ARTI / WAGENINGEN UNIVERSITY

RESEARCH PROJECT IN AGRICULTURAL PLANNING

REDUCED PLANNING EFFORTS: THE KEY REGION APPROACH IN RATNAPURA

REPORT NO.5

IN

REGIONAL PLANNING FOR AGRICULTURAL DEVELOPMENT

IN SRI LANKA

RESEARCH STUDY NO. 58

MARCH 1983

AGRARIAN RESEARCH AND TRAINING INSTITUTE,

114, Wijerama Mawatha, Colombo 7.

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R.A. Schipper

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FOREWORD

Since 1979 the Agrarian Research and Training Institute and the Department of Development Economics of the Agricultural University of Wageningen in the Netherlands have collaborated in a joint Research Project on "Regional Planning for Agricultural Development in Sri Lanka". This project aims at improving methods of intermediate level planning for agricultural development. With this as the primary objective several studies have been carried out.

The main purpose of this study is to examine the Key Region approach as one of several possible approaches to reduce the planning efforts at intermediate level in this country. Several agro-ecological regions were selected from the Ratnapura District and an attempt was made to identify potentials for a future Integrated Rural Development Programme for the District. This type of planning has so far not been attempted in the agricultural sector in Sri Lanka.

This report shows the possibility of reduction of planning efforts through key region approach, and demonstrates the requirements for following such an approach pointing out, where information is lacking or insufficient at present to follow the key region approach. I believe this will help to improve the agricultural planning procedures in Sri Lanka.

Mr. R.A. Schipper of the Wageningen Agricultural University headed the team that conducted this study in addition to writing this report. My thanks are due to him for his effort.

T.B. Subasinghe
Director

ABSTRACT

This paper examines theoretical considerations with regard to the key region approach in agricultural planning and selects key regions in Ratnapura District, Sri Lanka. The key region approach is one of the possible approaches which attempts to reduce the planning efforts necessary for regional comprehensive, resource based, intermediate level planning as part of a system of multi-level planning, the other approach being a key sector approach.

It is shown that a reduction of planning efforts is possible through the key region approach. Requirements for a proper key region approach are spelt out. These entail a district planning framework, a selection method, key region plans and a study of the impact of the key region development on the development objectives of the district. The impact depends on the nature of the development objectives and the type of key regions. This is elaborated for economic growth and diminishing intra-district income differences as objectives, and a two-by-two typology of regions, developed versus backwards, and with versus without potential. Although some spread effects of key region development can be expected through migration, trade and income, concepts such as the growth pole/centre and service centre are not appropriate for the key region approach. Better applicable concepts are geographical concentration of investment, integration of activities and poverty alleviation.

For the Ratnapura case, a district planning framework is prepared in terms of the present state of development of each region, as assessed by the income per capita yardstick, and of the potential for future agricultural development, as assessed through land evaluation.

A method to select a key region is shown. Three key regions are selected out of 11 possible regions. It is concluded that if a key region approach is adopted in the future, suitable indicators should be developed at the national level, as well as that a suitable data base per agro-ecological region should be set up. Both are lacking or insufficient at present.

PREFACE

This study was a result of the ARTI/Wageningen project's involvement in development planning of Ratnapura District, Sri Lanka. Development planning of Ratnapura was initiated by the Ministry of Plan Implementation and aims at a future Integrated Rural Development Programme for this district. Our involvement was mainly limited to an attempt to reduce the necessary planning efforts by selecting a few agro-ecological regions of Ratnapura where the development projects should be concentrated. For this, the project designed a selection method and indicated three agro-ecological regions as possible key regions. For these key regions, our project identified potentials for future development. We very much hope that our results are of use to the Ministry of Plan Implementation, the Kachcheri in Ratnapura and the many departments involved in the development of the district. We thank all the above institutions for giving us the opportunity not only to study the planning in Ratnapura but also to be able to contribute to the preparation of the IRDP. Finally, we like to mention Mr. S Visumperuma, Additional Government Agent in Ratnapura for all his assistance and friendship.

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GLOSSARY OF TERMS AND ABBREVIATIONS

AGA	Assistant Government Agent
ARTI/Wageningen	Agrarian Research and Training Institute/ Landbouw Hogeschool Wageningen (Agricultural University of Wageningen)
ILP	Intermediate Level Planning
IRDP	Integrated Rural Development Project
LHW	Landbouw Hogeschool Wageningen (Agricultural University of Wageningen)
MP	Member of Parliament
MPI	Ministry of Plan Implementation

Chapter One

INTRODUCTION

1.1 THE RESEARCH CONTEXT

The ARTI-Agricultural University of Wageningen Research Project on Agricultural Planning aims at improving methods of intermediate level planning for agricultural development. Development planning is to be seen as a deliberate effort to steer the development process in the desired direction through the identification of potentials and the formulation of strategies to permit their development for the attainment of predetermined objectives. The conceptual aspects of this research have been formulated in a Research Proposal (ARTI/ Wageningen 1978) and were further elaborated in an internal project document of March 1981 entitled "Research applied to the planning processes in the Sri Lankan agricultural sector" with the sub-title "a progress report on methodology" which underlines the explorative character of the research (ARTI/Wageningen 1981).

The main object of the study was intermediate level planning (ILP) as a part of a system of multi-level planning for development of a nation. By multi-level planning we mean planning at three levels (compare Tinbergen 1967:75):

1. macro or national level (planning of all sectors and regions);
2. intermediate level;
3. micro or project level (planning of individual economic entities or projects)

Intermediate level planning may be defined as planning of sectors or regions with a view to bridging the gap between global macro-planning and specific project planning. Macro-planning sets general guidelines for sectoral growth but usually does not deal with investment projects

and their spatial distribution. Project planning goes into great detail of costs, benefits, localization, organization and financing but tends to lose sight of the broader socio-economic framework in which the project operates. Proper identification and priority ranking of projects therefore require a planning middle ground which is specific enough to generate project proposals and broad enough to play a role in the national context.

The agricultural sector is a suitable entity for intermediate level planning, but a further breakdown into sub-sectors is warranted because of the diversity and scope of the sector in the Sri Lankan economy. From the spatial angle, districts in Sri Lanka are possible entities for intermediate level planning. They are small enough for concrete problem analysis and project identification and big enough to make their weight felt at national level. Whether districts are an optimal spatial delineation for agricultural planning is open to debate. From an agronomic point of view they are not, from an administrative and management point of view they may at least as far as small holder agriculture is concerned. Finally, the clear trend set by the present government to decentralize administration towards the districts was the decisive factor for the research team to study agricultural planning on a district basis. In this report planning of regions will be equated with planning of districts.

The research team decided to study intermediate level planning first from a regional angle, after which in a second phase, sectoral studies would be undertaken. The Integrated Rural Development Projects (IRDP) set in motion by the Ministry of Plan Implementation (MPI) in a number of districts in Sri Lanka were identified by the research team as the only important on-going development effort on a district basis. Although IRDPs consist of a multi-sectoral package of project components, agriculture and its supporting infrastructure take the lion's share of the investments. Of course, at district level other important development projects affecting agriculture do operate, but none of them take the district as the unit of planning and implementation.

The research team thus set out to study regional agricultural planning in three districts where an IRDP was being implemented or planned. This was the first ground rule for the selection of districts. As the research was to be policy oriented (Research Proposal, November 1978) it had to associate itself with the IRDP planning system. Working in districts which did not interest the MPI would be an academic exercise. Only in districts with an IRDP would the team be able to compare planning theory with planning practice.

The second criterion for the choice of districts was that they should comprise the major agro-ecological zones of Sri Lanka in order to cover the whole gamut of technical and socio-economic problems in agriculture. The districts finally selected, in consultation with the MPI, were Matara (wet zone), Kurunegala (wet, but mainly intermediate and dry zone) and Ratnapura (mainly wet, but with important parts in the intermediate and dry zone). In the final choice of districts the dry zone was under-represented in terms of acreage. The emphasis put on wet and intermediate zones was justified by the fact that they contain the majority of the country's population and include the largest range of crops.

The Research Project addressed itself not only to problems of analysis in plan formulation as the concern for coverage of agro-ecological zones may suggest. Problems of implementation were seen as equally crucial. Therefore, managerial and administrative aspects of the planning and implementation machinery had to be studied. This warranted studying different approaches to rural development design. These could be found within the IRDP set-up of the MPI. Hence, variations in rural development design were a third criterion underlying the choice of the three districts mentioned above. Whereas Kurunegala IRDP was designed as a five-year blueprint for implementation with a strong emphasis on production increase in a few key sectors (ARTI/Wageningen 1982 b), Matara IRDP adhered to flexible short term planning with a major concern for specific target groups (ARTI/Wageningen 1982 a). Ratnapura was a special case. The MPI had earmarked this district for an IRDP but planning had yet to start. The research team saw an opportunity to propose and to assess a key region approach in this district.

1.2 AIM OF THE PRESENT STUDY

It is often argued by politicians and government officials involved inthe planning and execution of development programs that planning takes too much time and is too complicated. These politicians and government officials are under constant pressure from the public or from international agencies to come up with new and promising projects and programs.

Rapid and less complicated planning can be achieved in two ways, either by shortening the present planning methods by taking short cuts for example, in data collection methods (e.g. Rapid Rural Appraisal : Carruthers and Chambers 1980) and in analysing this data (e.g. computerized data processing and analysis: Dixon/FAO, forthcoming), or else by changing the approach to planning itself. The latter approach is explored in this paper.

As stated in section 1.1, the involvement with district planning in Ratnapura presented the project team with the opportunity to research a key region approach with a view to discovering possibilities of reducing the necessary planning efforts. The ideas and concepts behind this approach will be explained in chapters two and three, but basically it boils down to the idea that by selecting only a part of a region or district for intensive planning, one reduces its planning efforts. Of course the key region approach should be of sufficient quality, that is to say, the selection of the key regions should be done "properly" while the planning of the key region itself should be according to certain standards. Furthermore, it is imperative that the development of the key region has an impact on the development of the whole district for a successful key region approach.

Having said this, it will be clear that the main aim of the research in Ratnapura is to assess the suitability of the key region approach as a means to reduce planning efforts in the context of regional agricultural planning.

However since Ratnapura is the third case, after Matara and Kurunegala, in a series of studies of regional agricultural planning, this study also aims at contributing to one of the overall research objectives of the project, namely to study intermediate level planning form a regional angle.

In the next section something will be said about the suitability of Ratnapura as a case, while some background information on the district will also be given.

1.3 RATNAPURA AS A CASE

As has been said in the last section, Ratnapura district has been chosen as a third case to study regional planning because it fulfilled our requirements:

1. policy oriented - the MPI earmarked the district for a future IRDP;
2. agro-ecological zone coverage - Ratnapura comprise all 3 major agro-ecological zones (72% of its area is wet zone, 18% intermediate zone and 11% dry zone);
3. approach to agricultural development planning - the involvement in Ratnapura gave the possibility of planning agricultural development using a key region approach for which it was thought to be a suitable district because of its diversified natural conditions.

Having indicated the suitability of Ratnapura as a case study for the ARTI/Wageningen project's field of study, the project did preliminary research on Ratnapura mainly to find out the attitude of the district's officials and politicians towards our proposed approach. Initially the project concluded that Assistant Government Agents Divisions (AGA divisions) would be suitable subdivisions of Ratnapura for three reasons:

1. convenient data base;
2. suitable unit for execution of a key region plan;
3. neither too big nor too small.

This approach was discussed with and accepted by the Ministry of Plan Implementation and the Kachcheri of Ratnapura, provided that next to a key region approach, an overall assessment would be made of the development potentials according to (sub-) sectors of the whole district. This would have been a kind of skelton plan and would provide an overall framework within which the key regions plans of AGA divisions were to be seen, as each (sub-) sector program and project would have been identified in line with priorities assigned to each (sub-) sector.

After a period of data collecting at AGA level, it appeared at a meeting in which the approach of the ARTI/Wageningen project was explained to the heads of departments, the Assistant Government Agents and some Members of Parliament whose electorates are in the Ratnapura district, that the AGA division was not the most suitable unit for a key region approach.

There are two major reasons behind this:

a) Present development administration thinking.

Presently all ongoing programmes are conceived and executed by departments/agencies/boards/authorities, all along (sub-) sectoral lines. Not only politicians but also people in departments and at the Kachcheri have difficulty in grasping the essence of a regional programme. Such a programme is thought to be merely the sum of programmes per department. The idea to do something special for a (sub) region because that region has priority instead of doing something for a sector (e.g. a crop like coconut) does not fit in the present thinking of how development should be administered.

b) Political reasoning.

Ratnapura district is divided into 12 AGA divisions, while there are 8 electorates. Electorates consist of one to three AGA divisions or parts of AGA divisions. Choosing an AGA division as a key region would mean that the MP whose electorate contains (part of) the AGA division would benefit more than other MPs. This is inacceptable to the MPs as a group. Benefitting MPs would explain the choice of a

certain AGA division as being a result of their personal efforts. This in turn would give them an advantage at the next election. Of course in a programme exclusively according to sectoral lines, some regions would benefit more than others because of the tendency of sectoral programmes to choose the best locations. However, this is not done explicitly from the start of the IRDP. In other words, it is less visible and therefore politically less troublesome*.

In view of the above difficulties, it was decided to switch to agro-ecological regions as key regions. Although it is much more complicated to collect/construct data for agro-ecological regions and it might be more difficult to implement a project specifically for an agro-ecological region, the choice of agro-ecological regions as key regions is more defensible on technical/agronomical grounds. Furthermore, planning of homogeneous agro-ecological zones is internationally accepted and advocated, (refer Luning 1981).

Given the diversified nature of Ratnapura, comprehensive agricultural planning of the district would require a division of the district into homogeneous agricultural zones. The present division into agro-ecological zones by the Land and Water Use Division, Department of Agriculture, Peradeniya, would be a suitable first approximation, (refer Appendix I). It then follows that the strategy of the ARTI/Wageningen project to select a number of agro-ecological zones

* In the context of the IRD programme, the question arises why geographical concentration of IRDP funds is politically difficult within a district but not between districts as can be deduced from the fact that the IRD programme concentrates investment geographically, designating certain districts for IRDP and others not. Also the MPI recently started a programme in three AGA divisions in three different districts (Karandeniya, Galle; Patha-Hewaheta, Kandy; and Deraniyagala, Kegalle) which also reflect the willingness at the national level to concentrate investments for rural development in specific rural areas. An explanation for this might be that at the national level, individual MPs are not so much in competition with each other as they are at district level, or that at national level MPs have less influence on such decisions as on those at district level. Therefore at national level it is easier for the administration to decide upon geographical concentration of funds, than it is for the district administration.

as key regions is not only interesting from a theoretical point of view, but also compatible with an eventual comprehensive agricultural plan for the whole district. The remainder of the agro-ecological zones, not planned as key regions, could be considered for comprehensive planning at a later stage.

As a last point in this section, we wish to present some basic facts about Ratnapura in order to familiarise the reader with the district. The facts are presented in Tables 3.1 and 3.2 without comment. A topographical map (figure 1.1) is also given, showing the agro-ecological regions. More detailed information of the agro-ecological regions can be found in chapter four and the Annexes.

