecessary work and possible confusion, our analysis of these data should as far as possible adopt the standards, classifications etc. already established by the MFEP. Thus, in terms of *project*-classification we will adopt the classification of table 2 "as is" also for our purpose.

[2] Note that these describe the origin of the *commodities* in question. In earlier RDP-documents there seems to have been a tendency to confuse this with the financial question: are the funds paying for these commodities coming from local or foreign sources? It is not at present known if this is also the case for the most recent RDP-profiles.

Definition of production sectors

In order to analyze the implications of the RDP-expenditures within the framework of a wider macro-economic model, we need to define the economic sectors of this model. A proposal towards this end is made in table 3. As seen from the table we have as far as possible adopted the same sectors as used in the official GDP-tables published by the Statistics Department (SD). This reflects the basic principle that there should be as direct a correspondence as possible between the model-structure and its basic statistical sources. The rational of the proposal contained in table 3 is further discussed in Annex 1.

Backward linkages

Analysing the RDP-expenditures in term of their backward linkages implies asking the questions:

- what kind of products will the projects demand, and from where,
- how will this demand affect the rest of the economy.

For instance: Are we talking about transport equipment, pesticides or consultancy services? Will they be imported or supplied from local sources? In terms of the (future) macro-economic model these are important questions. Because: even if the Government of Uganda (GOU) should have no problem *financing the Shs-expenditures* in question, these expenditures reflect *"physical" demand for goods and services*; demand that have to be satisfied by either local producers or by imports. Hence, relevant questions for the macro-analysis will be:

- Can all demand for local products actually be satisfied, given existing or expected production capacities?
- Can all demand for imports be satisfied, given the availability of Forex?

Having answered these questions one way or the other, the analysis may then move on to questions relating to the economic effects of satisfying these demand components, ie: to the second of above questions. In general, however, this is seen as being outside the scope of project documents etc. For the purpose of the present paper, we shall consequently put this question aside, leaving it to the future model to deal with. Hence, at this stage we shall limit ourselves to the task of classifying the project expenditures by cost component and source of supply.

Classification by cost component

For our present purpose, the data on project expenditures given in the project profiles merely represent raw data which we will have to convert, split and merge in various ways in order to analyze their economic implications. As a first step towards this end we will classify the expenditures according to the type of cost components involved. A classification of this description is given in table 4.

The classification is seen to associate each cost component with a four-digit numerical code. It is in principle intended that the person(s) doing the analysis will scrutinize the original expenditure items as they appear in the RDP, allocating each one a relevant cost component code.[3]

However, except for the cost category "other expenditures", there is a "1-to-1" correspondence between the expenditure codes and the cost categories of the RDP. Provided that all RDP-data are correctly classified (ie: in accordance with the definitions set out in table 1), most of the expenditure coding may therefore be left to the computer. The relevant codes for MFEP's original cost items are given in table 5.

As already noted, no code(s) may be a priori specified for "other expenditures", this cost category containing a "mixed bag" of residual costs. These costs, moreover, may tend to be of a highly diverse nature in terms of specification; some may be specified in great detail while others are only very broadly described. If this is the case, cost component codes reflecting alternative degrees of specification will have to be accepted. Thus, in table 4 the degree of specification with respect to the secondary production factors varies considerably.[4]

Classification by source of supply

Next we will convert project expenditures into demand components defined in terms of their typical sources of supply. A practical way of doing this is proposed in table 6, based on the cost components defined above. The sources of supply classification is seen to embrace two dimensions, one describing the source of supply in terms of the *producing sector* (ie: the sector of origin), and a second describing the source of supply in terms of the *geographical origin* (ie: the foreign versus local origin).

The sector of origin is consequently the sector typically supplying the item in question, given the production sectors defined for the present exercise. As concerns the imports we may alternatively define the sector of origin as the sector that *would have* produced the item in question, *if it had been* produced in Uganda.

In some instances the correspondence between a cost component and its sector of origin is unique and obvious, but in many cases this is not so. In these cases we have to split the cost components between sectors of origin as best we can. It

3 The cost component codes are essentially introduced for programming purposes, assuming that the subsequent analysis will (have to) be computerized.

4 The classification proposed in table 4 reflects the cost-structure of RDP-projects, as published in 1990/91. Additional classification codes may be added, if needed, to accommodate the "present" cost-structure.

should be noted that the "splittings" proposed in table 6 are of a preliminary and tentative nature only, reflecting an analysis of the RDP-data available in 1990/91. It should be the concern of the person performing this analysis at any given time to scrutinize these and revise them whenever feasible. The same is true for the percentage ratios splitting the cost components into foreign versus local origin.

Having done so there should be no need for further intervention from the analyst at this stage, the conversions proposed in table 6 having been structured in such a way that the cost components translates directly into sectors of origin. The actual task of converting the former into the latter may therefore be left to the computer.

Forward linkages

Analysing the RDP-expenditures in term of their forward linkages implies asking the questions:

- what benefits will the projects produce in terms of future supply of goods and services,
- what demand will their make on future public budgets etc. (in terms of implied operation and maintenance costs).

Even though these questions relate to the net benefits of the projects, and thus reflect on their basic rationale, project documentation tend not to address them to the satisfaction of the macro-analyst. Hence, the benefits of each project tends to be described in its own specific way, based on special and sometimes unstated assumptions. This fact make it difficult to extract proper and comprehensive macro-estimates from them, reflecting a common and "agreed base-line scenario". Even so, we should of course take note of all relevant information on these effects that may be available. Foreseeing that this will probably turn out a "mixed bag" of data, and probably also a difficult one to handle analytically, we should in addition utilize the existing expenditure data "to the maximum", converting them into economic categories that may assist the model in estimating these effects. In essence, this may be achieved by analysing the project costs in terms of *how* and *where* in the production system they are used, ie. in terms of their end-use and purpose.

Classification by end-use and purpose

In this section the cost components are classified according to their assumed end-use and purpose, ie.:

- in terms of their productive function (i.e. whether they represent accumulation of capital assets, or direct, recurrent inputs into the production-process),
- in terms of their receiving sectors (i.e. which production sectors are the (direct) recipients of the assets and inputs in question)

For this purpose we first allocate the various cost components to four cost elements: labour, intermediates, fixed capital and stocks (see table 7.A). Next, we aggregate these four elements into two broad cost categories: recurrent and capital costs. All these allocations are either standardized or definitional, and may as such safely be left to the computer to perform automatically.

The costs will however also have to be broken down by recipient and function. Ie: they will have to be classified in terms the sector(s) receiving the project-inputs, and in terms of the productive functions: capital formation and production inputs. We propose to do this on the basis of above defined broad cost categories: recurrent and capital costs. Hence, rather than breaking down the full project-costs in "one go", or each cost component individually (in several "goes"), we prefer to break down the two project-totals (for recurrent and capital costs). No a priori given ratios apply for these breakdowns, which must be specified exogenously for each project by the analyst himself. The ratios should be specified in the format given in table 7.B.

As seen from table 7.B there are a total of (3*N) possible coefficients (for each project), where N is the number of production sectors allowed for the macro-model. This may seem a "tall order"; considering that we have proposed a total of 9 sectors at the aggregated level, and 27 at the disaggregated, (see table 3). However, only a very few of these possibilities will apply in each actual case. Thus, as a rough first approximation we might expect the receiving sector to be identified by the project's RDP-sector-classification, the capital formation to be given by the capital costs, and the production inputs to correspond to the recurrent costs. Unfortunately, this represents an over-simplification of the real situation, (although not a total distortion). Thus:

- The sector-classification of RDP-projects does not correspond to the classification of production sectors on a "1-to-1"-basis, the RDP-project may for instance cover more than one production sector.
- If the project "supplies" more than one sector, the distribution of capital by receiving sector may differ from that of inputs.
- Recurrent cost may occasionally be capitalized, in which case they should be allocated to capital formation rather than to production inputs[5].

The great choice of options given in table 7.B consequently reflects the fact that we need to be able to specify more than one receiving sector, that we need to be able to specify different distributions for different cost categories, and that we need to be able to allocate recurrent costs both to capital and inputs.

[5] Capitalization of recurrent cost elements is feasible when the costs in question represent the construction, installation, start up etc. of some physical capital item. See Annex 2 for a further discussion.

The way to handle the exogenous data requirements of table 7.B is consequently (for each project):

- First, to decide on the relevant receiving sector(s), (as spelled out in the supporting project documentation)
- Next, to allocate the capital costs to capital formation, breaking them down between receiving sectors by specifying the percentage ratios: C_i.
- Finally, to split the recurrent costs between the two productive functions (capital formation and productive inputs), and allocate each one to its relevant receiving sector, by specifying the percentage ratios: R_{1i} (for the recurrent costs allocated to capital formation), and: R_{2i} (for the recurrent costs allocated to production inputs).

Based on above data the actual allocation of cost elements by productive function and receiving sector may be done in a single operation (for each project). In order better to illustrate the steps involved, we have nevertheless split the operation into two (ref. table 7.C and 7.D).