Table 1.1

Some basic facts of Ratnapura	
Location	South western part of Sri Lanka
Area	3,239 km^2
Length	North-west to South-east: ± 120 km
Width	North-east to South-west: ± 80 km
Accessibility	- Ratnapura town: 2-3 hours drive from Colombo. - because of topography, and type and quality of roads, travelling between places in Ratnapura takes considerable time.
Agro-ecological zoning	11 different agro-ecological regions: - wet zone: low, mid and up country - intermediate zone: low, mid and up country - dry zone: low country For details see map 1.1 and section 4.1.2 and Annex I.
Population	796,000 (1981 Census of population)
Population growth	- 1971 to 1981: 1.7% - 1963 to 1971: 2.4%
Population density	245 persons per km^2
Urban population	7%
Literacy rate	72%
School attendance rate	55-75% of children in the age group of 5-14 years.
Life expectancy	70 years at age one
Infant mortality rate	57 per 1,000 live births
Regional product 1981	Rs. 1,890 million (at factor cost prices 1980)
Per capita regional product 1981	Rs. 2,370 per year
Structure of Regional product	- Agriculture 42% - Gemming 31% - Industry 20% - Services 7%

Table 1.2 Some data on land use and crops in Ratnapura

A. Land use according to 1971 Census of Agriculture

	Area ha	%	%
Total District	323,900	100	
Outside holdings	177,100 (1)	54.7	100
forest	47,200		26.7
other	129,900		73.3
On holdings	146,800	45.3	100
used for agriculture	124,200		84.6
not used	22,600		15.4

B. Data on crops, year of reference 1981 (2)

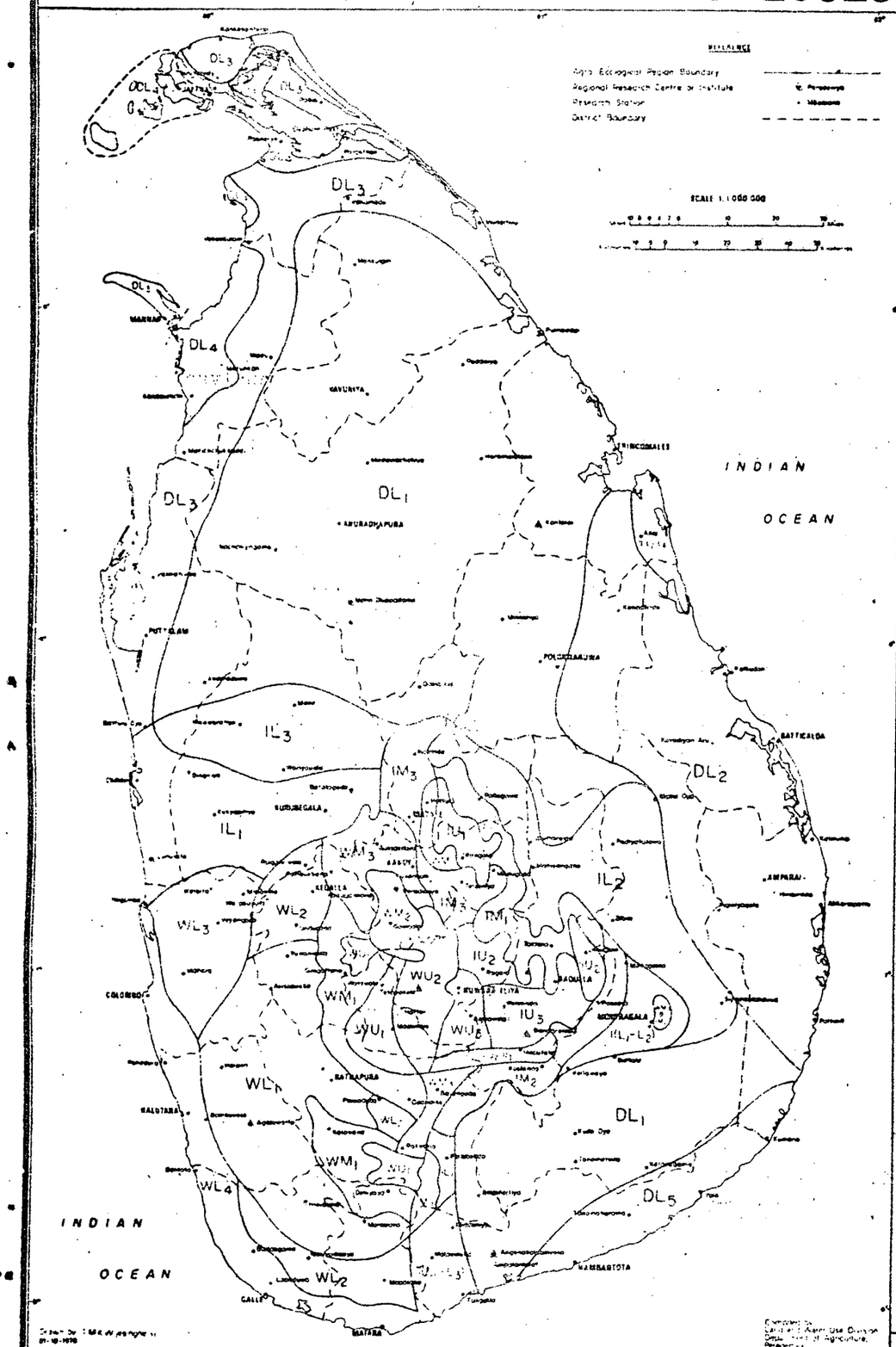
Crops	Area ha		Yields per ha unit	Value added		Employment	
				Rsx10^6	%	man days x 10^6	%
Perennial							
Rubber	39,200		840 (kg smoked sheets)	218.3	27	10.8	29
Tea	28,900		1,200 (kg made tea)	277.4	34	18.2	49
Coconut	12,500		2,800 (nuts)	42.0	5	0.6	2
Arecanuts	2,000					0.1	0
Minor export crops (pepper, coffee)	1,100			37.1	5	0.2	1
Sub Total	83,700			574.8	71	29.9	80
Annual	Maha	Yala					
Paddy	15,400	14,000	1,900 (kg per season)	95.9	12	5.0	13
Highland crops				122.8	15		
Cereals	2,400	1,300				0.3	1
Gingerly	1,200	700				0.1	0
Pulses	900	600				0.2	1
Tubers	4,300	3,200				1.2	3
Vegetables	1,300	700				0.7	2
Sub Total	25,500	20,500		218.7	27	7.5	20
Total Crops	109,200	104,200				37.4	100
Livestock products				12.0	2		
TOTAL				805.5	100		

(1) Centre for Remote Censing (1981)

(2) Where spaces are left blank, no reliable data existed.

Source: Estimates of ARTI/Wageningen project partly based on various sources.

AGRO - ECOLOGICAL REGIONS OF SRI LANKA



ZONE	AGRO - ECOLOGICAL REGION & SYMBOL		MONTHLY HISTOGRAMS of 75% RAINFALL PROBABILITY for RESPECTIVE REGIONS	75% EXPECTANCY VALUE of ANNUAL RAINFALL (ins)	75% EXPECTANCY OF DRYNESS for PARTICULAR MONTHS								MAJOR SOIL GROUPS	TERRAIN
					JAN	FEB	MAR	MAY	JUN	JUL	AUG	SEP		
WET ZONE	UP COUNTRY	WU_1		> 125	J½	F	•	•	•	•	•	•	Red - Yellow Podzolic soils and Mountain Regosols	Mountainous, steeply dissected hilly and rolling
		WU_2		> 75	J½	F	½M	•	•	•	•	•	Red - Yellow Podzolic soils and Mountain Regosols	Mountainous, steeply dissected hilly and rolling
		WU_3		> 55	J½	F	½M	•	•	•	•	•	Red - Yellow Podzolic soils with dark B horizon, and Red - Yellow Podzolic soils with prominent A_1 horizon	Rolling
	MID COUNTRY	WM_1		> 125	J½	F	•	•	•	•	•	•	Red - Yellow Podzolic soils, and Red - Yellow Podzolic soils with semi-prominent A_1 horizon	Steeply dissected, hilly and rolling
		WM_2		> 55	J½	F	½M	•	•	•	•	•	Reddish Brown Latosolic soils, Immature Brown Loams, and Red - Yellow Podzolic soils	Steeply dissected, hilly and rolling
		WM_3		> 50	J½	F	½M	•	•	•	Aug½	•	Reddish Brown Latosolic soils, Immature Brown Loams, and Red - Yellow Podzolic soils	Steeply dissected, hilly, rolling and undulating
	LOW COUNTRY	WL_1		> 100	J½	F	•	•	•	•	•	•	Red - Yellow Podzolic soils and Red - Yellow Podzolic soils with semi-prominent A_1 horizon	Rolling and undulating
		WL_2		> 75	J	F	•	•	•	•	•	•	Red - Yellow Podzolic soils, Red - Yellow Podzolic soils with strongly mottled sub soil, and Low Humic Gley soils	Rolling and undulating
		$WL_{3\&4}$		> 60	J	F	½M	•	•	•	Aug	•	WL_3 : Red - Yellow Podzolic soils with soft and hard laterite WL_4 : Red - Yellow Podzolic soils with soft and hard laterite, and Bog and Half Bog soils	WL_3 - Rolling and undulating WL_4 - Undulating and flat
INTERMEDIATE ZONE	UP COUNTRY	IU_1		> 85	•	•	½M	•	•	Jul½	Aug	½Sep	Red - Yellow Podzolic soils and Mountain Regosols	Mountainous, steeply dissected, hilly and rolling
		IU_2		> 55	•	F½	½M	My½	Jun	Jul	Aug	Sep	Red - Yellow Podzolic soils and Mountain Regosols	Mountainous, steeply dissected, hilly and rolling
		IU_3		> 45	•	F	½M	•	Jun	Jul	Aug	½Sep	Red - Yellow Podzolic soils	Steeply dissected, hilly and rolling
	MID COUNTRY	IM_1		> 55	•	•	M	My½	Jun	Jul	Aug	½Sep	Reddish Brown Earths and Immature Brown Loams	Rolling, hilly and steep
		IM_2		> 45	J½	F	•	•	Jun	Jul	Aug	Sep	Reddish Brown Earths and Immature Brown Loams	Rolling, hilly and steep
		IM_3		> 35	•	F	M	My½	Jun	Jul	Aug	Sep	Immature Brown loams, Reddish Brown Latosolic soils, and Reddish brown Earths	Steeply dissected, hilly and rolling
	LOW COUNTRY	IL_1		> 40	J	F	½M	•	•	Jul	Aug	½Sep	Red - Yellow Podzolic soils with strongly mottled sub soil, Low Humic Gley soils, Red - Yellow Podzolic soils with soft and hard laterite, and Regosols on old red and yellow sands	Rolling, undulating and flat
		IL_2		> 45	•	F½	M	My½	Jun	Jul	Aug	½Sep	Reddish Brown Earths, Immature Brown Loams and Low Humic Gley soils	Rolling, hilly and undulating
		IL_3		> 35	J	F	½M	My½	Jun	Jul	Aug	½Sep	Reddish Brown Earths, Non Calcic Brown soils and Low Humic Gley soils	Undulating
DRY ZONE	LOW COUNTRY	DL_1		> 30	J½	F	½M	My½	Jun	Jul	Aug	½Sep	Reddish Brown Earths and Low Humic Gley soils	Undulating
		DL_2		> 35	•	F½	M	My	Jun	Jul	Aug	Sep	Non Calcic Brown soils, Reddish Brown Earths, soils on old alluvium, Solodized Solonetz, Low Humic Gley soils and Regosols	Undulating and flat
		$DL_{3\&4}$		> 23	J½	F	M	My	Jun	Jul	Aug	½Sep	DL_3 - Red - yellow - Latosols and Regosols DL_4 - Solodized Solonetz, Solonchaks and Grumosols	DL_3 - Flat to slightly undulating DL_4 - Flat
		DL_5		> 20	J½	F	M	My	Jun	Jul	Aug	½Sep	Reddish Brown Earths with high amount of gravel in sub soil, Low Humic Gley soils and Solodized Solonetz	Undulating and flat

DISTINGUISHING CHARACTERISTICS

• Denotes wetness for the month —— J½ - Denotes second half of January, ½M - Denotes first half of March } Similarly for other months

Chapter Two

REDUCED PLANNING EFFORTS

Every attempt to reduce planning efforts has to be analysed to determine whether it really does reduce the efforts. For this, one needs a benchmark. In our case the planning efforts required for what we call "comprehensive resource based regional planning of the agricultural sector" will be used as a benchmark to compare with efforts needed for a reduced form of planning. What we mean by comprehensive planning will be explained in section 2.2. In section 2.3, ways of reducing planning efforts will be outlined. However, in order to make the analysis more concise and specifically appropriate to the case study, it is important to state the objectives of district development in Sri Lanka. This will be done in section 2.1. In the remaining text, regional development will mean district development, while a region will be taken to mean part of a district. This is legitimate since in Sri Lanka, the unit for regional planning is a district. In this way we avoid confusion and the need to use the concept of a sub-region.

2.1 OBJECTIVES OF DISTRICT DEVELOPMENT

From the different IRDP documents, supporting literature and public lectures of government officials, it can be deduced that the two main objectives of district development in general, and of the IRD programme in particular are:

1. Accelerating economic growth of the selected districts;
2. Diminishing income disparities within the selected districts.

These two objectives will be used in chapter three to tailor the proposed key region approach to Ratnapura. However, given the considerable income disparities between regions in Ratnapurs (see chapter four), more emphasis is placed on the second objective, and also because a key region approach in the Ratnapura context is more suited to contribute to the attainment of the second objective than to the first, as will be seen in chapter three.

2.2 COMPREHENSIVE RESOURCE BASED DISTRICT PLANNING

If one aims at comprehensive intermediate level planning (ILP) from a regional angle along the lines proposed by the ARTI/Wageningen team an enormous effort in planning has to be made.

Confined to the agricultural sector of a district, the idea of ILP is to analyse the resources to be developed ("resource based") for all sectors and for all regions ("comprehensice").

The contents of the resulting plan will be as follows:

1. Present situation.
   Present use of resources for all sectors (crops), analysed cropwise and as part of farming system(s) per region (or homogeneous agricultural zones) for all regions.

2. Potentials and constraints,
   Potentials and constraints of development of the resources with regard to all sectors and regions.

3. Objectives and options.
   Objectives to be reached and possible options ("strategies") to attain these objectives.

4. Selected option: programmes and projects.
   Out of the possible options, one is proposed. Identification and priority ranking of programmes and projects without detailed project formulation.

5. Economic analysis.
   Economic analysis of possible options and of the identified programmes and projects. Although points 3, 4 and 5 are separately presented, they have to be seen as part of an iterative planning process.

6. Organization of implementation.
   Structure of administration plus requirements in terms of manpower and equipment.

In order to prepare a plan with the above contents, the ARTI/Wageningen project proposes a planning procedure.

This procedure for comprehensive regional agricultural development planning follows a pragmatic path towards an "optimal" (or at least "better than at present") utilization of resources. It starts from a complete inventory of technical potentials and then gradually imposes constraints going from the least removable external constraints to constrainst which are easier to relax.

The procedure which is fully described in ARTI/Wageningen (1981) consists of 9 consecutive steps which will only be indicated here.

Step 1 Formulation of framework of national parameters and constraints guiding agricultural planning at the regional level by providing linkages with the national level.

Step 2 Inventory of land and water resources and estimation of technical possibilities for crop development.

Step 3 Imposing supra-regional constraints on crop development.

Step 4 Economic feasibility of crop development.

Step 5 Imposing constraints at farm level.

Step 6 Taking options, thus selecting the major "roads" to development.

Step 7 Identification of projects in a long term perspective.

Step 8 Define carrying capacity of agriculture: its capacity to produce and generate income and employment.

Step 9 Identification of implementation capacity.

Following the above steps leads to a comprehensive agricultural plan of a region. However, the path outlined requires a considerable planning team and time depending on the size of the district, its diversity, the scope of the plan and the detail required (see section 3.1). An example of a plan of the nature outlined above can be found in ARTI/Wageningen (1982 d).

Often it is not possible nor desirable to spend so much effort and time on planning. Therefore, ways and means to reduce the efforts in planning would be of considerable interest to planners and to those who commission the preparation of plans.

2.3 WAYS TO REDUCE PLANNING EFFORTS

In a system of comprehensive ILP at the national level, it is supposed to have plans for all sectors and regions to intertwine them in a consistent national framework. This would provide a base for complete project identification and ranking, and for the design of policies.

However, the amount of ILP to be done for such a system of comprehensive ILP is very large even in a small country like Sri Lanka. The complexity and size of comprehensive ILP are such that it is warranted to reduce the planning efforts. Next to reducing the detail and quality of ILP, which the ARTI/Wageningen team does not advocate, one can envisage two approaches* to diminish the planning efforts:

1. the key sector approach
2. the key region approach

In the context of agricultural sector planning at the national level, the first approach would lead to the planning of some sectors of the agricultural sector (e.g. rubber, minor export crops and paddy), and the second to the planning of some regions (e.g. Mahaweli and limited number of districts with Integrated Rural Development Projects).

At the level of district planning as is the case in Ratnapura, one can imagine the same type of examples, e.g.,

1. key sectors - rubber, minor export crops
2. key regions - some Assistant Government Agent (AGA) divisions or some agro-ecological regions

* Since development, and hence its planning, is for people, one can think of a third approach, the key group approach. However this does not fit into the theory of multi-level planning and experiences show that it is very difficult in practice to improve the lot of a specific target group. It can be expected that by selecting sectors or regions where a high percentage of people belonging to a target group work and live, the target group can benefit from the development in the key sectors and/or regions.

In both approaches, it is presumed that concentration on sectors, regions or groups is preceded by some kind of overall problem analysis. Hence key sectors and regions have to be selected on the basis of a planning framework which allows for priority ranking, however rough, of the same. Only then would these approaches fulfil the basic requirements of ILP, and come under the purview of the ARTI/Wageningen project research.

The emphasis in each of the two approaches may be different but both serve two purposes;

a) leverage - one may concentrate development efforts on certain sectors or regions expecting that effects will spread out to other sectors, regions or groups.

b) direct attack on poverty - one may select sectors and regions in which poor people particularly work or live.

The key sector approach is to select one or a very few sectors which are expected to be the main levers for high potential development, instead of embarking a priori upon a multi-sectoral package programme It is expected that growth in the key sectors would induce growth in other sectors through multiplier effects. Input-output analysis may be a useful technique here, but less formal techniques may also do.

In a key region approach one may select high potential developed areas, high potential depressed areas or low potential depressed areas. The main thrust in high potential areas is on strengthening the flow of goods, services, capital and labour between areas through economic development and improvement of roads, transport and other communication networks. High potential depressed areas may thus attract investment and increase their marketing. In low potential depressed areas one may see a reduction of population pressure through temporary or permanent migration, but the main objective would be the alleviation of poverty since a priori, not much is to be expected from "spread" effects.

As can be appreciated, purpose a. above (leverage) is linked to the first objective of district development, that is, accelerating economic growth of the selected districts. Purpose b. (direct attack on poverty) is linked to the second objective of district development which is diminishing income disparities within the selected districts. These linkages will be used for the outline of the key region approach.

After stating the objectives of district development, the comprehensive model for district planning of the agricultural sector and the two possible ways to reduce the planning efforts, the following chapter will examine one of these ways, namely the key group approach which will be explained in detail. Then in chapter four, its application in Ratnapura, as far as that was possible, will be shown.

Chapter Three

THE KEY REGION APPROACH

In section 2.3, the general idea that it is possible to reduce the efforts put into planning by a key sector or key region was explained. This is in comparison with the efforts put into comprehensive resource based regional planning. It was also emphasized that the reduction of efforts should still lead to a district plan of sufficient quality. To obtain sufficient quality it is thought necessary to have an overall district planning framework, a proper selection method, development plans for the selected key sectors or regions, and an assessment of the impact of the development in the key sectors or regions on the development of the district as a whole.

Here the specific aspects of the key region approach will be highlighted. The key region approach being a part of the reduced planning effort approach means that, given an overall district planning framework, planning efforts will be concentrated on a few well selected (sub) regions. This should result in comprehensive (resource based) key region plans with well defined localized projects. The impact of the development of the key regions on the district should be assessed. The key region approach does not exclude, next to it, sectoral programmes for the whole district.

In the next section it will be shown that the key region approach as applied in Ratnapura district indeed reduced the planning efforts in comparison with the efforts needed for comprehensive resource based planning of the agricultural sector for the whole district. Then in section 3.2, the requirements for a proper key region approach will be outlined. In the last section of this chapter some theoretical considerations with regard to the possible

impact of key region development on the development of the whole district, or to be more precise, on the attainment of the district development objectives will be discussed.

3.1 REDUCTION OF PLANNING EFFORTS

Comprehensive resource based regional planning requires a considerable planning input in the form of experts and time. Van Staveren and Van Dusseldrop (1980:20) distinguish 3 levels of elaboration for regional plans each with different levels of details: Inception Plan, Skeleton Plan and Detailed Plan. The following quotation gives an insight into the level of detail and the number of man/month required (1980:20).

"An inception plan presents a broad assessment of the major potentials and constraints for development, and outlines the more important development activities. It may constitute part of the national plan. Such a plan can be prepared by a small team of experienced experts (3-5 persons) in a period of 1 to 3 months.

A skeleton plan can be an elaboration of the inception regional plan. It should outline the major action programs and potential projects, and describe the structure of the region at the and of the planning period when the goals have been realized. This type of plan can be prepared by a group of 5 to 10 experts in 3 to 6 months.

A detailed plan contains programs of action detailed to the level of "identification" of projects. It includes a network plan indicating the time sequence of the identified projects, the annual budget allocations per project, a map showing the location of projects, and a detailed description of the future structure of the region when the goals have been realised. This type of plan may require a team of 5 to 20 experts and may take 6 months to 2 years to prepare. During that period, the relevant interim reports approach the form of the inception and skeleton plans mentioned above, with gradual transitions from one type to another".

In table 3.1, the required minimum, "average" and maximum man/months required, based on the above estimates, are calculated.

Table 3.1 Required man-months for "different levels of detail" regional plans.

		Type of Plans		
		Inception	Skeleton	Detailed
range	Manpower	3-5	5-10	5-20
	time (months)	1-3	3-6	6-24
man/months:	minimum	3	15	30
	average	8	30	180
	maximum	15	60	480

The ARTI/Wageningen team spent a total of 45 man-months on the agricultural* plan for the Matara district; of these 36 were used for preparatory work (technical consultancies 22, survey among Grama Sevaka's 2, and project proposals 12 man-months) and 9 man months for final analysis and writing. The agricultural plan for Matara has to be put somewhere between a "skeleton plan" and a "detailed plan". It contains the elements of a skeleton plan plus the identification of localized projects. However, the time sequence of projects, the annual budget allocations per project and the detailed description of the future structure of the region when the goals have been realised were not given.

* Our plan for the Matara district is only a plan for the agricultural sector. Although the agricultural sector in rural districts is the largest and the most important one, planning of the renaining non-agricultural sectors would also equire considerable manpower and time.

Matara is a relatively simple district in the Sri Lankan Agricultural context. It is small and has only 3 agro-ecological zones (in principle 4, but for planning purposes 3 were sufficient) and a total population of 645,000. Ratnapura is a more complicated district. More agro-ecological zones, a bigger area and more population. It would therefore require more manpower and time to prepare a comparable comprehensive agricultural development plan. In table 3.2 one can appreciate the main differences between Matara and Ratnapura.

Table 3.2 Some features of Matara and Ratnapura districts

	Matara	Ratnapura	Relative Increase
N° agro-ecological zones	3	11	3.7
Size (hectares)	129,000	324,000	2.5
Population	645,000	796,000	1.2

Since in an agricultural plan specification of many variables and parameters per agro-ecological zone is highly desirable (as it was done in the Matara case), the amount of work in Ratnapura would be 3.7 times more than in Matara. On the other hand, other features of preparatory work for planning like a land suitability study is more related to the size of the district. This would mean 2.5 times more work. Therefore, it seems reasonable to estimate the required man-months for a comprehensive resource based agricultural plan for the whole Ratnapura district, three times as much as in the Matara case. This would mean 135 man-months.

The ARTI/Wageningen team, using a key region approach, intended to spend 40 man-months plus 10 man-months for consultancies, or about 40% of what would have been required in the case of comprehensive planning for the whole district. However in actual facts, the team spent 35 man-months plus 10 for consultancies, somewhat less than envisaged, mainly because the actual plan for the selected key region does not reach the level of concrete project, identification (see section 3.3.3 and ARTI/Wageningen 1982 c).

Having shown that planning efforts are really reduced with a key region approach in comparison with comprehensive planning, the text now turns to the key region approach itself. In the next section the requirements with regard to how planning should be done for this approach will be outlined.

3.2 REQUIREMENTS OF THE PLANNING PROCESS

For the preparation of a district development plan following a key region approach, a planning team should basically follow the steps given below:

1. Prepare a district planning framework, consisting of an analysis of a) the present and potential levels of attainment of the main district development objectives in each region, and of b) the inter-regional flows of migration, trade and income as a means to create possible spread effects;

2. Design a proper method of selection of key regions and make a selection;

3. Prepare development plans for the key regions;

4. Study the possible impact of the development of the regions on the development of the whole district.

These points will be elaborated in the next sections.

3.2.1 District Planning Framework

The major aim of the district planning framework is to make possible a reasonable choice of the key regions in order to reach as many district development objectives as possible. The first necessity therefore is the definition of the objectives. As we have seen in section 2.1, these were a) accelerating economic growth of the district and
b) diminishing income differences within the district.

Confining ourselves to the agricultural sector, it is useful to discuss in brief, how one should interpret these objectives in such a way that they become operational for planning.

Objective A

We interpret economic growth in the agricultural sector as a growth of production resulting in an increase of the value added and hence the incomes. Income per capita would grow from a certain level to higher levels. The present level of income per capita as well as indications for future potential levels in each region of a district should be part of the framework in order to carry out a proper planning exercise. Then if some regions are selected as key regions, a framework should analyse how the development in one region could influence the economic growth in the other regions. This leads to an analysis of the flows like migration, trade and income between regions.

In short, for a proper analysis with regard to Objective A, one needs a framework consisting of:

1) present and potential levels of income and production ("levels of development");

2) present and potential flows between regions.

Objective B

Diminishing income levels between regions within a district can be accomplished by stimulating the economic growth in the poorest regions, or those regions with the lowest income per capita levels. Thus a framework containing point 1 under Objective A above would be sufficient for the analysis with regard to the intra-district income differences.

On the basis of the above analysis with regard to the district development objectives one can present the following scheme of data needed for the district framework.

Table 3.1 Scheme for data requirements for district planning framework.

1. Present and potential levels of development

	Present state of development	Potential for future development
region 1	.. ..	.. ..
region 2	.. ..	.. ..
...	.. ..	.. ..
region n	.. ..	.. ..
district	.. ..	.. ..

2. Flows between regions, at present and in potential situations

	region 1	region 2	....	region n
	MIGRATION TRADE INCOME	MIGRATION TRADE INCOME		MIGRATION TRADE INCOME
region 1	migration trade income			
....				
region n	migration trade income			

As can be seen in section 3.3, the ARTI/Wageningen team does not expect much effect from the development in one region on the other regions through flows between regions, except possibly from migration. Also it is extremely difficult and time consuming to collect data on flows. We therefore decided not to analyse these flows.

With regard to the present and potential levels of income per capita, the team made an estimate of the present levels of income per capita (section 4.1.1). The potential levels or the potential economic growth rate could be approximated with indications of the potential for future agricultural development. Such indications can be based on land evaluation techniques. However, as can be seen in section 4.1.2, this could only be done in a few regions due to limited funds.

3.2.2 Selection

Inherent to a key region approach is that one has to choose key regions since not all regions can be regarded as key regions. This choice should be based on the results of the analysis for the district framework and on the objectives for district development. What one essentially needs are the objectives as well as indicators for the objectives. To confine ourselves to the agricultural sector and the objectiveschosen here, economic growth would be best served by selecting key regions which have a good potential for future agricultural development while the second objective of diminishing income differences between regions would be best served if one selects backward regions. This is illustrated in Table 3.2.

Table 3.3 Typology of regions within a district.

Potential for future agricultural development	Present state of development	
	developed	backward
with potential		
without potential		

Objective A - economic growth: select regions with potential (out of first row).

Objective B - diminishing income differences between regions: select backward regions (out of last column)

The ARTI/Wageningen team decided to select in the first instance, backward regions because of two reasons.

1. It was not possible to make assessments of the potential for future agricultural production for all regions. See section 3.2.1 and 4.1.2. This means that no complete classification of the regions with regard to their potential could be made.

2. The ARTI/Wageningen team sees a special role for regional planning especially within the context of a key region approach: redressing regional imbalances emerging from national policies. This leads us to place more emphasis on the second district development objective.

Having presented the criteria for selection, the question arises of how to measure 'state of development' and 'potential for future agricultural development'. The assessment of potential for future agricultural development is dealt with in section 4.1.2, while the assessment of present state of development as it was done in the Ratnapura case, is explained in section 4.1.1. However some very general remarks with regard to the latter assessment should be made here.

The selection of suitable indicators for the state of development of a region depends basically on three factors:

a) the relation between possible indicators and the state of development;
b) interdependency of indicators and the difficulty of combining and thus weighing them;
c) the availability and quality of data.

Since the project was in no position to collect new data on all regions and since it also had the intention to attempt the selection with existing data only, it decided to see whether from the existing data suitable indicators for the state of development could be constructed. The resulting possible indicators will be discussed in Annex IV. After assessing the possible indicators the project decided to stick to the income per capita yardstick. The actual process of selecting key regions is discussed in chapter four and annex III.

The problems summarized under the above headings a,b,c, are discussed extensively in the literature. Examples are Scott et al (1973), Fanchette (1974), Hellweg (1974), Ivanovic (1974), Mukherjee (1976), Yeh (1976), Rao (1976) and Cant (1976). The reader is referred to these authors.

3.2.3. Key Region Plans

For the selected key regions, comprehensive resource based development plans of the agricultural sector should be made. In principle, the plan could be made according to the principles laid down in section 2.2. However in this case the planning can be simpler because of the probable smallness of the key region in relation to the national and international economies. Therefore national parameters can be treated as given and demand constraints are not likely except in some cases, for example, a cinnamon-producing region in Galle district. The key region plans should result in well localized projects and programmes.

It is a methodological question whether the key region plans with their projects and programmes still belong to Intermediate level planning. We do not think so and suggest the limitation of ILP to the selection of key regions ("identification") and to consider the key region plans as such projects, mainly because of the probable smallness of the key regions. ILP would then confined to the preparation of the district planning framework, the selection of key regions and the study of the impact of the development in the key regions on the development of the whole district. This last point is examined in section 3.2.4.