First, in table 7.C, the cost category elements of table 7.A are allocated to the productive functions introduced in table 7.B, without reference to the receiving sectors. Ie. they are allocated to recurrent production inputs and capital formation, defined as follows:

- Recurrent production inputs are goods and services consumed in the production process. These inputs are further subdivided into primary and secondary inputs. The primary production inputs are the *services* provided by the primary production factors, which in principle include both labour and capital. In practise, however, only labour services (wages and salaries) are included in the RDP cost estimates. The secondary production inputs are the goods and services supplied by other production sectors, ie. the intermediate inputs.

- Capital formation is the aggregate of all products used to increase or maintain the total store of the primary production factor: capital. It is further subdivided into Gross Fixed Capital Formation (GFCF) and Stocks. Gross fixed capital formation represents investments into buildings, constructions, machinery and equipment (incl. roads, dams, vehicles etc.), while stocks represent the increase in livestock herds as well as stocks of inputs, supplies and own products held by the production sectors.

The allocation of the cost category elements is quite straight forward, as illustrated in table 7.C, except for the allocation of the capitalized recurrent costs which are broken down between GFCF and Stock in accordance with the value of the capital costs allocated to them.

Finally, the totals for the various production functions are broken down with respect to their receiving sectors, as demonstrated in table 7.D. The mathematical formulas by which the final results may be calculated directly from the basic data (of tables 7.A and 7.B) are also given.

Future results generated

Finally, we shall look at the future results that the project is expected to generate. Assumedly these will primarily be in the form of benefits. Nevertheless, when analysing the future implications of a project one should not overlook the fact that projects may also bring costs; invested capital may deteriorate rapidly unless maintained, production capacity created may quickly become idle in the absence of adequate operational funds. Thus, roads will need to be maintained, health clinics will need to be staffed etc. Even so, these costs may tend to be ignored in the project documents. As long as one look at each project in isolation this is perhaps understandable; most projects are relatively small, and so are the costs arising from them. Aggregated up to the macro-level they may however become quite substantial, representing a significant burden on future public budgets. Nevertheless, we shall have to leave out this aspect in the present analysis; the data contained in the RDP project profiles etc (assumedly) being too lacking in this respect.

Concentrating on the future *benefits*, we may in principle differentiate between direct and indirect ones. The direct (or primary) benefits are those arising as a direct result of a given project, *in* the sectors that are the direct "recipients" of the project. The indirect (or secondary) benefits represent the *additional* effects arising throughout the rest of the economy, as a result of the increased activity implied by the direct effects. For instance: the building of a sawmill will in the first instance have the direct effect of increasing the production in the sawmill industry itself. In addition it may boost the production of other industries through its supply to, and demand from, them. The indirect effects are often important, and may even constitute the basic rational of the project. Thus, the creation of transport facilities has been a priority of past RDPs. This is assumedly not because transport *in itself* is such a good thing, but rather because transport is essential to the effective operation of the rest of the economy.

But even so, the estimates of future benefits that we may hope to obtain from project documents with any degree of reliability, tend to be restricted to the direct effects. This is so because these relate most directly to the project environment itself, whereas the latter relates to the entire economic structure. For the present exercise we may consequently have to restrict ourselves to the direct effects, leaving the indirect ones to be calculated within the framework of the future economy-wide model.

Basically, the expectation of future benefits in terms of increased production or supply of various goods and services, represents the fundamental reason for carrying out a project. As such, one might perhaps have expected these benefits to be spelled out in quite concrete and detailed form in the relevant project documents. However, this is not always so, in practise the benefits are often described in rather vague and "non-numerical" terms. And even when the benefits are described in terms of numerical estimates, these are, as earlier pointed out, of a highly diverse nature. Thus, it is in general not possible at this stage to express the benefits of the various projects in term of a *common* variable, reflecting a *common and well defined* set of assumptions about the general economic setting. Instead we shall have to collect whatever information is available, leaving it to the future model to decide how to make the best possible use of this material.

This being the case, we will have to use a fairly open-ended coding-format for the specification of future project-results. In table 8 we have proposed such a format, allowing for a wide variation in the specification of the future benefits.

It may be noted that table 8 specifies a time-horizon of six years for the representation of future benefits. This horizon basically reflects the four years RDP-period, (plus two extra years added for technical reasons). From the point of view of future "returns" on the financial resources "invested" today and in the next few years, this may seem a short period. Normally, one must allow for a certain time-lag between "the sowing and the reaping". Hence, the benefits of the investments made during the current plan period may to a great extent be expected to materialized only *after* the end of that period. However, depending on the definite time-horizon built into the future planning-model, these late benefits may not be directly relevant to our current exercise. Thus, while it may be undeniable that the full benefits resulting from the present investment plan may only materialize after quite a few years, the actual data needs of the planning model may not extend that far into the future. Since the current exercise is undertaken to meet the data needs of the model, rather than to analyze the plan as such, the ruling principle should be to tailor the analysis of the plan-results according to the actual needs of the model. The six-years horizon adopted in table 8 reflects this principle, on the assumption that the planning horizon of the government is expressed by the four year RDP-period.[6]

The fact that a significant part of the future benefits arising from the implementation of the RDP will only materialize after the end of the model's time-horizon, may have its blessings. As already stated, the factual representation of these benefits given in the basic project-documents leave a lot to be desired. However, to the extent that these benefits fall outside the model's time-frame, their unsatisfactory representation are of no immediate and real concern to us.

[6] See annex 3 for a further discussion of the time-frame of the future model.

Instead, we may have to be concerned about the representation of today's benefit from past projects. This, however, falls outside the scope of the current paper.

Changing the basic scenario

Above we have discussed how to analyze the RDP-data in order to satisfy the assumed data-needs of a future planning model. Throughout this exercise we have focused our attention on the technical question of how to achieve this end, given the nature of the present RDP. The specific characteristics of the *present* plan are of course both a natural and important point of reference for any attempt at analysing the economic implications of Uganda's development efforts. It does not, however, constitute the *only* scenario relevant for our present purpose. Realising that the overall project-content of the RDP, as well as the characteristics of individual projects, may (and will) change over time, we should be prepared to analyze also alternative RDP scenarios. Hence, in this chapter we shall propose a "formula" allowing us to analyze various alternatives to the "present" RDP. Technically speaking, the specific characteristics of the "present" RDP will consequently only be treated as one among several possible scenarios. Even so, it will still represent a basic alternative in our analysis, to be used as a point of reference for the other scenarios.

Taking the basic scenario as a point of departure, we may introduce changes in a number of ways. For instance:

- A: By changing the content of the project-"bag" making up the scenario (within the limits of existing priority and reserve listed projects).
- B: By rephasing the annual implementation *volume* of projects included in the scenario.
- C: By changing the overall *price*-structure of projects included in the scenario.
- D: By changing the basic character of projects included in the scenario (ie: their basic "size, content and direction", in other ways than specified under B and C).
- E: By introducing entirely new projects.

In the following we shall propose a mechanism for handling scenario revisions with respect to A, B and C above, these types of revisions assumedly being the most relevant ones for our present purpose. Similar structures *could* be constructed for the type of changes specified under D and E. This is not done, however, because this may seem unduly restrictive and complicated,[7] especially if one accepts the view that these types of revision are rather less likely to occur than the other. If changes of this nature are to be introduced, it is therefore proposed that

[7] Such revisions would for instance have to be made by blowing up (or down) an already existing expenditure pattern, based on the average cost-structure of some "basic projects", or similar.

they be specified and entered in the form of "dummy" projects, (ie: by introducing new project profiles into the project menu, specifying the values of the relevant additions or revisions).

Returning to the changes summarised under A, B and C above, we may take note of the following facts:

- Changing the content of the project-"bag" may be done quite easily by excluding projects which are part of the basic scenario, (ie: which are on the RDP priority list), and/or including projects from the present RDP "reserve list" (ie: projects that are included in the MFEP database, but not yet "elevated" to the status of priority projects).

- Rephasing annual implementation volumes implies changing the speed with which the projects are implemented, but *not* their total budgeted costs. This is done by shifting the base-scenario volumes backwards or forwards in time. By nature, these base-scenario implementation volumes are however cost-estimates rather than physical volumes, (ie. they are expenditure-"volumes" measured in terms of the price-set defined for the basic scenario). Shifting these cost-"volumes" around in time will consequently also imply a shift in the underlying price-factor, unless all costs are all measured in the same (constant) price-set. Luckily, this is the case for the RDP data. Thus, the project profiles of RDP 1991/92-1994/95 are all measured in constant June 1992 prices (for 1992/93 onwards). For our purpose, these cost-estimates may consequently be interpreted as reflecting the "real" volumes of implementation.

- Changing the overall price-structure of projects implies changing the overall financial costs of the given implementation-volumes, (i.e. *without* changing the magnitude of the latter). Such annual price-changes may be relevant whenever we want to change our cost-estimates from one set of constant prices into another, or from constant to current prices. It may also be used to account for changes in relative prices, or correct for under- or over-pricing in the original cost estimates. Ideally, therefore, the price changes ought to be effected on each cost item of each project individually. However, this would make the process of revision unduly cumbersome. In practice we have therefore limited our options so that each project may be price-revised on an individual basis, while the cost items of the project concerned are all revised by the same factor.