In Ratnapura the team did preliminary planning studies which can be used for subsequent project (component) identification within the key regions. See ARTI/Wageningen (1982 c). However since this study does not really identify project (components) but only indicate promising potentials, it should not be considered a proper key region plan (or project if one follows our suggestion to limit ILP to selection of key regions).

3.2.4 Impact Study

An important aspect of the key region approach is the anticipation that development of the key regions will have an impact on the attainment of the district development objectives. A study to assess whether this can indeed be expected is required as part of a proper key region approach. If such a study is not undertaken, one can hardly say that the key region approach is a form of district planning. It would be better then to treat the key region plans as projects without relationships with the district as such.

The assessment of the impact of the development of the key regions on the development of the district should be made in terms of the district development objectives and based on the district planning framework as well as the actual key region plans (projects). It can therefore only be made after the preparation of the key regions plans (projects).

Since the ARTI/Wageningen team did not prepare complete key region plans (projects), see last section, it was not possible to assess the impact of the proposed development of the key regions on the whole district. However some theoretical considerations could be given. This will be done in section 3.3.

3.3 Theoretical Considerations with regard to the Impact of Key Region Development on the Attainment of the District Development Objectives.

As is clear from the title of this section, we are concerned here with the impact of key region development on the district development objectives. In the Ratnapura case there are two objectives:

a) district economic growth

b) diminishing intra-district income differences

It was postulated in the section on selection that the first objective would be best served by selecting a key region with potential while the second objective would be best served by selecting a backward region (see section 3.2.2 and/or table 3.2).

Basically there are four concepts which could sustain the above postulates.

1. growth pole/centre and service centres
2. geographical concentration of investment
3. intergration of activities
4. poverty alleviation

These concepts will be discussed here, expecially with regard to their applicability in Ratnapura. However, two observations should be made. Firstly, present theory about regional development is not at all coherent nor very useful as a tool for planning. A recent exposition by Bolshaw and Douglas (1981) at a "Workshop on the Gap between Theory and Practice in Regional Development Planning", Cambridge (July 1981), explains this. Nevertheless, it will be useful to present some relevant ideas in order to put the key region approach into place.

Secondly, it is necessary to outline the nature of the key regions to be selected. Ratnapura is divided into 11 agro-ecological regions. These agro-ecological regions were first classified into three categories on the basis of their (relative) present state of development : high, medium and low (see chapter four). Out of each group one region was chosen as a key region.

Since Ratnapura is a predominantly rural district with emphasis on agricultural production, the regions are also rural with emphasis on agriculture (although gemming is an important activity with implications for agriculture and hence for agricultural planning). Furthermore, the agro-ecological regions are small which means that the impact of possible developments on the district can only be moderate and will be

negligible in the national context. Further, not one of the regions has any industrial base except a paper factory, tea and rubber factories, cottage industry and industry related to the gem trade. Let us now consider the above mentioned concepts.

3.3.1 Growth pole/centre and service centres

Since the early fifties following the publication of an article of Perroux (1980), it is thought that be creating a growth pole - being a "point in abstract economic space to which centripetal forces are attracted and form which (in time) centrifugal forces emanate throughout the field of influence of the set of activities constituting a pole" - it is possible to stimulate the economic growth of surrounding areas mainly through the so called "spread effects". The idea is that by increased economic activity in the pole, positive effects are felt in the surrounding areas through migration, trade and the spending of incomes.

Historically, the growth pole has been seen as an industrial centre on a large scale. One might think of one or two growth poles in Sri Lanka e.g. Colombo with the Free Trade Zone, and Trincomalee based on its deep sea harbour with possible future paddy exports and oil related industries. Clearly this concept cannot be applied to Ratnapura. A more modest concept is a growth centre of which there might be a number in Sri Lanka. But again the concept of growth centres relies very much on industrial development around an urban centre for which the key region in Ratnapura is not suitable. The key regions do not have any large cities and the prospects for industrial development of Ratnapura are dim. A number of studies on the usefulness of the growth pole/centre concept and regional development in developing countries underline this assessment. Examples are Appalraju and Safier (1975), Higgins (1968), Misra (1969), Prasad (1980), Sen (1972) and UNCRD (1976).

An even more modest concept of service centre should include the provision of goods and services needed for development to the surrounding areas. The centres of the Department of Agrarian Services are good examples of this type although in general, service centres are more linked with small towns than are the present centres of the Department, see Appalraju and Safier (1975). The key regions of Ratnapura cannot be service centres because they are merely rural areas without a central town and as such, not suitable to provide services to the surrounding regions.

Although the key regions in Ratnapura cannot be seen as growth pole/centres or service centres, development in the key regions could still have positive effects on the development of the whole district through migration, trade and the spending of incomes. These effects will differ depending on whether the selected regions are "high" potential or "low" potential regions. "Medium" potential regions will have effects somewhere inbetween.

a. Migration

In both type of key regions, it can be expected that there will be an attraction of labour because of the projects to be implemented (e.g. construction of roads or schools) or because of an increase in agricultural production. This will be so especially if real unemployment is not high and/or if unemployment has a seasonal character.

Although statistical information indicates high unemployment, this is not necessarily true. Furthermore if unemployment is seasonal, then an increase in agricultural production might create labour shortages in the peak seasons. This in turn might create seasonal labour migration.

The migration created by increased agricultural production will be higher in a "high" potential key region than in a "low" potential region. Migration to the key regions has two beneficial effects on the surrounding areas: reducing unemployment and increased incomes.

Next to immigration to the key regions, it is also possible to expect emigration from these areas. This is more likely from the low potential key regions. By improving incomes, infrastructure and the educational structure, it will make it easier for the people of key regions to migrate, especially school leavers.

b. Trade

The increased agricultural production will stimulate the trade in inputs as well as outputs. More likely, most of the inputs will come from outside the district, but part of the agricultural production might be traded in the district. This increased trade effect will be more pronounced from "high potential" key regions than from "low potential".

Increased income either because of increased production (high potential region) or because of possible poverty alleviation measures (low potential region) in the key regions might also induce trade, partly from outside the district and partly from inside.

c. Income

The increased incomes in the key regions will have a multiplier effect inside and outside the district. This also may induce production in the non-key regions in the district.

Increased incomes in key regions in principle, increases the capacity to pay more taxes, may it be land tax, income tax or turnover tax. The increased tax collected might be used for development of surrounding areas. Given the present system of tax collection in Sri Lanka, this idea might sound hypothetical. However, it is not an idea that should be overlooked altogether. Especially land tax, or water tax which may present a genuine source of income for the district.

Although it might seem contradictory to collect tax from people who have just received some benefit from development especially when they had been living in a backward area, the idea of collecting taxes from beneficiaries of development is socially justified from the point of view of those who do not benefit from the development. However, the difficulty lies in collecting the tax and in the cost of collecting.

The above positive spread effects were the so called flows between the regions in the district as was discussed in section 3.2.1. As the reader can appreciate from the analysis in this section, we do not believe that the spread effects will be very important, which made us decide among other things, not to analyse the flows.

It also follows that only a modest influence of spread effects on the objective of economic growth of the district can be expected. With regard to the second objective, it can be observed that if one selects the poorest regions as key regions, development of those key regions in itself will diminish income differences without the need for spread effects. However, if one selects higher income regions, again one cannot expect any positive influence on the second objective through spread effects.

In the next section we consider the idea that geographical concentration of investments is more effective than spreading investments over a larger area.

3.3.2 Geographical concentration of investments

It is widely accepted that concentrating investments in a limited area which has a reasonable potential for agricultural development leads to better results (e.g. increased agricultural production), than by thinly spreading the efforts on the whole area. This is especially so when resources of developing agencies are limited (funds for investment, trained personnel). The idea that it is efficient to concentrate resources in a certain area is one of the (implicit) assumptions of the Sri Lanka IRD programme. In contrast with the IRD programme, the programmes of the line ministries are spread over the whole island and not concentrated in specific areas. This is not the place to judge the effectiveness of the national programmes, but clearly their philosophy is not one of concentrating efforts in a regional sense.

Although the usefulness of concentrating efforts in a limited area is widely accepted, in practice, many national programmes - public investment and efforts - are scattered and dispersed among a large number of minor projects diffused widely over the national territory. Reasons for this are ideas of social justice: as many people as possible should benefit. This might lead to misallocation of investments. As Prasad (1980:355) put it: "People show their opposition to any preferential treatment being meted out to particular regions and want that each region should be treated equally and no sector should lag behind others. Under constant political pressure, governments lose sight of priorities and sequences that are very quintessence or crux of developmental programmes and adopt a policy of scatter".

As said above, it can be observed that in Sri Lanka, most of the national programmes are scattered around the country except the major Irrigation Schemes, the Mahaweli Project and the IRD Programme. Obviously, the river basin projects have to be concentrated in specific areas, but there is no such obvious need to concentrate IRD programme in certain districts. The IRD programme reinforces in practice, the national programmes (for example, a replanting subsidy scheme), inject money into it in order to strengthen the programmes in the relevant IRDP districts. However, the IRDP's within the districts are again a set of projects scattered in the district. The question arises then, at what level investments should be concentrated in certain areas, and at what level should investments be dispersed.

The main reason why a concentrated effort in some regions of a district is a more efficient use of development resources than spreading it over the district, is a kind of "critical minimum effort" thesis, originally proposed by Leibenstein (1957). To quote Prasad (1980:357).

"Leibenstein's critical minimum effort thesis expounds that at the low per capita income level the income-depressing forces are more powerful than the income-raising ones. For ensuring self-sustaining development it is imperative that the initial effort or the initial series of efforts must be above a certain minimum magnitude or threshold.

Not all efforts to raise per capita income lead to economic development. There are some that are too small to do so...The injection of investment must be large enough to get over the underlying indivisibilities and discontinuties. Besides, certain complementarities and economies of scale may necessitate a sufficiently large dose of exogenous investment. Above all, for accelerating the thrust or tempo of change the planned investment must be large. This amounts to saying that a dispersal of development expenditure would deny the possibility of a successful take-off to any area. Many projects have, of necessity, to be embarked upon in big chunks so as to attain a minimum efficient scale. Also, they must be pulled together to produce maximum results. To illustrate, a crash programme for pushing improved inputs into a few selected areas may turn out to be more effective than trying to supply them to all areas through an infinite number of small and scattered schemes."

The resources to be invested in the Ratnapura IRDP are of three kinds:

1. Planning Efforts
2. Investment
3. Capacity to organise the implementation

In this section, the more efficient use of resources on the "critical minimum effort" was related to the resource types 2 and 3. In section 2.3.1, the idea of a reduction of planning efforts by concentrating planning activities in a few key regions was discussed. It was suggested that there will be a reduction of planning efforts in relation to the efforts necessary for a whole district comprehensive plan. This can also be interpreted as trying to make the best use of the available resources through concentrating them geographically, or to put it in other words, as efficient as possible.

One can also say that because of an increase in effectiveness, concentrating efforts in the key regions would stimulate the attainment of the district's development objectives more than by dispersing investments and planning efforts over the whole district.

After having analysed the advantages of a geographical concentration of investments, in the next section the possibilities for an increased integration of activities in a limited area will be discussed.

3.3.3 Integration of activities

It is thought that the concentrating efforts in a small area, projects could be designed better in relation to other projects. In other works, more integrated projects should reinforce each other, mostly through input-output relationships or externalities and economies of scale. Real support of one project to another and vice versa, is only possible if local conditions are taken into account, and due account is given to local participation. The district level is not appropriate for this. This has to be accomplished at sub-district level. The ARTI/Wageningen team also is of the opinion that the village or Grama Sevaka division is too small for agricultural planning. It would look too much with "frog eyes" at development. In practice, only three possible areas are then possible: electorates, AGA divisions and agro-ecological regions. For reasons explained in section 1.3, agro-ecological regions were selected in Ratnapura. A more profound discussion of the concept of integration can be found in ARTI/Wageningen (1982 a).

Increased integration of activities in a key region would serve the district development objectives more than loosely connected projects in the whole district.

We now turn to the last point - poverty alleviation - which is related only to the second district development objective, that of diminishing income differences.

3.3.4 Poverty Alleviation

An important argument for key region development is the fact that income distribution is not equal among sub-divisions of districts. Some parts are more developed or are better endowed with natural resources, including its location, than others. From the point of view of the second objective of district development, or even from a more shrewd political calculation, it therefore can make sense to concentrate part of the development budget in "poorer" regions. In the case where these backward regions do not have much potential for future development, allocating investment to such areas has the character of poverty alleviation measures. Although little or no influence on the objective of economic growth of the district can be expected, injecting investment in a "less developed, without potential" key region does contribute to the second objective of district development.

3.4 Summary and Conclusions

In this chapter three points were discussed. Firstly the reduction of planning efforts through a key region approach in comparison with comprehensive planning of the agricultural sector. It was found that the planning efforts were indeed reduced. Secondly, the requirements for a proper key region approach in district planning were outlined. Briefly, this consisted of:

1) a framework analysing (i) the present situation in the different regions in terms of the district development objectives as well as an assessment of the potential situation, and (ii) the flows between the regions;

2) a proper selection method;

3) key region plans;

4) a study of the impact of the development in the key regions on the development of the whole district.

In the Ratnapura case, the above requirements were only partially fulfilled. A framework was prepared in as far as the present situation in terms of the objectives, and in part with regard to the potential for future development. The flows between the regions were not studied however because the team a priori did not expect much from so called "spread" effects and the time needed to collect data on flows. The team considers the framework sufficient, given the circumstances, except that insight into the potential of all regions would have been better, see section 4.1.3. With regard to the selection of key regions, it can be said that the method used was correct. Key region plans as such were not prepared but a more general study on the potentials for improved agriculture was done. Although the document ARTI/Wageningen 1982 c. will be very useful for subsequent project formulation, in itself, it is not a document which could be presented to an agency for financing.

With regard to the impact study, it can be said that this study could not be done since the key region plans are not as elaborate as would be necessary. However, some observations on the possible impact were made on the basis of some theoretical considerations which is recapitulated below.

Thirdly, some consideration was given to the impact of development in the key regions on the attainment of the district development objectives. With regard to the objective of economic growth it was concluded that the concepts of growth pole/centre and service centre are not applicable to the key regions and that not much can be expected of so called "spread" effects. Furthermore, by concentrating limited resources for development in a selected area, increased effectiveness of the investment can be expected and a better integration of activities can be obtained. These last two conclusions also apply to the second objective, diminishing of income differences if one selects the more backward areas.

The fourth point of the theoretical considerations, alleviation of poverty, is directly related to the diminishing of intra-district income differences if one selects the "poorer" regions.

After having explained in this chapter, how and what the ARTI/ Wageningen team sees as the key region approach, in the next chapter the district framework as used in Ratnapura will be presented as well as the actual selection of the key regions.

Chapter Four

DISTRICT PLANNING FRAMEWORK AND SELECTION OF KEY REGIONS IN RATNAPURA

In this chapter the district planning framework as a basis for the selection of key regions in Ratnapura will be given. It consists of an analysis of the present state of development of each region in terms of income per capita (section 4.1.1) and of an assessment of the potential for future agricultural development for a limited number of key regions only (section 4.1.2). Then in section 4.2, the actual selection of the key regions is discussed.

4.1 District Planning Framework

As the district's development objectives are economic growth and diminishing income differences between regions, a framework needs to analyse the present state of development and the potential for future development as was explained in section 3.2.1.

For the present state of development the project selected income per capita as a yardstick. This yeardstick is suitable for three reasons:

1. It is commonly accepted that income per capita does reflect the state of development in a region, although it may not do so completely, (see point 3 below) expecially if the district development objectives are economic growth and diminishing income disparities.

2. Given the available data it was possible to estimate the income per capita of each agro-ecological region.

3. Other yardsticks which could be constructed from the data were either rather one sided or did not have a firm one-to-one relationship with the state of development; especially not so if the objective of regional development and thus its planning is seen as an increase of the incomes of the local population.

During the exercise of selecting key areas, much energy and time was devoted to the preparation of the data in such a way that it could be used for the construction of the indicators other than income per capita which after all, were not used for selection. The reader is referred to Annex II and IV for this material. In the main text we exclusively report on the selection with the help of income per capita as a yardstick.

Present state of development of a region is thus defined as the income per capita in that region (see section 4.1.1). Since our planning in Ratnapura is confined to the agricultural sector, the potential for future development is interpreted as the potential for future agricultural development. This potential is assessed through land evaluation (see section 4.1.2).

4.1.1 Estimation of income per capita

The income per capita of the agro-ecological regions in Ratnapura were estimated in the following manner. The labour force with employment of each region was divided into groups of different types of employment called occupational categories : paddy or food crop cultivators, including animal husbandry workers; plantation labourers; casual labourers; gem diggers; and others. For each group an income level was estimated, details of which are given in Annex III. The data for the occupational distribution can be found in Annex II. The total income of an agro-ecological region was estimated either by estimating the total income of an occupational group as in the case of paddy and food crop cultivators, or by multiplying the number of workers in a category with its income level (remaining cases). The group's

total incomes were then summed. This total income was divided by the total population of each agro-ecological region to arrive at the income per capita. Although the procedure sounds rather straight forward it is time consuming and full of pitfalls. Time consuming because available data were not organised per agro-ecological region and this required some 4 man-month of clerical staff and 2 man-month of professional staff. Pitfalls are there because of the quality of the data and some heroic assumptions which have to be made. Nevertheless we think that the results are sufficient to compare regions although too much value should not be given to absolute figures.* For details of data, data handling and assumptions, see Annex II and expecially III. A summary of the data and the results of the assumptions can be found in table 4.1. For the readers convenience, some extra data on area and population have been given.

*It is interesting to note that the team estimated the per capita income at Rs. 2,370 via the production side of the economic process, see table 1.1. The difference with the income per capita as estimated in the present section is about 18% which is remarkably small given the crude estimation methods and the fact that the influence of the prosperous ~~sem~~ section on the Rs. 2,370 figure is more pronounced.

Table 4.1 Agro-ecological Regions of Ratnapura: Area, Population, Income Data, and ranking of the same by Income per capita.

	Area		Population		Income		Population density	Income per capita	Rank
	ha (1)	% (2)	number (3)	% (4)	$Rs.10^6$ (5)	% (6)	$Num./KM^2$ (7)	Rs. (8)	(9)
WL_1	81,650	25.2	212,647	38.9	418.79	38.7	260	1,970	3
WL_2	13,730	4.2	60,462	11.1	115.67	10.7	440	1,913	4
WM_1 south	47,000	14.5	47,901	8.8	85.77	7.9	102	1,791	6
WU_1 south	16,580	5.1	13,464	2.5	17.55	1.6	81	1,304	10
WM_3	24,050	7.4	55,896	10.2	72.80	6.7	232	1,410	9
WM_1 north	31,375	9.7	56,792	10.4	105.75	9.8	181	1,862	5
WU_1 north	13,520	4.2	3,427	0.6	4.27	0.4	25	1,246	11
IU_2	7,735	2.4	3,432	0.6	5.65	0.5	44	1,646	8
IM_2	27,674	8.5	31,506	5.8	55.06	5.1	114	1,748	7
IL_1	22,223	6.9	17,671	3.2	58.33	5.4	80	3,300	1
DL_1	34,468	10.6	42,803	7.8	137.69	12.7	124	3,217	2
District Total	323,890	100	546,004	100	1,083.46	100	169	1,984	

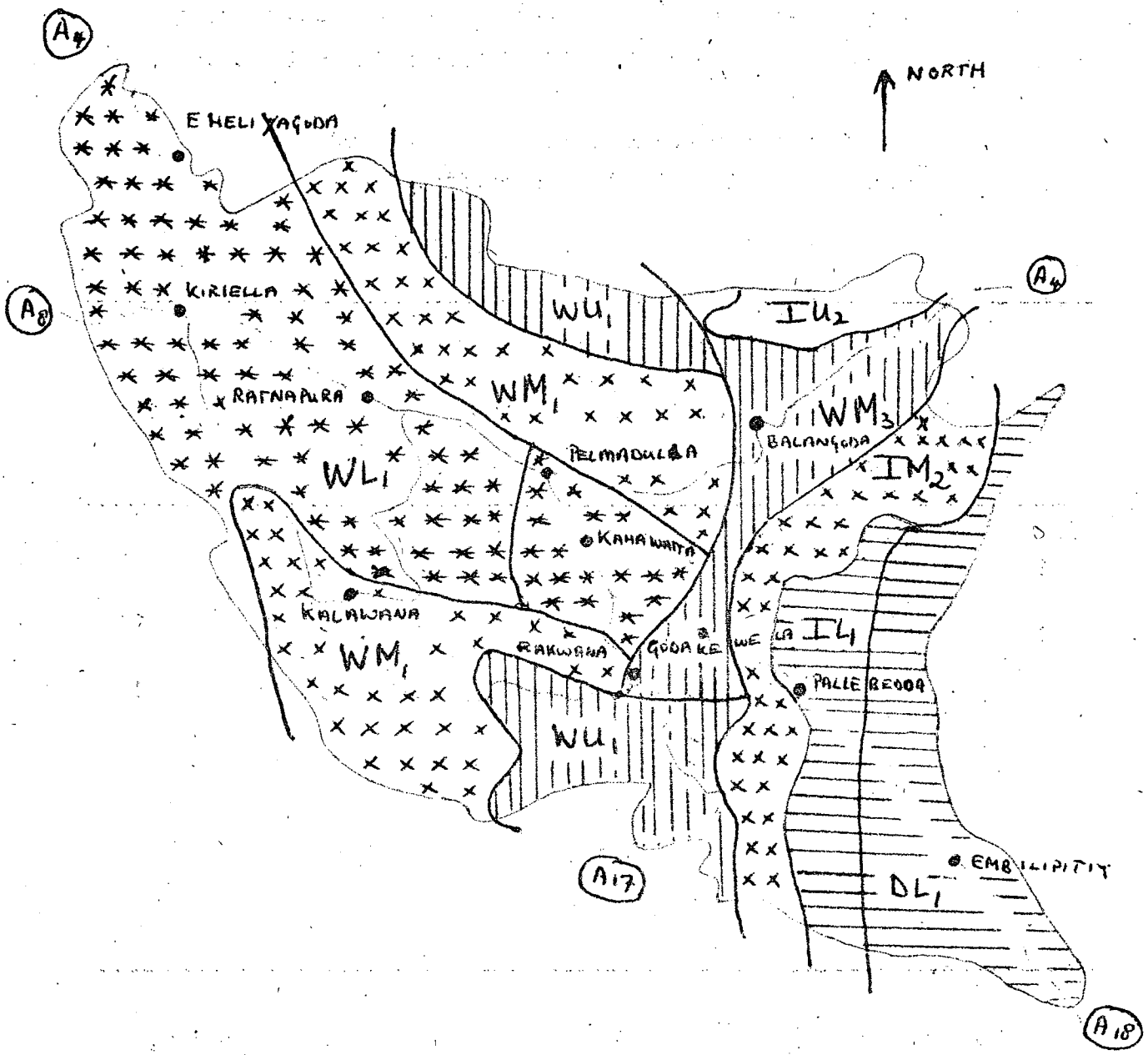
On the basis of the income per capita, the agro-ecological regions can be ranked and grouped. This is shown in table 4.2.

Table 4.2 Grouping of agro-ecological regions according to relative level of income per capita.

Income per capita levels					
High More than Rs. 2000		Middle Rs. 1500 to Rs. 2000		Low Less than Rs. 1500	
Name	Rank	Name	Rank	Name	Rank
IL_1	1	WL_1	3	WM_3	9
DL_1	2	WL_2	4	WU_1 south	10
		WM_1 north	5	WU_1 north	11
		WM_1 south	6		
		IM_2	7		
		IU_2	8		

Given the results of the estimation of the incomes per capita, it is not advisable nor is it possible to group the agro-ecological regions into two groups, one with high incomes and one with low incomes. Three groups are more appropriate.

Figure 4.1 Grouping of Agro-ecological regions in Ratnapura according to income per capita levels.



Legend:

WL	wet zone	low country	
WM	do	mid	do
WU	do	up	do
IL	intermediate zone	low	do
IM	do	mid	do
IU	do	up	do
DL_1	dry	low	do

||| low per capita incomes

XXX lower middle per capita incomes (1)

*** higher middle per capita incomes (1)

≡ high per capita incomes

(1) The subdivision of the middle level group is not used for the selection of key regions.

4.1.2 Preliminary assessment of the potential for future agricultural development

The potential for future agricultural development was assessed by a land evaluation. This study was commissioned to the Land Use Division of the Irrigation Department and reported in Dimantha (1982). However only a limited number of agro-ecological regions could be studied due to limitations in funds and time. Land evaluation can be explained as follows:

> An agro-ecological region is subdivided into homogeneous (at least more homogeneous than the agro-ecological regions as such) sub regions called Land (mapping) units (LU). Each LU is evaluated with regards to its suitability to use it for a number of pre-selected Land Use Types (LUT) e.g. tea, paddy etc. This evaluation results in judgements expressed in suitability ratings, S_1 - suitable, S_2 - moderately suitable, S_3 - marginally suitable and N - not suitable. See Dimantha (1982)

To quantify and summarize these ratings for a whole agro-ecological region, the ARTI/Wageningen team transformed the suitability ratings to scoring numbers (N=0, S_3=1, S_2=2 and S_1=3) which were summed for all LUTs per LU and subsequently aggregated for all LUs, taking into account the relative area of each LU. The result, converted on a scale from 0 - 100 can be seen in table 4.3.

Table 4.3 Quantitative assessment of the potential for future agricultural development for some agro-ecological regions in the Ratnapura District.

Agro-ecological Region	Indication[1] for Agricultural Potential
WM_3	35.6
DL_1	24.8
IL_1	16.0
IM_2	10.8
IU_1	4.2

(1) Based on scores of S_1=3, S_2=2, S_3=1 and N=0 per LUs per LUTs, simple summing of scores per LU for LUTs, and weighed aggregation of scores per LU for all LUs. The resulting indications were transformed to a scale of 0 to 100. This implies that 0 means that the whole agro-ecological region is not suitable (N) for any of the evaluated LUTs, while 100 means that all LUs are suitable (S_1) for all LUTs

A note of warning is made here. In grosso mode it can be said that the suitability of LUs for LUTs is largely based on water availability and erodability of the LUs. This resulted in the relative potentials of the agro-ecological regions in the sequence given here: $WM_3 > DL_1 > IL_1 > IM_2 > IU_2$. However the evaluation was done for given sets of LUTs. Although the selection of LUTs was done with care, there might exist other LUTs with better potentials. Also for the crops evaluated, there might be existing varieties unknown in Sri Lanka or to the land evaluator, which would do much better under the given ecological circumstances.

Furthermore, a recent socio-economic survey in the key regions revealed that even in certain parts of LUs without any potential, some farmers are doing well.

Another point is that in the low potential regions people are living and apparently obtaining a (meagre) livelihood. To declare that most of these areas should not be farmed but come under a protective forest is side stepping the real issues. Better farming methods will have to be found to accommodate a growing population and at the same time stabilize the degradation of the natural resources. All this points to the need for long term adaptive research to improve highland or stabilizing chena farming and its impact on forests, minor irrigation schemes and other asweddumised land, see ARTI/Wageningen (1982 c).

In the next section on selection of key regions, the results with regard to the assessment of the present state of development, via income per capita, and of the potential for future agricultural development, via land evaluation, will be combined and summarised. This will be the district planning framework as prepared for the selection of the key regions.

4.2 Selection of Key Regions

The results of the last section are combined in table 4.4.

Table 4.4 Present state of development and relative potential for future agricultural development for some agro-ecological regions in the Ratnapura district.

		relative present state of development		
		high	medium	low
Relative Potential for future agricultural development	high	DL_1 IL_1		WM_3
	low		IM_2 IU_2	
Potential unknown			WL_1 WL_2 WM_1 north WM_1 south	WU_1 north WU_1 south

Since the potential for agricultural development is not known for each agro-ecological region, an objective choice is impossible from a planner's point of view given the nature of one of the district's development objectives, economic growth.

The project team decided to select anyhow a region for which a land evaluation study was available, in other words, for which an assessment of the potential was made. Why were the land evaluation studies restricted to the WM_3, IU_2, IM_2, IL_1 and DL_1 agro-ecological reasons? This is related to the second research aim of the ARTI/ Wageningen project, namely to study three cases of district agricultural planning. Since Matara is a Wet Zone district the project wanted to use its limited consultancy budget and time for land evaluation studies of the Intermediate and Dry Zones of Ratnapura. The WM_3 area was included because it can be considered as a boundary region, having properties of the Wet Zone as well as of the Intermediate Zone and as such was of interest. It has to be emphasized that from a district planning point of view, this is not a correct procedure; land evaluation should have been made of all agro-ecological regions although perhaps on a larger scale with less detailed information. However the team was compelled to compromise between its research aims.

Of the two district development objectives - economic growth and diminishing income differences - the team tended to stress the second one because of the special role it foresees of regional planning in a district like Ratnapura, namely to counter balance regional imbalances caused by national policies. Therefore the team in the first instance, intended to select "backward" regions, here identified as those in the "low" and "medium" state of development categories. Together with the previous requirement for land evaluation study, this would have led to the selection of WM_3, IM_2 and IU_2. Since however IU_2 is a very small region in terms of its size and population (see table 4.1) and much of its area is a national reserve, the team excluded IU_2*.

*For the same reason WU_1 north and WU_1 south would have been excluded even if a land suitability study had been available.

The team then decided to include the IL_1 region for reasons of comparison. From the analysis of the incomes per capita, it appeared that IL_1 has the highest per capita income of Ratnapura while IM_2 has one of the lowest. Although a priori there are some obvious reasons for this discrepancy (lower population density, somewhat better agricultural potential), the team was not very satisfied with such an explanation, especially as the agro-ecological conditions and certain socio-economic factors are very similar. The team therefore even doubted that the per capita income in IL_1 was that high. Subsequent farm level research however, confirmed the fact that in general the people in IL_1 are better off than those in IM_2. See also ARTI/ Wageningen (1982 c). On the basis of the comparative research between the IM_2 and IL_1 regions, the team also hoped to use this information when formulating key region plans.

From a planning point of view, it can be noted that if emphasis is placed on the objective of diminishing income differences between regions in Ratnapura, projects in the IM_2 region can get a higher priority for implementation than those in the IL_1 region.