In order to deal with these three types of scenario-changes, we propose to introduce a Project Scenario Register, detailing the various project specifications making up a given scenario. As seen from table 9 the register contains:

- Firstly: a Project Menu identifying *all* tentatively relevant RDP-projects; ie: all projects included in the MFEP project database, whether they are presently included in the priority list or not.[8]
- Secondly: a Project Selection Code specifying whether to include or exclude the project in question in the "current" scenario. (Ref. A above).
- Thirdly: a set of codes and coefficients detailing the changes to be made with respect to the phasing of project implementation volumes. (Ref. B above).
- Fourthly: a set of codes and coefficients detailing the changes to be made with respect to the price structure of the implemented volumes. (Ref. C above).

Revisions with respect to the volume- and price-dimension (ref. type B and C) consequently require the specification of a code defining the method of revision, and (depending on the method of revision specified) a set of revision coefficients. This "two-step" approach is adopted in order to allow for the possibility of both individual and aggregate treatment of the projects concerned. Assumedly, revisions may best be undertaken on an aggregate rather than an individual basis for a number of smaller projects. For instance: the most practical way of estimating the rephased implementation patterns of a multitude of health-projects, may be to rephase their combined annual disbursements, rather than those of each individual project. Hence, in this case we will specify the coefficients: k_{it} against the relevant subsector-heading in the scenario register.

In other cases however, we may want to utilize the option of individual treatment. This may for instance be the case as concern certain large or important projects. The programme consequently allows for this through the introduction of the relevant codes and coefficients.

The further technical aspects of constructing a mechanism allowing for the calculation of revised cost- and implementation-estimates, are discussed in Annex 4.

8 Note that the tentative inclusion of the reserve-listed projects into our analysis, have implications also for the number of projects that need to be analyzed as described in previous chapters. Hence, all projects included in some scenario or other will have to be analyzed in terms of economic linkages etc.

Table 1 Definition of existing RDP-data

For *each project* the MFEP collects the following types of data on disbursement and funding for *each year* of the plan-period:

	Foreign[2]	Local[2]	Total[1]
EXPENDITURES: 010 - Assets[3] Construction & Buildings Machinery Roads 020 - Vehicle Purchase Trucks Cars Other[4] 030 - Non Capital Payments Foreign Salaries & Wages[5] Local Salaries & Wages[6] Project Allowances[7] Vehicle Operation & Maintenance[8] 040 - Other Expenditures[9] - - Total expenditure			
FUNDING:[10] Funds Secured - - Total Secured Funds Funding Gap			

Notes:

1) Total disbursement on each expenditure item (as valued in a designated currency (USD), at prices and exchange-rates referring to a specified date)

2) The total disbursements are broken down by their foreign and local cost-elements; i.e. by the type of funds (Forex versus Ushs) they will require. Hence, this breakdown reflects the source of supply of the expenditure-items (Foreign = imports; Local = domestic supplies). For some years the local costs are broken further down into: Loc-Don and Loc-GoU, ie local costs financed by donors and by the government of Uganda.

3) Assets = immovable plants and equipment that have a multi-year lifespan.

4) Tractors, motorcycles etc.

5) Foreign salaries and wages = personnel costs for expatriates (usually donor funded)

6) Local salaries and wages = personnel costs of project employees and staff assigned to Special Development Projects

7) Project Allowances = payment to staff still in government service, but assigned to work on the project. This is in reality "topping up" salaries & wages to local staff

8) Vehicle Operation & Maintenance = spares, repairs, servicing, fuel etc. for *project vehicles*

9) Other Expenditures = Covers a variety of cost-items not specified elsewhere, such as: movable assets, furniture, small equipment, livestock, tools, non-vehicle spares, office equipment and expendables, etc. The items in question are to be specified individually

10) The project-data also contain information about the funds already secured for the project (specified by source), and the remaining funding gap. These data will however not be used "at this stage" (i.e. for the construction of a GDP-model). At a later stage, however, this model will probably be extended to include i.a. the government budget. It will then be of interest to get these data summed up to get some estimates for instance of the implied:
    - foreign aid secured for the development programme, by donor & year
    - local contributions (by GOU) already negotiated

Table 2 Classification of RDP-projects by sector and subsector

Sector / Subsector

1: Agriculture
- a) Crops
- b) Forestry
- c) Livestock
- d) Fisheries
- e) Cooperatives
- f) Others

2: Environment Protection
- a) Forestry
- b) Environment

3: Manufacturing
- a) Manufacturing
- b) Inspectorate

4: Mining & Energy
- a) Mining
- b) Energy

5: Public Administration

6: Social Infrastructure
- a) All
- b) Health
- c) Water
- d) Education
- e) Housing
- f) Information & Broadcasting
- g) Culture & Community Development
- h) Others

7: Transport & Communications
- a) Railways
- b) Aviation
- c) Road Infrastructure
- d) Communications

8: Tourism & Wildlife
- a) All
- b) Hotels

Table 3 Definition of production-sectors[1)]

GDP-sectors, as published by Statistics Department	Production-sectors of modelling exercise	Corresponding ISIC classification[2)]
Agriculture:	1: Agriculture	1
Cash crops	11: Cash crops	part of 111
Food crops	12: Food crops	111, nes
Livestock	13: Livestock	part of 111
Forestry	14: Forestry	12
Fishing	15: Fishing	13
	16: Other agriculture, nes[3)]	112, 113
Mining & quarrying	2: Mining & quarrying	2
	21: Mining	2, nes
	22: Quarrying	2901
Manufacturing	3: Manufacturing	3
Coffee, cotton & sugar manufacturing	31: Coffee, cotton & sugar manufacturing	part of 3121 and 3211, 3118
Manufactured foods	32: Manufactured foods	311-312 nes
Miscellaneous	33: Misc. manufacturing, nes	3 nes
Electricity/Water	4: Electricity & Water	4
	41: Electricity	41
	42: Water	42
Construction	5: Construction	5
	50: Construction	5
Commerce	6: Trading	6
	61: Wholesale & retail trade	61, 62
	62: Hotels & restaurants[3)]	63
Transport/Communications	7: Transport & Communications	7
Road	71: Road transport	7112, 7113, 7114
Rail	72: Rail transport	7111
Air	73: Air transport	7131
Communications	74: Communications	72
	75: Other transport, nes[3)]	7115, 7116, 7121, 7122, 719
Community Services	8: Misc services	8, 9
General government	81: General government services	See note 4)
Education	82: Education	931
Health	83: Health	933

Rents/Dwellings[5)]	84: Housing services	part of 8310
Miscellaneous	85: Other services, nes	See note 6)
	0: Unspecified	0
	00: Unspecified	0

Notes:

1) We have in general adopted the same sectors as used in the official GDP-tables published by the Statistics Department (SD). This reflects the basic principle that there should be as direct a correspondence as possible between the model-structure and its basic statistical sources. (See Annex 1 for a further discussion of the rational behind the sector-definitions).

2) International Standard for Industrial Classification, Rev. 2

3) Sectors assumedly not included in SD's GDP-tables (as of 1991).

4) The general government sector is assumed to be quite broadly defined, so that it includes some services which ideally ought to have been split out from this sector, although they clearly are government responsibilities today. In total, sector 81 is assumed to include the following ISIC-groups:
   - -91: Public Administration & Defence
   - -92: Sanitary & Similar Services
   - -9413: Radio & TV
   - -part of 9420: Game parks, museums etc.
   - -7123: Operation of harbours etc.
   - -7132: Operation of airports etc.

5) Monetary GDP-sector: Rents, plus non-monetary GDP-sector Owner-occupied dwellings.

6) Sector 85: Other services is a very mixed bag of production-types, (which ought at some later stage to be disaggregated). It currently contains ISIC-groups:
   - -8, nes: Finance, insurance & business services
   - -9, nes: Community, social, cultural & personal services

Table 4 Classification of RDP project expenditures by type of cost component

1: Purchase of primary production factors
- 10: Total (1000)[1)]
- 11: Labour
  - 1100: Total
  - 1101: Expatriate labour
  - 1102: Local labour
  - 1109: Unspecified
- 12: Capital assets
  - 1200: Total
  - 1201: Buildings & constructions (excl. roads)
  - 1202: Roads
  - 1203: Vehicles & transport equipment
  - 1204: Other machinery & equipment
  - 1205: Livestock
  - 1206: Other stocks
  - 1209: Unspecified

2: Purchase of secondary production factors (=intermediate inputs)
- 20: Total (2000)[1)]
- 21: Inputs directly identifiable by sector of origin
  - 2100: Total
  - 21XX: products of sector XX, (where XX is 2-digit sector code, as given in table 1)
- 22: Inputs otherwise identified by type of product
  - 2200: Total
  - 2201: Stationary & other office expenses
  - 2202: Studies, evaluations etc.
  - 2203: Training, seminars etc.
  - 2204: Travel, transport etc.
  - 2205: Agricultural inputs
  - 2206: Operation & Maintenance of transport equipment
  - 2207: Repair & maintenance of other equipment
- 23: Inputs only broadly identified
  - 2300: Total
  - 2301: Goods
  - 2302: Services
  - 2309: Unspecified inputs

3: Other expenditure components
- 30: Total (3000)[1)]
- 32: Contingencies (3200)[1)]
- 33: Unidentified (3300)[1)]

1) If 4-digit codes are required throughout (for technical reasons), use codes given in brackets.

Table 5 Coding of RDP project expenditures by type of cost component

Project expenditure	Cost component codes
010 - Assets	
Construction & Buildings	1201
Machinery	1204
Roads	1202
020 - Vehicle Purchase	
Trucks	1203
Cars	1203
Other	1203
030 - Non Capital Payments	
Foreign Salaries & Wages	1101
Local Salaries & Wages	1102
Project Allowances	1102
Vehicle Operat. & Maint.	2206
040 - Other Expenditures[1)]	

1) Other expenditures are of a very diverse nature. No standard conversion/coding-key therefore applies. Each individual cost element must be coded according to the classification given in table 4.

Table 6 Conversion of cost components into typical sources of supply

Cost component	Allocation by sector of origin[1)]		Allocation by foreign/local origin	
	%	Sector of origin	Foreign	Local
11: Labour				
1101: Expatriate	100 %	90: Households	100 %	-
1102: Local	100 %	90: Households	-	100 %
1109: Unspecified	100 %	90: Households	65 %[2)]	35 %[2)]
12: Capital assets				
1201: Build. & const.	100 %	50: Construction	-	100 %
1202: Roads	100 %	50: Construction	-	100 %
1203: Vehicles etc.	100 %	33: Misc. manufact.	100 %	-
1204: Oth. mach. & equip.	100 %	33: Misc. manufact.	100 %	-
1205: Livestock	100 %	13: Livestock	100 %	-
1206: Other stocks	100 %	33: Misc. manufact.	100 %	-
1209: Unspecified	100 %	00: Unspecified	(50 %)[2)]	(50 %)[2)]
21: Intermed. inputs, identified by sector of origin				
2111: Cash crops	100 %	11: Cash crops	-	100 %
2112: Food crops	100 %	12: Food crops[3)]	100 %	-
2113: Livestock	100 %	13: Livestock	65 %	35 %
2114: Forestry	100 %	14: Forestry	-	100 %
2115: Fishing	100 %	15: Fishing	-	100 %
2116: Other	100 %	16: Other	100 %	-
2121: Mining	100 %	21: Mining	50 %	50 %
2122: Quarrying	100 %	22: Quarrying	-	100 %
2131: Cof/cot/sug. manuf.	100 %	31: Cof/cot/sug.manuf.	-	100 %
2132: Manufactured foods	100 %	32: Manufact. foods[3)]	100 %	-
2133: Misc. manufacturing	100 %	33: Misc. manufact.[3)]	95 %	5 %
2141: Electricity	100 %	41: Electricity[3)]	-	100 %
2142: Water	100 %	42: Water	-	100 %
2150: Construction	100 %	50: Construction[3)]	-	100 %
2161: Trade	100 %	61: Trade	-	100 %
2162: Hotels & restaurants	100 %	62: Hotels etc.[3)]	50 %	50 %
2171: Road transport	100 %	71: Road transport	-	100 %
2172: Rail transport	100 %	72: Rail transport	-	100 %
2173: Air transport	100 %	73: Air transport	80 %	20 %

Cost component	Allocation by sector of origin[1)		Allocation by foreign/local origin	
	%	Sector of origin	Foreign	Local
2174: Communication	100 %	74: Communication[3)	50 %	50 %
2175: Other transport	100 %	75: Other transport	50 %	50 %
2181: General government	100 %	81: General governm.	-	100 %
2182: Education	100 %	82: Education	50 %	50 %
2183: Health	100 %	83: Health	50 %	50 %
2184: Housing	100 %	84: Housing[4)	-	100 %
2185: Other services	100 %	85: Other services[3)	80 %	20 %
22: Intermediate inputs, otherwise identified by type of product				
2201: Office expenses	60 %	33: Stationary etc	95 %	5 %
	10 %	41: Electricity	-	100 %
	10 %	74: Telephone etc.	50 %	50 %
	10 %	84: Rents	-	100 %
	10 %	85: Repair of equip. etc.	-	100 %
2202: Studies etc.	15 %	62: Accommodation	-	100 %
	2,5 %	71: Road transport	-	100 %
	10 %	73: Air transport	95 %	5 %
	2,5 %	74: Communication	-	100 %
	70 %	85: Consultancies	95 %	5 %
2203: Training etc.	10 %	33: Books, training materials etc.	90 %	10 %
	20 %	62: Accommodation	65 %	35 %
	5 %	71: Road transport	-	100 %
	5 %	72: Rail transport	-	100 %
	10 %	73: Air transport	95 %	5 %
	50 %	82: Education	80 %	20 %
2204: Travel etc.	30 %	62: Accommodation	75 %	25 %
	3 %	71: Road transport	5 %	95 %
	4 %	72: Rail transport	5 %	95 %
	60 %	73: Air transport	95 %	5 %
	2 %	75: Other transport	25 %	75 %
	1 %	85: Insurance & misc. financial services	50 %	50
2205: Agricultural inputs	20 %	12: Seeds etc.	100 %	-

Cost component	Allocation by sector of origin[1]		Allocation by foreign/local origin	
	%	Sector of origin	Foreign	Local
	80 %	33: Fertilizers etc.	95 %	5 %
2206: Operation of transport equipment	85 %	33: Fuel, spares etc.	100 %	-
	15 %	85: Vehicle repair & service, insurance etc.	-	100 %
2207: Repair of other equipment	50 %	33: Spares	100 %	-
	50 %	85: Repair services	-	100 %
23: Intermediate inputs only broadly identified				
2301: Goods	2 %	11: Cashcrop seeds etc.	75 %	25 %
	3 %	12: Foodcrop seeds etc.	75 %	25 %
	90 %	33: Misc. manufact.	95 %	5 %
	5 %	41: Electricity	-	100 %
2302: Services	10 %	62: Accommodation	50 %	50 %
	5 %	71: Road transport	-	100 %
	5 %	72: Rail transport	-	100 %
	5 %	73: Air transport	50 %	50 %
	10 %	74: Communication	50 %	50 %
	2 %	75: Other transport	100 %	-
	30 %	84: Rents	-	100 %
	25 %	85: Misc. services	65 %	35 %
	5 %	41: Electricity	-	100 %
	3 %	42: Water	-	100 %
2309: Unspecified	100 %	00: Unspecified	(50 %)[2]	(50 %)[2]
3: Other expenditure components				
3200: Contingencies	100 %	00: Unspecified	(50 %)[2]	(50 %)[2]
3300: Unidentified	100 %	00: Unspecified	(50 %)[2]	(50 %)[2]

Notes to table: See next page

1) The sector of origin is source of supply typically providing the good or service in question. With one exception this is a regular production sector. The exception is labour, which is "produced" by private households. These are given the code: 90, while the regular production sectors are coded according to the classification of production sectors (see table 3).

2) These percentages are pure guestimates, and as such highly unsatisfactory. Ideally one should avoid having to classify any significant cost-element under these groups by obtaining additional information enabling a more "focused" classification. To the extent that such information is unavailable, however, an alternative way of treating these unspecified cost-elements might be to use the information contained in the MFEP database about the source of supply (ie. foreign versus local) for these elements. Admittedly, these data may in many cases to be misreported, representing source of funding rather than source of supply, but assumedly there is a degree of correspondence between the two, so that, hopefully, they are not *totally* useless for our present limited purpose. Using this information we may:
   i) revise the foreign, versus local percentages of cost-components 1109, 2309, 3200 and 3300, accepting the sector of origin-allocations as they are.
   ii) revise the foreign, versus local percentages of cost-component 1209, and possibly also try to revise the sector of origin-allocations accordingly (for instance by allocating the foreign component to sector 33, and the local component to sector 50).

3) Of all the 26 possible alternatives under coding-group 21XX, only these 9 were in fact used when classifying the 1990/91 RDP-projects. Hence, not much effort was in fact invested in "researching" the proper foreign, versus local breakdown of most of the sectors of origin.

Table 7 Allocation of cost components by end-use (productive function and receiving sector)

7.A: Classification of cost components by cost category and element

Cost components	Recurrent costs		Capital costs		Unknown
	Labour	Interm. inputs	Fixed capital	Stocks	
1: Primary production factors:					
11: Labour					
1100: Total	100 %	-	-	-	-
12: Capital assets:					
1201: Build. & const.	-	-	100 %	-	-
1202: Roads	-	-	100 %	-	-
1203: Vehicles	-	-	100 %	-	-
1204: Oth.mac.& eq.	-	-	100 %	-	-
1205: Livestock	-	-	-	100 %	-
1206: Other stocks	-	-	-	100 %	-
1209: Unspecified[1)]	-	-	100 %	-	-
2: Secondary production factors:					
2000: Total	-	100 %	-	-	-
3: Other expenditure factors:					
3000: Total	-	-	-	-	100 %
SUM, cost elements	LA	IN	FC	ST	UN
SUM, cost categories	RC		CC		UN

1) The precise nature of unspecified capital assets are of course unknown. Even so we propose to treat them as fixed capital. This is based on the following assumptions:
- -capital costs incurred on stocks are of relatively marginal importance in the RDP,
- -in (perhaps) most cases capital costs are classified as unspecified because their specific breakdown into buildings, machinery etc has not been given. But even so we do know that they represent a combination of such fixed assets as these.