In resume it can be said here that the final selection of key regions resulted in the selection of three agro-ecological regions with different relative states of development as measured by the income per capita yardstick and with different relative potentials for future agricultural development, as assessed by the method described in section 4.1.2. The characteristics of each selected region can be summarised as follows, taking into account the underlinings in the last sentence:

WM_3 - low present state of development; high potential
IM_2 - medium present state of development; low potential
IL_1 - high present state of development; medium potential

Chapter Five

CONCLUSIONS

From the material in chapers two, three and four, a number of conclusions can be drawn.

1. A reduction of planning efforts through the key region approach in comparison with comprehensive, resource based regional planning is possible. The key region approach is desirable when the manpower and time available for planning are limited and the agro-ecological circumstances are diverse. In such circumstances the key region approach to district planning, if done properly, is a satisfactory replacement for more comprehensive planning. A proper key region approach consists of a district planning framework, a selection method, key region plans and a study of the impact of key region development on the development of the district as a whole.

2. Another question is whether key region plans as such are still part of intermediate level planning within the theory of multi-level planning, or whether it would be appropriate to consider the key region plans projects. Given the size of the key regions it would be better to limit intermediate level planning in the case of the key region approach to preparing an overall district planning framework and to the selection of key regions ("identification"). Then the key region plan itself should be called a project. Assessing the key region projects of their impact and effects on the district as a whole and evaluating the projects after completion are again tasks of intermediate level planning.

3. Agro-ecological regions are suitable key regions for agricultural planning. They are reasonably homogeneous with regard to agro-ecological conditions and certainly the variation within agro-ecological regions is less than between these regions*. A drawback is the difficulty of setting up a data base per agro-ecological region since most of the available data is on an administrative basis (district, AGA divisions, Grama Sevaka divisions or villages) or on a political basis (electorates). The attempts of the National Agrarian Sample Survey (NASS) to collect data per agro-ecological region is highly commendable and should be persisted and refined.

Whether agro-ecological regions are also suitable regional divisions for the implementation of a plan is doubtful. Since most departments are organised on an administrative or political division base, it might be very difficult and unwise to have the departments implement projects in a coordinated way per agro-ecological region. If it is decided to do so, it might be imperative to create a special coordinating committee with the authority to supervise the activities of the line departments in each key region.

4. The assessment in conclusion 3 that agro-ecological regions are suitable objects for planning lacked one foundation. In theory, the choice between agro-ecological regions and administrative divisions should also rest on an analysis of the main development problems. The problems in the agricultural sector are related to agro-ecological conditions (e.g. typical wet zone problems with regard to paddy, tea and rubber versus typical intermediate and dry zone problems with regard to chena/highland farming and the related problems of deforestration and diminishing reliability

* Of course detailed studies of land use and land suitability reveals a varied picture inside agro-ecological regions. This is quite logical and does not diminish the value of agro-ecological regions as a first step towards the demarcation of homogeneous agricultural zones.

of minor irrigation schemes). It is therefore advisable to delineate regions for planning on the basis of agro-ecological conditions.

However what is true for agricultural problems to development is not necessarily true for socio-economic problems. In fact many of these problems are unrelated to the conditions of agro-ecological regions. Still a number of socio-economic problems in Ratnapura are caused by agro-ecological conditions either directly or indirectly. This is highlighted by the groupings of agro-ecological regions in chapter four and Annex IV , and can be made plausible on the basis of the results of socio-economic research by the project. However, this is outside the scope of the present paper.

5. The main theoretical concepts (growth pole/centre) behind the idea of selecting certain areas in the geographical space are confused and not operational in general, and of little help in the Ratnapura setting in particular. More useful is the common sense concept of concentrating scarce resources (planning efforts, investments and the capacity to implement) in a limited area instead of thinly spreading them out over too big an area, in order to increase the changes for an efficient use of the resources and for a better integration of activities.

6. The project team also asked itself the question on how far the key region approach could coincide with either a key sector or a target group approach. Since two of the key regions are relatively poor regions, it is likely that groups of poor people are living in these regions. Whether the proposed key region development will indeed reach them has yet to be seen. A preliminary assessment could be made on the basis of the key region plans. (ARTI/Wageningen 1982 c). If however the target groups are concentrated in certain villages (or Grama Sevaka Divisions) for which we have some indications, then the question arises whether it is an efficient strategy to identify first key regions

and then "poor" villages within the key regions instead of directly identifying the "poor" villages in the whole district.

With regard to the key sector approach, it can be remarked that one of the reasons that such an approach does not coincide with the key region approach (different crops, areas and target groups would benefit probably from it, e.g. tea and rubber had been developed instead of highland crops) is the way the district boundaries came into being in the past. Had Ratnapura been confined to the wet zone only, then other key regions would have been selected which most likely had tea and rubber cultivation as the most important economic activities.

7. The selection of key regions either at the national level (districts or agro-ecological regions) or at the district level (administrative divisions or agro-ecological regions within districts) presupposes the existence of objective criteria and suitable indicators. If it is decided to follow in the future a key region approach (of which the IRD programme as such is an example next to what the ARTI/Wageningen project attempted to do within Ratnapura) then the selection criteria and a set of indicators have to be developed at the national level.

Selection of key regions on the basis of indicators also requires a suitable data base per unit of selection. Presently this suitable data base is lacking. In the Ratnapura case the consequence was that in part this data base had to be created and in part, data of inferior quality had to be used. Creation of data is very time consuming, while working with inferior data leads to less than satisfactory results. Data should be geared towards development planning which means that the data should give an adequate impression of the present situation and an insight into the potentials for future development, and expose the constraints faced if and when it is attempted to develop the regions.

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ANNEX 1 DESCRIPTION OF THE AGRO-ECOLOGICAL REGIONS OF SRI LANKA AND RATNAPURA

The Land and Water Use Division of the Department of Agriculture, Peradeniya, Sri Lanka divides the Ratnapura District into 14 Agro-ecological regions. This can be deducted from the map "Agro-ecological Regions of Sri Lanka" compiled by the Department in 1979. This map and the main characteristics of the Agro-ecological Regions, can be found below. The classification of the Agro-ecological Regions is based on rainfall, altitude, major soil group and terrain, of which rainfall and altitude are the most important. The study was done on an island-wide basis and originally mapped on a one inch to 2 miles scale. Based on a Land Evaluation Study of the Dry and Intermediate Zone of the Ratnapura District (Dimantha, 1982) it was possible to reduce the number of Agro-ecological regions to 11. These regions, with their respective areas are listed in table I-1.

A map of the Ratnapura District showing the Agro-ecological regions in Ratnapura as conceived by the project can also be found in the main text on page .

TABLE I - 1

AGRO-ECOLOGICAL REGIONS OF THE RATNAPURA DISTRICT

Agro-ecological Region	Size (ha)	Distribution (%)
Wet Zone		
WL_1	81,650	25.2
WL_2	13,730	4.2
WM_1 (South)	47,000	14.5
WU_1 (South)	16,580	5.1
WM_3	24,050	7.4
WM_1 (North)	31,375	9.7
WU_1 (North)	13,520	4.2
Intermediate Zone		
IU_2	7,735	2.4
IM_2	27,674	8.5
IL_1	22,223	6.9
Dry Zone		
DL_1	34,468	10.6
District Total	323,890	100%

ANNEX II DATA OF THE BASIC VILLAGE SURVEY 1977 GROUPED UNEER AGROECOLOGICAL REGION IN THE RATNAPURA DISTRICT

The only data available of all villages in the Ratnapura District were the Basic Village Survey of 1977 (B.V.S.) and as such the Project decided to group these data into Agro-ecological Zones. Therefore the villages of Ratnapura (officially recorded no. of villages 1515 but data collected relate to only 1428 villages) were classified into the 11 Agro-ecological zones with the help of one inch to a mile topographical maps and local knowledge. This in itself was time consuming and somewhat difficult especially when villages are located close to the boundaries.

The BVS data were mainly collected from rural villages; all Urban, Municipal, and Town Council Areas were excluded. Although in most cases the estate villages were not surveyed the position was not clear with regard to a few villages. The statistics can be grouped into nine categories.

1. Landuse
2. Landownership
3. Livestock
4. Population
5. Occupational distribution and unemployment
6. Social and physical infrastructure
7. Factories and small scale industries
8. Divisional Development Council Projects
9. Mineral resources

The project selected a number of subjects/items which are shown in Table II-I. In this table one finds a short description of the subject/item, the numbering of the original BVS questionnaire (Department of Statistics, 1977) and a reference number to the column of the tabulation sheets used for the grouping of the data into Agro-ecological Zones.

As stated in chapter 4 the quality of the data of the BVS is not accurate enough, it could be used for purposes of comparison. Too much value need not be placed on absolute figures. Some specific remarks on certain subjects/items are as follows.

TABLE II-1

SUBJECT/ITEM OF BVS, NUMBERING IN FORM: BVS 77/1 AND CORRESPONDING TABULATION NUMBER OF ARTI/LHW PROJECT

SUBJECT/ITEM	BVS question number: Number	Letter		ARTI/LHW Number
Whether electricity is available in the village	6			2
Land utilization: area of village	7	a		3
forest area		b		7
Cultivated area: tea		c	I	5
rubber			II	6
coconut			III	7
other crops			V	9
Area not cultivated		d		11
Total number of families	8			12
No. of families owning no land	9		I	13
No. of families owning less than half an acre			II	14
No. of families owning half a acre but less than 3 acres			III	15
No. of families owning 3 acres but less than 5 acres			IV	16
No. of families owning more than 5 acres			V	17
Paddy cultivated extent:				
maha 76/77 major irrigation	10			18
do do minor irrigation				19
do do rainfed				20
yala 77 major irrigation				21
do minor irrigation				22
do rainfed				23
Paddy uncultivated extent:				
maha 76/77	11	a		24
yala 77				25
Highlands uncultivated extent:				
maha 76/77		b		26
yala 77				27
livestock and poultry cattle	13		I	28
buffaloes				29
pigs				30
goats				31
poultry			II	32
Industry				
(a) large, medium and small scale				
tea	16	a	I	33
rubber			II	34
rice mills			IV	35
brick & tile kilns			VII	36
(b) cottage industries textile:				
No. of Institutions		b	I	37
No. of households				38
pottery: No. of Institutions			III	39
No. of households				40

TABLE II-1 continued.

Subject/item	BVS question number			ARTI/LBW Number
	Number	Letter		
Tailoring and needlework: No. of Institutions			IV	41
No. of households				42
Carpentry No. of Institutions			VI	43
No. of households				44
Reed and rattan work: No. of Institutions			VIII	45
No. of households				46
Metal work No. of institutions	16	b	VIII	77
No. of households				48
Brick and tiles No. of institutions			IX	49
No. of households				50
Population (a) Total number of housing units	19	b		51
(b) population 5-14 years: males		b	II	52
do females				53
Population aged 15-54 years: males			III	55
females				56
Total population males				58
females				59
(c) occupational distribution	19	c		
Paddy or other food crops cultivator			I	60
Animal husbandry worker			II	61
Plantation worker			III	63
Other workers			II to XXII plus XXIV	64
Gem miners				64 a
Casual labourers			XXIII	65
Unemployment total males plus females	20	a		67
Total male		b		68
Total female		c		69
No. of primary schools	21	I		7c
No. of government medical Institutions- hospitals	22	I		71
maternity hospitals		II		72
Government dispenseries		III		73
Ayurvedic hospitals		IV		74
Ayurvedic dispensaries		V		75

Remarks on the questionnaires

* The questionnaires sent to the Grama Sevakas did not contain additional information. Some questions were obvious and the others were subject to personal interpretations. Here, criteria should have been included: for example, is a person who works only two days a week unemployed? Is a farmer who can cultivate a plot only once every five years (due to complex tenure systems) considered to be landless or not?

* The information on a village within one G.S. was compiled by one and the same person therefore, we expect these statistics to be filled in according to similar criteria.

* In a few of the surveys (+ 5% of the total), some statistics were altered. We do not know whether this was done by the Department of Census and Statistics, by the G.S. or by some other person. As we consider the changed figures to be more accurate, we have proceeded to tabulate them.

Additional remarks

(the numbers correspond to the headings above the columns 1 to 75 of the tabulation papers)

* The total of (3) should be equal to the total (10)+ (11). Whenever this was true we had the impression that (10) had been subtracted from (3) and the result filled in (11).

* (12) is not always equal to the total of (13) upto (17)

* We were told that large estates were not included in the survey. However, we have the impression that in some cases this was done, because in (12), extra families were added as well as to (13) and (63), the number of plantation labourers.

* (37) upto (50) have not been answered in most cases. Therefore, they cannot give a good picture of the total cottage industries.

* In some cases, there seems to be a correlation between the number of casual labourers and the number of unemployed people; a higher number in the first category means a low number in the second and vice versa.

* The number of unemployed were very high in many villages, sometimes even higher than the number of employed.

On the whole, we felt that the statistics were not very reliable and uniform. One should, therefore, be very careful in the interpretation of these figures.

The sum total of the different subjects/items under each Agro-ecological region can be found in table II-2 to II-8. The column numbers refer to the reference members given in table II-1.

Although the BVS 1977 data of all the villages were the only available complete set which enabled us to aggregate them to the Agro-ecological zones, most of them were of little use to planning. Some short comings and possible improvements are disscused here, under the headings/numbering of the original form.

7. Land Utilization

Although the information about the extents of crop in each village is useful, more details about highland crops would have been worthwhile. However, the quality of the information is questionable. We checked some extents and found some were correct, while others were not. Another short comings of these data on extents of each village is that they do not give an insight into the cropping pattern of different farm types, knowledge of which is essential in agricultural planning. Next to the data on crop extents the production of crops and its productivity (e.g. production per ha and production per working day) are very important for planning. These data could be collected better through a well designed sample of farm households.

9. Families owning land

In itself a useful question, but given the complexity of landtenure in Sri Lanka, e.g. full ownership, Thattumaru/Kattimaru, share cropping/fixed rent, permits on crown land, encroachment and chena cultivation, the information of little value to planning, even if one takes the quality for granted.

13. Livestock and poultry

The quality of these data in is extremely low. See FARRINGTON et al. (1980, Appendix V). A well designed sample would probably give better information.

16. a) Industry

It seems to us not a very efficient way of collecting data on an item like industry when a very few villages have industries. Other government institutions too should have this information.

19. Population

Population is known from the census. Therefore it is not necessary to collect these data again from village statistics. The problem is whether the census data about a village could be obtained within a reasonable short time. This could be realized if the analysis of the census data is computerized and showed in such a way that the data can be retrieved on a village basis. This would enable planners to aggragate the data on the basis of agro-ecological regions, or AGA regions, on electorates and so on. Provided of course that the villages are classified according to these geographical units.

20. Unemployment

As stated earlier the unemployment data is questionable. Since unemployment data is very important to planning a method of improving these data ought to be studied in depth.

21 & 22 Schools and government medical institutions

(the same

What is already stated under Item 16(a) Industry, is applicable to this section as well.

Table II-3

NUMBER OF FAMILIES OWNING LAND PER SIZE CLASS (ACRES), IN EACH AGRO-ECOLOGICAL REGION IN RATNAPURA DISTRICT, 1977

Agro ecological region	Total number of families (12)	No. of families owning no land (13)	No. of families owning less than ½ acre (14)	No. of families owning between ½ and 3 acres (15)	No. of families owning between 3 and 5 acres (16)	No. of families owning more than 5 acres (17)	Sum of families (13) to (17)
WL_1	43,679	12,379	14,601	13,056	1,872	1,212	43,120
WL_2	11,625	5,981	2,688	3,273	327	267	12,536
WM_L south	3,241	2,633	1,695	4,027	609	421	9,385
WU_1 south	2,451	436	808	1,070	122	64	2,500
WM_3	11,213	2,524	3,072	4,559	511	312	10,978
WM_1 north	12,521	3,826	2,805	4,128	420	251	11,430
WU_1 north	638	86	170	346	32	4	638
IU_2	704	89	221	352	16	16	694
IM_2	5,852	1,293	995	2,796	468	283	5,835
IU_1	3,207	777	533	1,363	377	195	3,245
DL_1	7,831	1,861	665	2,489	1,585	1,096	7,696
Total District	108,972	31,885	28,253	37,459	6,339	4,121	108,057

TABLE II - 2 LAND USE IN EACH AGRO-ECOLOGICAL REGIONS IN THE RATNAPURA DISTRICT, 1977 (ha)

Agro ecological region	Village area	Forest	Tea	Rubber	Coconut	Paddy	Other crops	Total crops (used)	Unused	Used (plus) and unused	Total
	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(5) to (9)	(11)	(5) to (9) + (11)	(4) to (9) + (1
WL_1	82,278	10,035	7,377	31,474	4,274	5,939	8,899	57,963	7,995	65,958	75,993
WL_2	16,038	1,167	4,310	3,279	1,227	1,324	2,642	12,782	1,394	14,176	15,343
WM_1 South	37,532	14,750	4,311	3,533	667	1,716	5,188	15,415	6,246	21,661	36,411
WU_1 South	7,724	2,373	1,035	2	205	584	2,048	3,874	1,341	5,215	7,587
WM_3	21,842	6,016	4,583	275	1,718	1,781	3,694	12,051	3,238	15,289	21,305
WM_1 North	35,603	8,451	9,683	4,079	1,091	1,029	7,116	22,998	5,998	28,996	37,447
IJ_2	1,368	209	353	-	10	139	195	697	241	938	1,147
$I1_2$	26,464	8,404	997	50	1,282	1,091	5,404	8,824	7,287	16,111	24,515
IL_1	22,125	1,657	-	12	1,149	992	7,245	9,398	11,484	20,882	22,539
DL_1	22,261	2,368	6	7	1,019	4,295	7,671	12,998	5,208	18,206	20,574
Total district	274,935	55,859	33,098	42,711	12,649	19,039	50,193	157,690	50,781	208,471	264,330

TABLE II - 5 POPULATION, MALE, FEMALE AND TOTAL IN EACH AGRO-ECOLOGICAL REGION IN THE RATNAPURA DISTRICT, 1977

Agro ecological region	Population male	Aged 5-14 years Female	Total	Population aged 15 - 54 years Male	Female	Total	Total population Male	Female	Total
	(52)	(53)	(54)	(55)	(56)	(57)	(58)	(59)	
WL_1	24,095	23,690	47,785	62,355	59,497	121,852	108,090		104,557
WL_2	7,531	7,337	14,878	17,067	16,465	33,532	30,633	29,829	60,462
WM_1 South	6,110	5,966	12,076	13,415	13,147	26,562	24,252	23,649	47,901
WU_1 South	1,847	1,774	3,621	3,728	3,484	7,212	7,038	6,426	13,464
WM_1	7,070	6,775	13,845	15,875	15,283	31,158	28,452	27,444	55,896
WM_1 North	6,483	6,732	13,215	15,980	15,621	31,601	28,599	28,193	56,792
WU_1 North	445	443	878	958	906	1,864	1,747	1,680	3,427
IU_2	451	435	886	966	928	1,894	1,746	1,686	3,432
IM_2	4,229	4,023	8,319	8,791	8,221	17,012	16,169	15,337	31,506
IL_1	2,502	2,435	5,017	4,763	4,247	9,010	9,360	2,314	17,671
DL_1	5,798	5,638	11,436	12,230	10,325	22,555	22,986	19,817	42,803
Total District	66,638	65,238	131,956	156,128	148,124	304,252	279,072	266,932	546,004

TABLE II - 4 LIVESTOCK AND POULTRY IN EACH AGRO-ECOLOGICAL REGION IN THE RATNAPURA DISTRICT (UNITS), 1977

Agro-ecological region	Cattle	Buffaloes	Pigs	Goats	Poultry
	(28)	(29)	(30)	(31)	(32)
WL_1	6,119	2,620	139	1,477	22,832
WL_2	1,370	264	28	1,230	8,186
WM_1 South	900	385	18	419	4,207
WU_1 North	371	36	13	155	768
WM_3	2,711	885	19	694	4,637
WM_1 South	1,393	192	73	524	4,122
WU_1 North	115	62	-	14	80
IU_2	181	67	-	33	212
IM_2	1,907	866	12	210	1,621
IU_1	1,445	773	2	35	1,021
DL_1	2,607	2,337	16	158	4,168
Total District	19,119	8,487	320	4,949	51,854

TABLE II - 6 OCCUPATIONAL DISTRIBUTION AND UNEMPLOYMENT IN EACH AGRO-ECOLOGICAL REGION IN THE RATNAPURA DISTRICT, 1977

Agro ecological region	OCCUPATIONAL DISTRIBUTION						UNEMPLOY PERSONS		
	Paddy or other food cultivation (62)	Plantation worker (63)	Gem miners (64a)	Casual labourers (65)	Others (64b)	Total (66)	Total (67)	Male (68)	Female (69)
WL_1	11,132	18,006	8,145	8,080	8,700	54,063	55,178	23,687	31,829
WL_2	2,374	11,783	1,872	1,803	1,850	19,662	9,993	3,777	6,216
WL_1 South	4,455	5,223	1,225	1,422	491	13,698	10,200	4,367	5,833
WM_1 South	1,321	1,298	122	133	189	3,063	1,833	1,070	1,203
WL_3	5,854	3,640	206	2,818	2,443	14,951	14,247	5,860	8,303
WM_1 North	2,981	7,280	553	1,630	1,357	13,807	14,195	6,483	7,803
WU_1 North	406	191	-	201	36	834	907	383	524
IU_2	485	323	5	94	170	1,077	573	268	303
IL_2	5,324	789	172	319	983	7,587	6,173	3,260	3,611
IL_1	3,905	35	129	201	308	4,578	3,360	1,366	1,993
DL_1	5,042	3	696	1,503	1,421	8,665	8,775	4,531	4,712
Total District	43,279	48,557	13,125	18,204	18,819	141,984	125,414	55,052	72,330

Table II-7

FACTORIES AND COTTAGE INDUSTRIES IN EACH AGRO-ECOLOGICAL REGION IN THE RATNAPURA DISTRICT, 1977

Agro-ecological regions	FACTORIES				COTTAGE INDUSTRIES													
	Tea	Rubber	Rice Mills	Brick	Textiles		Pottery		Tailoring		Carpentry		Reed & Ratton		Mealwork		Brick & Tiles	
					No. of Inst.	Household.	No. of Inst.	Household.	No. of Inst.	Household.	No. of Inst.	Household.	No. of Inst.	Household.	No. of Inst.	Household.	No. of Inst.	Household.
	(33)	(34)	(35)	(36)	(37)	(38)	(39)	(40)	(41)	(42)	(43)	(44)	(45)	(46)	(47)	(48)	(49)	(50)
WL_1	29	271	62	38	80	223	-	10	7	37	125	206	20	21	11	17	23	86
WL_2	10	39	7	11	7	23	25	37	1	2	20	32	1	1	6	10	10	41
WM_1 south	13	14	7	2	2	26	-	-	2	3	4	10	-	-	-	-	-	-
WU_1 south	2	-	1	-	1	2	-	-	1	3	6	8	-	-	-	5	-	-
WM_3	12	7	11	7	21	107	15	31	2	23	34	52	26	6	3	2	4	21
WM_1 north	13	6	2	2	9	42	-	-	3	4	57	39	19	11	-	-	1	8
WU_1 north	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-
IU_2N	3	-	2	-	2	16	-	-	-	-	1	1	-	-	1	3	-	-
IM_2	1	-	8	3	4	19	4	30	-	-	20	31	2	2	4	4	1	7
IL_1	-	-	1	1	1	2	-	-	-	-	8	10	-	-	5	7	7	13
DL_1	-	-	59	12	1	26	1	4	2	4	65	135	2	6	7	11	30	141
Total District	84	337	160	76	128	496	45	112	18	76	340	524	70	47	37	59	76	317

TABLE II - 8 PHYSICAL AND SOCIAL INFRASTRUCTURE IN EACH AGRO-ECOLOGICAL REGION IN THE RATNAPURA DISTRICT, 1977

Agro ecological regions	Electricity		Schools	Health Sector				
	No. of villages with elect.	Total No. villages	No. of primary schools	Hospitals	Maternity hospitals	Government Dispensaries	Ayurvedic hospitals	Ayurvedic dispensaries
	(2)		(70)	(71)	(72)	(73)	(74)	(75)
WL_1	63	375	91	3	2	14	1	9
WL_2	8	106	26	1	1	2	-	1
WM_1 South	10	100	27	2	2	2	2	3
WU_1 South	-	39	9	-	1	2	1	-
WM_3	28	264	33	5	3	-	-	7
WM_1 North	11	275	29	5	5	5	2	2
WU_1 North	-	19	3	-	-	-	-	-
IU_2	1	16	3	1	1	-	-	-
IM_2	5	166	16	3	3	3	-	1
IL_1	-	34	9	1	1	1	1	-
DL_1	-	42	17	4	1	1	2	3
Total District	133	1428	263	25	20	30	9	26

ANNEX III ASSUMPTIONS, DATA AND CALCULATIONS FOR THE INCOME PER CAPITA ESTIMATION UNDER EACH AGRO-ECOLOGICAL REGION

This annex shows how the income per capita in each Agro-ecological Region was estimated. These incomes were presented in section 3.3 of the main text. This annex will at the outset present the final results of the estimations (see Table III - I) and subsequently discuss the assumptions, data and calculations for each detail under the headings of the occupational categories.

1. Paddy and Food Crop Cultivator

The income of this groups were calculated on the basis of incomes from individual crops and groups of crops: paddy, tea, rubber, home-gardens, highlands and chenas. The total income for each crop or group of crops is shown in Table III-2. Details of the estimation per crop are discussed below.

1.1 Paddy

The income from paddy was calculated by multiplying the areas of irrigated and rainfed paddy with their respective net returns per acre. The areas of paddy are based on the Basic Village Statistics, 1977. (BVS 1977) while the net returns per acre are based on the cost of cultivation of Agricultural crops, Maha 1980/81 cultivation. (Department of Agriculture 1981). The results can be seen in Table III-3.

1.2 Tea and Rubber

The income derived from tea and rubber is assumed to be the income of the smallholders. According to the 1973 Agricultural Census for the Ratnapura District the percentage of area under smallholders tea was 20.7 while that for Rubber was 52. (Department of Census and Statistics, 1977). To estimate the areas of small holders under tea and rubber, it was assumed that these percentages would be the same in each agro-ecological region. The total area under tea and rubber according to the BVS 1977 was multiplied by these percentages to arrive at the acreage under each crop. For details see Table III-4.

TABLE III - 1 TOTAL INCOME PER OCCUPATIONAL CATEGORY AND INCOME PER CAPITA IN EACH AGRO-ECOLOGICAL REGION, RATNAPURA DISTRICT, 1980.

Ecological region	TOTAL INCOME (RS. X 10^6) Paddy and food crop cultivation	Plantation labourers	Gem miners	Casual labourers	Others	Total	Rural population	Income per capita (Rs.)	Rank of income per capita
WL_1	205.21	69.63	48.87	34.70	60.38	418.79	212,617	1,970	3
WL_2	30.37	45.49	11.23	7.74	12.84	115.67	60,462	1,913	4
WM_1 South	48.70	20.20	7.35	6.11	3.41	85.77	47,901	1,791	6
WU_1 South	9.53	5.41	0.73	0.57	1.31	17.55	13,464	1,304	10
WM_3	34.46	14.08	1.24	12.10	16.96	78.84	55,896	1,410	9
WM_1 North	57.85	28.17	3.32	6.99	9.42	105.75	56,792	1,862	5
WU_1 North	2.42	0.74	-	0.86	0.25	4.27	3,427	1,246	11
IU_2	2.80	1.24	0.03	0.40	1.18	5.65	3,432	1,646	8
IM_2	42.80	3.04	1.03	1.37	6.42	55.06	31,506	1,748	7
IU_1	54.43	0.13	0.77	0.86	2.14	58.33	17,674	3,300	1
DL_1	117.20	-	4.18	6.45	9.86	137.69	42,803	3,217	2
Total District	607.73	188.13	78.75	78.17	130.62	1,083.40	546,004	1,984	

Table III-3

INCOME FROM AGRICULTURE TO PADDY AND OTHER FOOD CROP CULTIVATORS IN EACH AGRO-ECOLOGICAL REGION, RATNAPURA DISTRICT 1980.

Agro ecological region	Paddy	Tea	Rubber	Homegardens	Highland	Chena	Total	No. of cultivators	Income per cultivator (Rs)
WL_1	38.07	12.60	124.49	15.34	14,39		205.21	11.132	18.645
WL_2	9.83	7.36	13.00	3.27	4.91		38.37	2.374	16,702
WM_1 south	12.71	7.36	14.01	3.37	11.15		48.70	4.455	10.981
WU_1 south	2.12	1.77	0.01	1.03	4.60		9.53	1.321	7,169
WM_3	14.28	7.83	1.09	4.22	7.04		34.46	5.854	5,887
WM_1 north	5.64	16.54	16.17	3.79	15.70		57.85	2.981	19,574
WU_1 north	1.29	0.76	-	0.28	0.09		2.42	406	5,985
IU_2	0.97	0.60	-	0.40	0.63	0.20	2.80	485	5,773
IM_2	6.02	1.70	0.20	16.08	11.93	6.87	42.80	5,324	8,039
IU_1	6.83	-	0.05	11.52	29.10	6.88	54.43	3.905	13,880
DL_1	32.53	0.01	0.03	28.07	48.57	7.99	117.20	5.042	23,245
Total District	130.27	56.54	169.35				612.39	43.279	14,150

TABLE III - 3: INCOME FROM PADDY IN EACH AGRO-ECOLOGICAL REGIONS, RATNAPURA DISTRICT, 1980.