In practise we may therefore safely classify the unspecified assets as fixed capital.

Table 7, cont.

7.B: Exogenous data needed to disaggregate cost categories by end use[1)]

	Productive function		
	Capital formation		Prod. Inputs
	Cost category		
Receiving sector	Capital costs[2)]	Recurrent costs[3)]	
S_1	C_1	R_{11}	R_{21}
.	.	.	.
.	.	.	.
S_i	C_i	R_{1i}	R_{2i}
.	.	.	.
.	.	.	.
S_n	C_n	R_{1n}	R_{2n}
Sum	C	R_1	R_2

1) These data are needed for each project (except the sum-data which may be calculated by the computer). The "data" here specified are symbols used in tables 7.C & 7.D below.

2) The data: C_1 --- C_n represent the *percentage* breakdown (by receiving sector) of the total capital costs, i.e. of CC from table 7.A above. Their sum (C) should consequently equal 100.

3) The data R_{11} --- R_{2n} represent the *percentage* breakdown (by productive function and receiving sector) of the total recurrent costs, i.e. of RC from table A above. Their sum: R_1 + R_2 consequently should equal 100. The data R_{11} --- R_{1n} represent capitalized recurrent cost (by receiving sector), while R_{21} --- R_{2n} represent regular recurrent production inputs.

Table 7, cont.

7.C: Allocation of cost category elements by type of productive function[1)]

Cost elements	Recurrent production inputs		Capital formation		Unknown
	Primary	Secondary	GFCF[11)]	Stocks	
LA	LAI[2)]	-	LAF[3)]	LAS[4)]	-
FC	-	-	FCF[5)]	-	-
ST	-	-	-	STS[6)]	-
IN	-	INI[7)]	INF[8)]	INS[9)]	-
UN	-	-	-	-	UNK[10)]
Sum	LAI	INI	GFC	STO	UNK

1) All the two-letter-variables are defined in table A above, and the one-letter-variables in table 7.B.

2) LAI (labour inputs) = R_2 * LA/100

3) LAF (labour, capitalized and allocated to fixed capital formation) = R_1 * LA * FC/CC * 100

4) LAS (labour, capitalized and allocated to stocks) = R_1 * LA * ST/CC * 100

5) FCF (fixed capital formation) = FC

6) STS (stocks) = ST

7) INI (intermediate inputs) = R_2 * IN/100

8) INF (intermediates, capitalized and allocated to fixed capital formation) = R_1 * IN * FC/CC * 100

9) INS (intermediates, capitalized and allocated to stocks) = R_1 * IN * ST/CC * 100

10) UNK (unknown) = UN

11) GFCF = gross fixed capital formation

Table 7, cont.

7.D: Disaggregation of productive function totals by receiving sectors

Receiving sector:	Recurrent production inputs		Capital formation		Unknown
	Primary	Secondary	GFCF	Stocks	
S_1	LAI_1	INI_1	GFC_1	STO_1	-
.	.	.	.	.	.
.	.	.	.	.	.
S_i	LAI_i 1)	INI_i 2)	GFC_i 3)	STO_i 4)	-
.	.	.	.	.	.
.	.	.	.	.	.
S_n	LAI_n	INI_n	GFC_n	STO_n	-
Unallocated	-	-	-	-	UNK 5)
Total	LAI	INI	GFC	STO	UNK

1) LAI_i (labour inputs, allocated to sector: i) = $R_{2i} * LAI/R_2 = R_{2i} * LA/100$

2) INI_i (intermediated inputs, allocated to sector: i) = $R_{2i} * INI/R_2 = R_{2i} * IN/100$

3) GFC_i (gross fixed capital formation, allocated to sector: i) =
$(C_i * FCF/100) + (LAF + INF) * R_{1i}/R_1 = (C_I + R_{1i} * RC/CC) * FC/100 =$
$(C_i * CC + R_{1i} * RC) * FC/CC * 100$

4) STO_i (stocks, allocated to sector: i) = $(C_i * STS/100) + (LAS + INS) * R_{1i}/R_1 =$
$(C_i + R_{1i} * RC/CC) * ST/100 = (C_i * CC + R_{1i} * RC) * ST/CC * 100$

5) UNK = UN

Table 8 Data entry sheet for future benefits

Project menu[1]	Data defin.[2]		Prod. sect.[3]	Data on expected annual outputs:[4]						Note ref.[5]
	A	B		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	
1: Agriculture										
a: Crops										
AG-01										
AG-04										
AG-05										
.										
.										
.										

1) The project menu lists all tentatively relevant RDP-projects. The listing should for practical reasons be arranged according to the project-classification etc used for these projects in the MFEP's project/data-base (see table 2). Sector and sub-sector headings should be entered in their own right, so that output-data may be entered against them, should this prove necessary or desirable.

2) Data definator, ie. a code defining the nature of the data specified (in terms of expected outputs). Codes may for instance be:
   A : Type of data specified:
      0 : No data given (for the project or sub-sector in question)
      1 : Annual increase in Gross Output, measured as defined by X
      2 : Annual increase in Gross Domestic Product, measured as defined by X
      3 :.....
   B : Type of increase specified:
      1 : percentage increases, in terms of % pa "returns" on the project-costs.
      2 : absolute *values* (of annual production-increases, expressed in terms of a specified set of prices)
      3 : absolute *volumes* (of annual production-increases, expressed in terms of a specified denominator (ton, kwh etc))
      4 : ....

   Note that when the future outputs are specified in terms of absolute values, these values may be measured in terms of prices that do not necessarily correspond to the prices adopted for the basic scenario, (or indeed any other scenario that the analyst chooses to investigate; see chapter: "Changing the basic scenario"). In general, one should suspect all such estimates of reflecting prices used in the basic project documents. Investigation and recalculation of each individual case may therefore be required.

   The same may be true when future outputs are specified in terms of % pa "returns" on project-costs. Because: the nominal value of project-costs referred to may *not* be those given in the project profiles (or any specified scenario). We should therefore try to investigate if the price revisions involved have effected all variables *uniformly*, (ie. if all relevant input and output prices have been revised by the same percentage, when comparing the prices used in the project documents to those used in later scenarios). If all price revisions are uniform, they are of no consequence to our present calculations. If, however, they are not, (for instance because they have involved revisions for cost-overruns, changes in relative prices, or similar), percentages reflecting "base-priced" costs will in principle not apply to "current-priced" costs. Hence, the future outputs should *in* principle be recalculated, (for instance by: 1: estimating base-priced output-value from basic documentation, and 2: revising this value in terms of relevant product price). This may however prove a rather cumbersome task; with "costs exceeding benefits". It is consequently unlikely to be a *practical* alternative for anything but the very largest projects).

Note that the data entered into above data sheet should reflect expected benefits, given the implementation profile of the basic scenario. We may however want to change this profile (ref.: "Changing the basic scenario"). Such revisions may need to be taken into account when calculating the future (annual) benefits. Thus: if project completion is delayed, so should project benefits.

3) Production sector, ie: the sector(s) in which output-increase is supposed to materialise (as a result of the project-"investments"). The production sector(s) should be specified according to the sector-definition assumed for the future macro-model (see table 3). Note that the production-increase in question is the direct, "primary" one, not the indirect secondary ones resulting throughout the economy in general when the effects of the project have "filtered" through to the rest of the sectors. The relevant production sector(s) in this connection are therefore closely associated with the sector(s) receiving the project-"investments" in question.

4) A six-years period is *assumed.* See chapter on "Future results generated" and Annex 3 for a further discussion of the planning horizon.

5) This data-entry form being very open-ended we may need to make further notes explaining the nature of the data given. Alternatively, we may want to take note of other information, if such should occasionally be available, (for instance about indirect effects, recurrent costs arising etc). These notes will probably be of no direct use to the computer, but may nevertheless be entered in the above data-entry sheet as a reminder to the data-analyst. The entry in above column will probably be in the form of a reference number, (referring to a descriptive note in an accompanying file of notes).

Table 9 Project scenario register

Project menu[1]	Project selection code[2]	Phasing revisions[3]					Price revisions[4]				
		Rev. code[5]	Revision-coefficients[6]				Rev. code[5]	Revision-coefficients[7]			
			k_1	k_2	k_3	k_4		m_1	m_2	m_3	m_4
1:Agricult.											
a:Crops											
AG-01											
AG-04											
AG-05											
.											
.											
.											

1) A list of *all* tentatively relevant RDP-projects, ie. inclusive of both present priority projects and projects on the reserve list. The list should for practical reasons be arranged according to the project-classification etc used for these projects in the MFEP's project data-base (see table 2). Sector and sub-sector headings should be entered in their own right, so that coefficients may be entered against them.

2) Selection-codes deciding which projects to include or exclude in the "current" analysis. Proposed codes:
   -1: for inclusion
   -0: for exclusion.

3) Phasing revisions relate to the annual phasing of expenditure volumes *within* the limits of an existing (financial) project-budget, ie: they do not affect the budget-limit itself.

4) Price revisions relate to the overall and annual financial costs of a project. They change the overall nominal budget of the project, but not the underlying real volume of resources required, benefits produced etc.

5) Codes specifying *how* the project should be revised (in terms of costs or phasing). Proposed codes:
   -0: if the project is *not* to be revised
   -1: if the project is to be revised on an individual basis, in accordance with the coefficients given against its project number.
   -2: if the project is to be revised on an aggregate basis; ie: aggregated with other projects so specified within the subsector, to be revised collectively in accordance with the coefficients given against the subsector heading.

   Codes for projects not included in the "current" analysis (via the project selection) may be specified or left out according to preference. These projects and codes will in any case be ignored by the calculation programme.

6) Annual revision-coefficients specifying the factors by which the annual implementation volumes of the *basic* scenario (ie: the projects' expenditure-data, as given in MFEP's project-data-base) should be *multiplied* in order to calculate the revised implementation-estimates. Hence:
   -1.00 indicates that no change should be made in the "original" data,
   -1.05 indicates a 5 % increase in the "original" data,
   -0.95 indicates a 5 % decrease in the "original" data.

   Coefficients applying for projects subject to *aggregate revisions*, should be entered against the relevant *sub-sector heading* (for instance against "Crops" above).

   Note that these coefficients apply to the *rephasing* of expenditures *within* the limits of an existing project-budget, *not* to the revision of this budget-limit itself. In principle, the coefficients may therefore *not* be specified in such a way that the total rephased project-expenditures exceed the total project-budget (as given by the total original project-expenditures). However, this may be difficult to ensure. The calculation-routine used to perform these revisions should therefore test against such "excess expenditures" and reduce the rephased expenditure estimates as appropriate (starting from the end of the plan period).

7) Annual revision-coefficients specifying the factors by which the prices of the basic scenario should be *multiplied* in order to calculate revised cost-estimates. Hence:
   -1.00 indicates that no change should be made in the original price,
   -1.05 indicates a 5 % increase in the original price,
   -0.95 indicates a 5 % decrease in the original price.

   The price-increases so specified will (for technical reasons) be assumed to affect all cost items equally.

   Coefficients applying for projects subject to *aggregate revisions*, should be entered against the relevant *sub-sector heading*.

Annex 1: Definition of production sectors

In order to analyze the implications of the RDP-expenditures within the framework of a wider macro-economic model, we need to define the economic sectors of that model. As seen from table 3 we have in general adopted the sectors used in Uganda's GDP-statistics. This reflects the basic principle that there should be as direct correspondence as possible between the model-structure and its basic statistical sources.

In a few cases we have nevertheless chosen to disaggregate the official GDP-sectors, reflecting a possible or assumed difference in the economic behaviour of the various subsectors. In other cases we have chosen to introduced new sectors, in order to take account of activities assumedly left out of the GDP-tables. In general we may assume these GDP-exclusions to be of negligible importance, but in order to get a complete "picture" we have nevertheless chosen to include them in the model. Such a complete picture is necessary in view of the fact that:

- the model will deal with *future* economic activities, some of which may possibly be in such "new" sectors,
- the model may possibly require a full sector-of-origin analysis of imports, some of which may originate in production-activities not presently existing in Uganda.

Hence, for the modelling exercise, *all* ISIC-codes are distributed among the various production sectors, even though some of them clearly represent activities presently non-existing in Uganda.

It may be noted that the sectors of table 3 are not disaggregated into Monetary and Non-Monetary subsectors, although this distinction is central to the official GDP-estimates. Assumedly this dimension will be introduced in the future model, but in such a way that it can be ignored for the present purpose of analyzing the RDP. I.e. it will (probably) be assumed that the difference between the monetary and non-monetary subsector basically concerns the *marketing* of products, and *not* the way they are produced. This means that if we want to promote the production of for instance food crops through the use of direct investments, input supplies, training, extension services or similar, we may regard the food-crop sector as *one* production-activity, rather than as two basically different ones. Other promotion-efforts of a more indirect nature, such as the creation of transport facilities, marketing channels etc, will however effect the monetary/non-monetary dimension.

Summing up, we shall consequently assume that our sectors, when seen from the production-side (i.e. from the input-side) are basically unaffected by the degree of monetarization. However, when seen as marketing sectors (i.e. as a supplier to other sectors etc.), they may need to be disaggregated according to the degree of "monetarization" or market-orientation; the latter assumedly increasing with:

- the increase in sector's own production,
- the general growth of the economy,
- the increase in marketing opportunities (transport opportunities included).

Annex 2: A note on the capitalization of recurrent costs

From a National Accounts point of view capital formation is made up of physical assets, ie: *goods* with a lifespan exceeding one year. Typical examples of such goods are buildings and constructions, machinery and equipment. Hence, various types of "non-physical investments" are not capital formation according to this definition, even though they may be important to the development process. Examples of such "non-physical investments" may be training and education ("investment in human capital"), capacity- and institution-building in the public administration sector, etc.

Basically, the capital formation components of the RDP are consequently given by the costs specified against the various assets in the project profiles. Even so, however, the capitalization of recurrent cost-items may occasionally be feasible. This will typically be the case for recurrent costs associated with the freight, insurance, installation and running in of capital assets.

Therefore, as a rule of thumb, capitalization is *not* applicable to recurrent costs, if these represent the normal *operational* costs of the project (ie: if they are regular production inputs). Capitalization is only feasible if the costs concerned clearly are an integral and supporting element in a concrete, time-limited investment-project, involving for instance the transportation, construction, completion, installation, operationalization or similar of significant assets.

Annex 3: A note on the time-frame of the future macro-model

The following elements should be central to any macro-economic model built to meet the needs of the MFEP-planners:

- The Government Budget
- The Development Plan (ie: the RDP)
- The Balance of Payments
- The National Accounts

Broadly speaking, the National Accounts are expected to form the framework for the model, while the other will constitute important model inputs and outputs. As such all these elements should be "dimensioned" in such a way that the data of one correspond to the data of the other. One such dimension concerns the definition of a common accounting year to which all variables may relate.

In practise, different accounting years are today used for above model-elements. The data of the two former ones relate to the Ugandan financial year, covering the period July-June, while the data of the two latter ones relate to the calendar year (Jan.-Dec.). The conversion from one type of year to the other is however a question to be solved later, ie: at the modelling stage. For the present, we shall only observe that whatever the final decision on this matter, the model shall have to be constructed in such a way that all "official" inputs can be "fed" directly into it without changing their original time-format: Ie: if official budget and plan estimates have to be converted from financial year to calender year, this should be done within the model, not prior to the inputting of these data to the model. Similarly, the model should contain conversion standards allowing for the presentation of results and predictions relating to the year otherwise utilized for the variable in question.

A second aspect of the time-dimension concerns the total period to be covered by the model. Basically the model should cover the planning horizon of the government (as a minimum). As a point of departure, we may assume that this horizon is expressed (for instance) by the period chosen for the RDP. In addition it should tie in with the "known facts" in the area of National Accounts, Balance of Payments etc. These will in many cases be lagging somewhat behind the start of the plan period. In practise the model may therefore have to bridge the gap between the period of "fully known facts" and the current plan period, by allowing for a few "prediction" years prior to start of the latter. In addition, the model may for technical reasons need to cover a few years after the end of the current plan period. Hence, the model will probably contain equations involving lagged variables. This is for instance normally the case when depicting the functional relationship between capital formation and derived production increases. If so, the period covered by the model will have to be increased by the number of years represented by the longest lag, in order to allow the model-variables to "work themselves out".

Another technical reason why it may be necessary to extend the model horizon (both backwards and forwards) is connected to the conversion of data from one type of accounting year to another. Thus: in order to calculate (for instance) data for six financial years, it may be necessary to calculate corresponding calendar year data for eight years.

Consequently, even if the official planning horizon should correspond to the four year RDP-period, the period covered by the model may need to be considerably longer, for instance 8-10 years.

In all probability the model will consequently need data on development expenditures for more years than those of the current plan period. Even so, we have limited our discussion in this paper to the four-year "lifespan" of the "current" plan, accepting the financial year as the proper one for this exercise. This reflects the fact that our present aim has been limited to that of proposing a practical way of handling the RDP-data, in view of anticipated model needs, rather than to resolve the full data needs of the model in this area.

Annex 4: A technical note on the calculation of revised annual cost- and implementation-estimates

When estimating the various economic implications of Uganda's rehabilitation and development expenditures over the next few years, the annual volumes of these expenditures are, of course, of crucial importance for the result. As a point of departure we may assume that these volumes are given by the "existing" expenditure plans of the projects "presently" included in the RDP priority list. Realizing that actual project disbursements tend to differ from what was originally planned, this should however only be seen as one among several tentatively relevant scenarios, although a basic one. Hence, we should be prepared to analyze alternative scenarios by changing the characteristics of the basic one. In this annex we shall propose a way of achieving this.

In our current model we may introduce alterations in the basic scenario in the following ways:

- A: By changing the content of the project-"bag" making up the scenario (within the limits of existing priority and reserve listed projects).
- B: By rephasing the annual implementation *volume* of projects included in the scenario.
- C: By changing the overall *price*-structure of projects included in the scenario.
- D: By changing the basic character of projects included in the scenario (ie: their basic "size, content and direction", in other ways than specified under B and C).
- E: By "creating" entirely new projects.

The technical side of revisions under A is straight forward, given the existence of the relevant project selection codes (ref. table 9), while revisions with respect to D and E are best effected through the introduction of "dummy" project profiles or similar. In the following we shall consequently not elaborate on the technique of making these types of revisions. Instead we shall concentrate on revisions referring to B and C. Mathematical formulas by which these revisions may be made, are described below.

I. Some definitions

At the outset we define the following variables:

x_t = total expenditures in year: t, as specified in the *basic* scenario
x_{it} = the part of x_t spent on cost item: i

Note that:
- the expenditures are here defined with reference to the basic scenario, ie. they represent the originally planned implementation-volumes (as specified in the MFEP's data-base).
- x_t and x_{it} may refer to a single project, but in many cases they will refer to a sub-sector.
- t may take the value 1, 2, 3, 4 or 5; the first four representing the four years of the plan period, while t=5 represent the carry-over into next plan-period.[1]

Similarly we define the variables representing the *rephased implementation-estimates* of x_t and x_{it}:

y_t = total rephased implementation estimate for year: t
y_{it} = the part of y_t spent on cost item: i

and the variables representing the *price-revised cost-estimates* of y_t and y_{it}:[2]

z_t = total price-revised cost-estimate for year: t
z_{it} = the part of z_t spent on cost item: i

We also define:

k_t = revision-coefficient with respect to rephasing, year: t
m_t = revision-coefficient with respect to price-changes, year: t

The revision-coefficients (k_t and m_t) are defined for each of the four years of the planning period (ie. for t=1, 2, 3 & 4). The coefficient k_t represents the factor by which x_t should be multiplied in order to calculate y_t. Similarly, the coefficient m_t represents the factor by which y_t should be multiplied in order to calculate z_t. The relevant data are specified in the Project Scenario Register (see table 9)).

Finally, we introduce the following variables used to store interim calculation-results during rephasing:

a_t = the annual allocation, year: t
c_t = the annual carry-over, year: t

1 Regarding the existence of these carry-overs, see "IV: A note concerning the carry-overs" at the end of this annex.

2 Note the sequence of revisions: basic variables are first rephased, and afterwards price-revised.

The annual allocation (a_t) is the (absolute) part of x_t that is "consumed" in a given round of allocations (where "a given round of allocations" simply implies the calculation and "satisfaction" of the y_{it}-components for *a given year*, i.e. any one of step 1, 2, 3, 4 or 5 in the calculation routine for y_{it} below).

The annual carry-over (c_t) is the (absolute) part of x_t that remains un-allocated after a given round of allocations (and consequently have to be carried over to the next round of allocations).

II. Summary description of calculation programme

Below we shall give a rough summary description of a computerized calculation programme, illustrating the various individual operations involved in these calculations, as well as their internal sequence.

1: Having been given all relevant input data (ie: the basic project-data (x_t and x_{it}), plus the codes and coefficients of table 9), the programme should sort out the relevant projects, and discard the ones that are to be excluded from the "current" scenario. Next, it might test the revision codes defining what kinds of rephasing and price-changes to effect, in order to make sure that such revisions have indeed been specified. (If not, there is obviously no need to go through the below described operations). Assuming that changes have been prescribed, we proceed to 2 below.

2: Calculate the value of y_t by the following formulas:

$$\textit{Calculate}: \; y_t = k_t x_t \qquad \textit{for } t=1-4$$

$$\textit{Calculate}: \; y_5 = \sum_{t=1}^{5} x_t - \sum_{t=1}^{4} y_t \qquad (\textit{for } t=5)$$

3: Test the y_t-values for misspecification of k_t, and revise as appropriate:[3]

$$\textit{If } y_t < 0; \quad \textit{Set}: \; y_t = 0; \quad \textit{Recalculate}: \; y_{t-1} = \sum_{j=1}^{5} x_j - \sum_{j=1}^{t-2} y_j \qquad \textit{for } t=4,3,..$$

[3] See chapter III,1 for an explanation of these formulas.

4: Calculate the value of y_{it} by the following formulas:[4]

```
      do 100  j=1,5
      c_j = x_j
100   continue
      do 200  k=1,4
      do 210  j=1,5
      a_j = 0.0
210   continue
      a_1 = y_k
      do 220  j=1,5
      if (a_j ≤ c_j) go to 230
      a_j+1 = a_j - c_j  5)
      a_j = c_j
220   continue
230   do 240  i=1,n
      s = 0.0
      do 250  j=1,5
      s = s + (a_j/x_j)*x_ij
250   continue
      y_ik = s
240   continue
      do 200  j=1,5
      c_j = c_j - a_j
200   continue
      Do 300  i=1,n
      s = 0.0
      do 310  j = 1,4
      s = s + x_ij - y_ij
310   continue
      y_i5 = x_i5 + s
300   continue
```

4 Later on we shall at *great length* explain the workings of the routine for calculating the y_{it}-values (see chapter III,2). In terms of mathematical programming, however, these operations may be condensed considerably, as presently illustrated.
The above programme is written in simple BASIC. j & k represent the time dimension: t, and i the sector dimension. n is the number of sectors, and s is a variable used for summation.

5 This require that a_j is defined also for j = 6 (ie. for t = 6). This variable is merely a " convenience", with no economic meaning. If we wish to avoid the introduction of such a variable, we may reformulate this equation in the following way:
if $(j \leq 4)\ a_{j+1} = a_j - c_j$.

5: Calculate the value of z_t and z_{it} by the following formulas:

$$\textit{Calculate: } z_t = m_t y_t \quad \textit{for } t=1-4$$

$$\textit{Calculate: } z_{it} = m_t y_{it} \quad \textit{for } i=1-N;\ t=1-4$$

III. An in-depth look at the calculation of y_t and y_{it}

III.1. The calculation of y_t

The calculation of the rephased implementation volumes (y_t) is in principle straight forward, once the earlier defined data are given:

$$\text{-for } t=1-4 : \ y_t = k_t x_t$$

$$\text{-for } t=5 : \ y_5 = \sum_{t=1}^{5} x_t - \sum_{t=1}^{4} y_t$$

In practise, however, it is quite possible that the value of y_5 thus calculated is negative. If this is the case, the coefficients k_t must have been misspecified. Hence, if $y_5 < 0$ we adjust the y_t-values as follows:

-First set $y_5 = 0$ and recalculate y_4 by the formula:

$$y_4 = \sum_{t=1}^{5} x_t - \sum_{t=1}^{3} y_t$$

-Next, test the value of y_4 thus calculated against zero. If $y_4 < 0$ it must be revised in the same way as y_5. Thus:

$$\textit{If } y_4 < 0; \quad \textit{Set: } y_4 = 0; \quad \textit{Recalculate: } y_3 = \sum_{t=1}^{5} x_t - \sum_{t=1}^{2} y_t$$

-Next, test the new value of y_3 etc. Thus:

$$\textit{If } y_3 < 0; \quad \textit{Set: } y_3 = 0, \quad \textit{Recalculate: } y_2 = \sum_{t=1}^{5} x_t - y_1$$

$$\textit{If } y_2 < 0; \quad \textit{Set}: y_2=0, \quad \textit{Recalculate}: y_1=\sum_{t=1}^{5} x_t$$

III.2. Calculate routine for y_{it}

The above revised variables (y_t) represent the *total* annual expenditures. For our purpose they must be broken down into cost items (y_{it}). We want this to be done in such a way as to ensure that *all* of the original cost-items are accounted for, keeping their internal time-sequence unchanged.[6] A calculation routine towards this end is sketched out below.

Step 1: Calculation of y_{i1} (i.e.: y_{it} for t = 1)

We start by comparing the value of y_1 to the value of x_1.

1.1 If $y_1 \leq x_1$ all the y_i-costs may be taken out of the x_1-costs. We may consequently calculate the y_1-costs as follows:

$$y_{i,1}=\frac{y_1}{x_1}x_{i,1} \qquad (=k_1 x_{i,1})$$

In addition we calculate the carry-over as the part of x_i that was not consumed by y_i

$$c_1=x_1-y_1$$

In this "scenario" allocation-round no. 1 is thereby completed, and the calculation-routine therefore moves to step 2 below.

1.2 If, on the other hand, $y_1 > x_1$ all the x_1-costs will be consumed by y_2, which in addition will "eat into" x_2 (and possibly even into x_3, x_4 and x_5). In this case we consequently first let y_1 consume all of x_1, record the fact by setting the allocation-variable a_1 equal to x_1, and compare the value of the still unsatisfied part of y_1 to the value of x_2.

I.e.: 1) set a_1 equal to x_1

2) test y_1-x_1 against x_2

[6] I.e.: *all* x_{it}-costs (for all: i and: t) should be allocated to some y_{it}, and in such a way that <u>all</u> the x_t-costs are allocated before *any* of the x_{t+1}-costs are.

1.2.1 If $y_1 - x_1 \leq x_2$ all the remaining y_1-costs (i.e. $y_1 - x_1$) may be covered by x_2. We record the allocation of $(y_1 - x_1)$ out of the x_2-total:

$$a_2 = y_1 - x_1$$

and calculate:

$$y_{i,1} = \frac{a_1}{x_1} x_{i,1} + \frac{a_2}{x_2} x_{i,2} \quad \left(= x_{i,1} + \frac{y_1 - x_1}{x_2} (x_{i,2}) \right)$$

$$c_1 = x_1 - a_1 \quad (=0)$$

$$c_2 = x_2 - a_2 \quad (= x_2 - (y_1 - x_1))$$

In this "scenario" allocation-round no. 1 is thereby completed and the calculations move to step 2 below.

1.2.2 If, on the other hand, $y_1 - x_1 > x_2$ the whole of x_2 will be consumed by $(y_1 - x_1)$, which in addition will "eat into" x_3 etc. In this case we consequently copy the procedure started in step 1.2 above. I.e.: first allocate all of x_2 to y_1 and record the allocation from x_2 using the variable a_2. Next, test the value of the still unsatisfied part of y_1 against the value of x_3.

I.e.: 1) $a_2 = x_2$

2) test $y_1 - x_1 - x_2$ against x_3

1.2.2.1 If $y_1 - x_1 - x_2 \leq x_3$ we have a situation similar to that of step 1.2.1 above. Hence, by the same logic:

$$a_3 = y_1 - x_1 - x_2$$

$$y_{i1} = \sum_{j=1}^{3} \frac{a_j}{x_j} x_{ij}$$

$$c_j = x_j - a_j \quad (j = 1,2,3)$$

go to step 2

1.2.2.2 If y_1 - x_1 - x_1 > x_3 we have a situation similar to that of step 1.2.2 above. Hence:

$$a_3=x_3$$

$$test\ y_1-x_1-x_2-x_3\ against\ x_4$$

1.2.2.2.1 If y_1 - x_1 x_2 - x_3 ≤ x_4 we again have a situation similar to that of step 1.2.1 above. Hence:

$$a_4=y_1-x_1-x_2-x_3$$

$$y_{i1}=\sum_{j=1}^{4}\frac{a_j}{x_j}x_{ij}$$

$$c_j=x_j-a_j \quad (j=1,2,3,4)$$

go to step 2

1.2.2.2.2 If y_1 - x_1 - x_2 - x_3 > x_4 we again have a situation similar to that of step 1.2.2 above. Hence:

$$a_4=x_4$$

$$test\ y_1-x_1-x_2-x_3-x_4\ against\ x_5$$

1.2.2.2.2.1 If y_1 - x_1 - x_2 - x_3 - x_4 ≤ x_5 repeat step 1.2.1 above:

$$a_5=y_1-x_1-x_2-x_3-x_4$$

$$y_{i1}=\sum_{j=1}^{5}\frac{a_j}{x_j}x_{ij}$$

go to step 2

$$c_j = x_j - a_j \quad (j=1,..,5)$$

1.2.2.2.2.2 If $y_1 - x_1 - x_2 - x_3 - x_4 > x_5$ we have a situation where the value of y_1 exceeds the combined value of all x_t-costs. We consequently allocate all available x_t-costs to y_1 (including the remaining one: x_5), record the fact:

$$a_5 = x_5$$

and calculate:

$$y_{i1} = \sum_{j=1}^{5} \frac{a_j}{x_j} x_{ij}$$

$$c_j = x_j - a_j \quad (j=1,..,5)$$

Step 2: Calculation of y_{i2}

Above we calculate the "step-1-values" of the interim variables: a_t and c_t. Before carrying the calculations on to step 2, we must:

-prepare the a_t-variables for a new "round" by setting them back to zero

-let all hitherto "untouched" x_t-costs be carried over to the new "round" by setting $c_t = x_t$ (for all c_t which have not already been calculated above)

Next, we observe that as we start the calculations of step 2 (or indeed any other step) we do not a priori know to what degree x_t-costs remain to be allocated. Throughout all the calculations we must therefore taken into account the possibility that x_t-costs, for *all* t, remain unallocated. Thus, we must again start by testing the value of the unallocated x_1-costs, which in this case is represented by the variable: c_1; i.e.: we must test y_2 against c_1

2.1 If $y_2 \leq c_1$ we have a situation similar to that of step 1.1 above. Hence:

$$a_1 = y_2$$

$$y_{i2} = \frac{a_1}{x_1} x_{i1}$$

$$c_1 = c_1 - a_1 \quad \textit{(i.e. recalculate the } c_1\textit{-value)}$$

go to step 3

2.2 If $y_2 > c_1$ we have a situation similar to that of step 1.2 above. Hence:
Set $a_1 = c_1$ and test $y_2 - c_1$ against c_2
If $y_2 - c_1 \leq c_2$ set $a_2 = y_2 - c_1$ and go to step 2.3
If $y_2 - c_1 > c_2$ set $a_2 = c_2$ and test $y_2 - c_1 - c_2$ against c_3
If $y_2 - c_1 - c_2 \leq$ set $a_3 = y_2 - c_1 - c_2$ and go to step 2.3
If $y_2 - c_1 - c_2 > c_3$ set $a_3 = c_3$ and test $y_2 - c_1 - c_2 - c_3$ against c_4
If $y_2 - c_1 - c_2 - c_3 \leq c_4$ set $a_4 = y_2 - c_1 - c_2 - c_3$ and go to step 2.3
If $y_2 - c_1 - c_2 - c_3 > c_4$ set $a_4 = c_4$ and test $y_2 - c_1 - c_2 - c_3 - c_4$ against c_5
If $y_2 - c_1 - c_2 - c_3 - c_4 \leq c_5$ set $a_5 = y_2 - c_1 - c_2 - c_3 - c_4$ and go to step 2.3
If $y_2 - c_1 - c_2 - c_3 - c_4 > c_5$ set $a_5 = c_5$ and go to step 2.3

2.3 Using the above calculated values of a_t, calculate the values of y_{i2} and c_t as follows:

$$y_{i2} = \sum_{j=1}^{5} \frac{a_j}{x_j} x_{ij}$$

$$c_j = c_j - a_j \quad (j = 1,..,5)$$

Step 3 and 4: Calculation of y_{it} for t = 3 and 4

These calculations are similar to those described in step 2 above; i.e. for each t-value, go through the following routine (which is mathematically equal to that of step 2, although somewhat shortened in expression):

1) $a_j = 0.0$ for j = 1,..,5
2) $a_1 = y_t$
3) If ($a_1 \leq c_1$) go directly to 17) below, if not proceed to 4)
4) $a_1 = c_1$
5) $a_2 = y_t - c_1$

6) If ($a_2 \leq c_2$) go directly to 17) below, if not proceed to 7)
7) $a_2 = c_2$
8) $a_3 = y_t - c_1 - c_2$
9) If ($a_3 \leq c_3$) go directly to 17) below, if not proceed to 10)
10) $a_3 = c_3$
11) $a_4 = y_t - c_1 - c_2 - c_3$
12) If ($a_4 \leq c_4$) go directly to 17) below, if not proceed to 13)
13) $a_4 = c_4$
14) $a_5 = y_t - c_1 - c_2 - c_3 - c_4$
15) If ($a_5 \leq c_5$) go directly to 17) below, if not proceed to 16)
16) $a_5 = c_5$

17) $$y_{it} = \sum_{j=1}^{5} \frac{a_j}{x_j} x_{ij}$$

18) $c_j = c_j - a_j$ for $j = 1,..,5$

Step 5: Calculate of y_{i5}

The expenditures remaining unallocated after the four year plan period are calculated as follows:

$$y_{i5} = \sum_{t=1}^{5} x_{it} - \sum_{t=1}^{4} y_{it}$$

It may be noted that the sum of the y_{i5}-values should equal the sum of the carry-overs (as calculated in step 4), a fact which may be used to verify the results of the calculations.

IV. A note concerning the carry-overs

The calculation routine presented above requires data on the carry-overs into the subsequent plan period (ie. for t=5). In previously published RDP documents these data were included in the project profiles.[7] In the most resent RDP however, the carry-overs have been omitted.[8] It is nevertheless our hope that the relevant data on carry-overs may still be available from the MFEP data-bank.

[7] See for instance RDP 1990/91-1993/94, which was the "present" RDP-version when the present calculation-routine was constructed.

[8] See RDP 1991/92-1994/95.

However, even if this is not the case, we should still leave room in our computer program for the carry-overs, allowing these to be inputed from other sources. Thus, the *total* carry-overs of each project (x_5) may quite easily be calculated from published project-data[9]. In this case, however, we will be left without data disaggregating the total carry-overs into various cost categories (x_{i5}).

In practice this may not prove too much of a problem. The typical case of rephasing will assumedly be one of implementation slipperage (ie: one of expenditures being shifted further into the future). If so, the original carry-overs will play no part in the rephasing calculations. Only when the (full) project-expenditures are rephased towards the present will they do so. For the benefit of these (assumedly rather few) cases we may *impute* a breakdown of the carry-overs. We may for instance do this by allowing x_5 to be broken into cost categories (x_{i5}) using the percentage breakdown of x_4 or similar.

However, if the project concerned is an important one, we may have to go to the trouble of calculating the relevant data from basic project documentation, and insert them directly into the computer programme.

[9]By deducting total plan expenditures from total future cost, both of which are given in the RDP project-documentation.

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