Agro-ecological region	AREAS WITH PADDY IN 1977 (ACRES) MAHA 76/77 Major Irrigation (18)	MAHA 76/77 Minor Irrigation (19)	MAHA 76/77 Rainfed (20)	YALA 77 Major Irrigation (21)	YALA 77 Minor Irrigation (22)	YALA 77 Rainfed (23)	IRRIGATED PADDY Total area (18)+(19)+(21)+(22)	IRRIGATED PADDY Net returns per acre Rs.	RAINFED PADDY Total area (20)+(23)	RAINFED PADDY Net returns per acre Rs.	Income from Paddy Rs.X'10
WL_1	198	6,636	8,480	93	5,896	6,526	12,823	1,752.90	15,006	1,040.15	38.09
WL_2	-	2,108	1,150	-	2,140	1,145	4,248	1,752.90	5,295	1,040.15	9.83
WM_1 south	-	2,630	1,687	-	2,626	1,679	5,256	1,752.90	3,366	1,040.15	12.71
WU_1 south	-	410	296	-	415	348	825	1,752.90	644	1,040.15	2.12
WM_3	133	3,191	1,250	117	3,273	1,160	6,714	1,752.90	2,410	1,040.15	14.28
WM_1 north	-	1,045	959	3	1,068	901	2,116	1,752.90	1,860	1,040.15	5.64
WU_1 north	-	366	5	-	366	5	732	1,752.90	10	1,040.15	1.29
IU_2	-	270	10	-	269	17	539	1,752.90	27	1,040.15	0.97
IM_2	-	904	834	-	1,583	758	2,487	1,752.90	1,592	1,040.15	6.02
IL_1	320	1,632	211	310	1,416	107	3,678	1,752.90	318	1,040.15	6.78
DL_1	9,438	818	327	7,156	806	253	18,218	1,752.90	580	1,040.15	32.53
Total District	10,089	20,010	15,209	7,679	19,858	12,899	57,636	1,752.90	28,108	1,040.15	130.27

The areas of small holder tea and rubber were then multiplied with the net return per acre for each of these crop based on our planning study of the Matara district. (ARTI-Wageningen, 1982, p. 120; average earnings per hectare of small holdings and medium sized holdings in the Nothern Zone, which comprises the WL_1 and WM_1 agro-ecological zones in which zones also most of the tea and rubber in Ratnapura are grown.

1.3 Homegardens, Highland and Chena cultivation

Because of the availability of the landuse study (Dimantha, 1982) of the intermediate and dry zone, the estimation of incomes of home-garden, highland, and chena cultivation in those zones was different from the one in the Wet Zone.

1.2.1 Wet Zone

In the Wet Zone it was assumed that each land owning family in the rural areas has, on an average, 0.1 ha. of home garden; as in the Matara District (ARTI/Wageningen, 1981....,) The net return of one acre of homegarden was suppossed to be Rs. 2020, which is a district average. This net return is based on an average cropping pattern (Department of Census and Statistics 1981) and net returns per acre of individual crop (Department of Agriculture 1981) Details of the calculation can be found in Table III-5. The area under highland crops of the wet zone was estimated by deducting the area under homegardens from the area under "other" crops as shown in the BVS.77. Since in general the returns from highlad crops in the wet zone are lower than that of the dry zone the nett returns from highland per acre in the wet zone was assumed to be Rs. 1,000. The calculations for the incomes from homegarden and highland cultivation are shown in Table III-6.

1.3.2 Intermediate and Dry Zone

The areas with homegarden, highland and chena cultivation in the intermediate and dry zone were known from Dimantha (1982).... Assuming a cycle of one year use and four years fallow for chena cultivation, the area under chena cultivation was divided by 5. As in the Wet Zone

Table III-4

INCOME FROM TEA AND RUBBER IN EACH AGRO-ECOLOGICAL REGION, RATNAPURA DISTRICT, 1980

Agro ecological region	TEA					RUBBER				
	Total area (5) (ha)	Fraction of small holders area	Tea area of small holders	Nett return per HA (Rs)	Total income Rs.X 10^6	Total area (ha) (6)	Fraction of small holders area	Rubber area of small holders (ha)	Nett return per ha (Rs)	Total income Rs.X 10^6
WL_1	7,377	0.207	1,527	8,252	12.60	31,474	.52	16,366	7,625	124.79
WL_2	4,310	do	892	do	7.36	3,279	do	1,705	do	13.00
WM_1 south	4,311	do	892	do	7.36	3,533	do	1,837	do	14.01
WU_1 south	1,035	do	214	do	1.77	2	do	1	do	0.01
WM_3	4,583	do	549	do	7.83	275	do	143	do	1.09
WM_1 north	9,683	do	2,004	do	16.54	4,079	do	2,121	do	16.17
WU_1 north	433	do	92	do	0.76	-	do	-	do	-
IU_2	353	do	73	do	0.60	-	do	-	do	-
IM_2	997	do	206	do	1.70	50	do	26	do	0.20
IL_1	-	do	-	do	-	12	do	6	do	0.05
DL_1	6	do	1	do	0.01	7	do	4	do	0.03
Total District	33,098	do	6,851	do	56.54	42,711	do	22,210	do	169.35

the nett returns per acre were cultivated at Rs. 2020., based on the same cropping pattern. See Table III-5. For the estimation of the incomes from homegarden, highland and chena cultivation see Table III-6.

2. Plantation Labourers

The total income of plantation labourers in the rural sector was estimated as follows:

The income of males and ferales in tea and rubber was summed taking into account the wages, participation ratio of men and women and the relative area of tea and rubber. See Table III-7.

Estimation of the annual wages of plantation workers in tea and rubber.

		Daily wage	Participation ratio male/female	Relative area	No. of working days per year	Total Rs.
Male worker	= tea	14.05	.45	0.55	267	928.46
Female "	= tea	11.69	.55	0.55	267	944.17
Male "	= rubber	17.83	.45	0.45	267	964.02
Female "	- rubber	15.59	.55	0.45	267	1030.23
			Average annual wage			3866.88

Sources:

= daily wages
= participation ratio male/female
= relative area tea/female
- No. of working days/year

Using the data in Table III-7 the resulting average annual wage is Rs. 3867. This average annual wage was multiplied by the number of plantation labourers according to the BVS 77. See Table III-8 for the calculation.

TABLE III - 5 AVERAGE NET RETURN PER ACRE AND HECTARE IN HOUSE GARDEN, HIGHLAND AND CHENA, RATNAPURA 1980

Crops	Distribution %	Net return per acre	Contribution to average net return Rs.	Average nett net return per ha. (Rs.)	Average net return in Wet zone regions Rs. acre	ha
Chillies	7	4.222	295	This average nett return applies to homegardens highlands and chena in all agro-ecological regions, except highlands in wet zone regions.	It is assumed that highlands in the wet zone regions yield about half of highlands in the dry and intermediate zones.	
Red onions	3	3,710	111			
Maize	5	750	75			
Green gram	3	2,198	66			
Groundnuts	1	2,095	21			
Kurukkan	11	304	334			
Gingerly	6	875	53			
Cowpea	2	1,275	25			
Tumeric	1	16,542	165			
Manioc	36	1,366	492			
Sweet potatoes	19	2,016	383			
Total	100		2020	4989	1000	2.470

Table III-6

INCOME FROM HOMEGARDENS, HIGHLANDS, CHENA IN EACH AGRO-ECOLOGICAL REGION, RATNAPURA DISTRICT, 1980

Agro-ecological regions	AREA (ha)				NET RETURNS PER HA. RS.				TOTAL INCOME FROM (RS.x 10)			
	Land with other crops	No. of families with land	Home garden	Other land less home garden/ highland	Chena	Chena 5	Home garden	High land	Chena	Home garden	High land	Chena
WL_1	8,899	30,741	3,074	5,825	-	-	49,892	2,470	-	15.34	14.39	
WL_2	2,642	6,555	656	1,986	-	-	do	do	-	3.27	4.91	
WM_1 south	5,188	6,752	675	4,513	-	-	do	do	-	3.37	11.15	
WU_1 south	2,048	2,064	206	1,062	-	-	do	do	-	1.03	4.60	
WM_3	3,694	8,454	845	2,849	-	-	do	do	-	4.22	7.04	
WM_1 north	7,116	7,604	760	6,356	-	-	do	do	-	3.79	15.70	
WU_1 north	91	552	55	36	-	-	do	do	-	0.27	0.09	
IU_2	-	-	80	127	16	3.2	4,989	4,989	4,989	0.60	0.60	0.20
IM_2	-	-	3.223	2,390	6,878	1,375.6	do	do	do	16.08	11.93	6.87
IU_1	-	-	2,309	5,830	6,891	1,378.2	do	do	do	11.52	29.10	6.88
DL_1	-	-	5,624	9,730	8,008	1,601.6	do	do	do	28.07	48.57	7.99
Total District												

3. Gem Miners

The estimation of the income of gem miners was the most risky of all. A number of informal interviews with officials of the State Gem Corporation, Gem Merchants and Gem Miners led to the conclusion that Rs. 6,000, per year might be an approximate income. Their monthly earnings varies sharply at times. The figure Rs. 6,000/= therefore is only an indication for the possible average income in a very risky profession.

Since gem mining is a very important profession and source of income for the Ratnapura district a more detailed investigation into income and employment levels would be an essential requirement for a future planning of the Ratnapura district.

The income level of Rs. 6,000/= per gem miner is supported by an another estimate, taking the gem pit as a unit.

The earmings from a gem pit could be either nil or any substantial amount. Our impression is that Rs. 50,000/= could be the earning of an average pit for a year. (with an estimated legal and illegal, 17,000 pits this would give Rs. 590 million value added, which is consistent with State Gem Corporation data on Gem exports.) It is a usual custom in Ratnapura that the miners get about 35% of the earnings or Rs. 18,000/=.

The number of labourers varies between one and ten per pit but, since there are more small pits than large ones 3 labourers as an average per pit is reasonable. This also leads to Rs. 6,000/= per miner per year.

For the calculation of the total income of gem miners see Table III-8.

A remark has to be made about the number of gem miners in Ratnapura. The BVS 77 gives 13,125 in 1977, while the ARTI/LHW project estimates the number in 1981 at 50,000 (17,000 pits, times 3 miners). The following two factors explain the difference.

i) the enormous growth of the gem trade, on the basis of custom data annually with 15.4% in the period of 1977 - 1980 or in total 54%. This probably even underestimate the real growth.

ii) The BVS 77 survey noted only those who had gem mining as their main occupation as gem miners, leaving out the part-timers who form a substantial number.

Although the number of gem miners of 13,125 is too low the data on them is still sufficient to compare between agro-ecological regions.

4. Casual labourers

The income level of casual labourers was assumed to be that of the so-called "workers not classified" in the Consumers Finance (Central Bank 1973, 456) for zone 4 (Kandy, Matale, Nuwara Eliya, Badulla, Ratnapura, Kegalle and Kurunegala districts). In 1973 their average income was Rs. 1717 per year, which would be in 1980 prices, Rs. 4294, (250% increase). In the Consumer Finance, page 456 it is reported that 175 persons, "workers not classified" got in two months Rs. 50,097 which means Rs. 1717 per year per person. For the calculation of the total incomes of the casual labourers see Table III-8.

5. Other labourers

The average income of this group of labourers was estimated by using data of the Consumer Finance. Table I-260 (Central Bank 1973, 265). These data related to the zone 4 of the country. First the incomes were increased to reflect the general income increase over the period 1973 - 1980, government employees with 100%; non government employees with 150%. Then an average was calculated for the wages in manufacturing (industrial categories 20, 21, 22, 23, 24, 25, 26, 28, 30, 33, 34, 36, 38 and 39) government (I.C. 81) services (I.C. 51, 52, 61, 62, 71, 81, 82, 83, 84 and 85) and others (I.C. 90, 91, 92, 94, 95 and 96). This resulted in 1980 in an average income per year per worker of Rs. 6,941.

Table III-8

INCOME OF PLANTATION LABOURERS, GEM MINERS, CASUAL LABOURERS, AND OTHER WORKERS, IN EACH AGRO-ECOLOGICAL REGION RATNAPURA DISTRICT, 1980

Agro-ecological zone	PLANTATION LABOURERS			GEM MINERS			CASUAL LABOURERS			OTHER LABOURERS		
	No. of labourers (63)	Average annual wage (Rs)	Total income Rs, X 10^6	No. of Diggers (64a)	Average annual income (Rs)	Total income Rs, 10^6	No. of labourers (65)	Average annual income (Rs)	Total income Rs, 10^6	No. of workers (64b)	Average annual income (Rs)	Total income Rs, X 10^6
WL_1	18,006	3,867	69.63	8,145	6,000	48.87	8,080	4.294	34.70	8,700	6,940	60.38
WL_2	11,763	do	45.49	1,872	do	11.23	1,802	do	7.74	1,650	do	12.84
WM_1 south	5,223	do	20.20	1,225	do	7.35	1,422	do	6.11	491	do	3.41
WU_1 south	1,398	do	5.41	122	do	0.73	133	do	0.57	189	do	1.31
WM_3	3,640	do	14.08	206	do	1.24	2,818	do	12.10	2,443	do	16.96
WM_1 north	7,286	do	28.17	553	do	3.32	1,630	do	6.99	1,357	do	9.42
WU_1 north	191	do	0.74	-	do	-	201	do	0.86	36	do	0.25
IU_2	323	do	1.24	5	do	0.03	94	do	0.40	171	do	1.18
IM_2	789	do	3.04	172	do	1.03	319	do	1.37	988	do	6.82
IL_1	35	do	0.13	129	do	0.77	201	do	0.86	308	do	2.14
DL_1	3	do	-	696	do	4.18	1,503	do	6.45	1,421	do	9.86
Total District	48,557	do	188.13	13,125	do	78.75	19,204	do	78.17	18,319	do	130.62

Annex IV

POSSIBLE INDICATORS OF DEVELOPMENT OTHER THAN INCOME PER CAPITA

On the basis of the available data of the BVS 77 it is possible to construct numerous indicators which may or may not reflect the present state of development of the agro-ecological regions.

The project initially selected 10 indicators which had some relation to the state of development. Although several other indicators were selected, after a first analysis it was found that either the relationship with the main variable was very weak and/or controversial or the quality of the data was such that we could not rely on the obtained ranking. These indicators will not be described here, as the basic data can be found in Annex II.

The ten indicators selected for discussion in this annex are as follows.

- Employment

1. Percentage of employed population engaged in the non-agricultural sector.
2. Percentage of employed population engaged in gem mining as gem miner

- agriculture in general

3. Percentage of the total area under cultivation.
4. Number of agricultural workers per area cultivated.

- Agriculture, commercialization

5. Percentage of total area cultivated under tea or rubber.
6. Marketable surplus of paddy as percentage of total paddy production.

- Population

7. Average number of persons per family

- Education

8. Availability of primary schools per area and per capita in the age group of 5 - 14 years.

- Physical infrastructure

9. Percentage of total number of village with electricity.

- Distribution of land ownership

10. Percentage of total number of families owing no land or less than half an acre.

The method of calculating the above indicators can be seen in table IV-1, while the resulting figures are shown in table IV-2.

As stated above, each indicator has its pro's and contra's with regard to the relationship with the state of development. Each indicator will be discussed briefly.

1. Percentage of employed population engaged in the non-agricultural sector.

In the literature as regards development, it is normally assumed that that a bigger non-agricultural sector denotes a higher state of development. This may be true for entire nations, but is questionable for the rural setting of Ratnapura district. On the one hand much development took place in the agricultural sector (e.g. tea and rubber cultivation, and irrigated paddy) and will take place in this sector. On the other hand much of the development outside the agricultural sector is linked to the gem industry. In the nature of this last sector (depletion of natural resources, backward technology, high risk for entrepreneurs and gem miners, extremely skew resulting income distribution) it is doubtful whether gem mining development leads to progress in a socio-economic sense.

2. Percentage of employed population engaged as gem miners

Under the first indicator it was shown that gemming is a fast developing activity in Ratnapura. It gives high, but risky incomes and employment, but does it indicate a lasting development? Do the figures about employment in the gem sector indicate development?

3. Percentage of total area under cultivation

One could say that a region is more developed when more land is cultivated. On the other hand the amount of land cultivated in related to the population density, so that more land in use does not necessarily mean better incomes. Also more land in use could imply a more extensive form of land use (little labour and capital per unit of land), which may be interpreted as a lesser state of development.

4. Number of agricultural workers per area cultivated

More agricultural workers per area cultivated implies a more labour intensive type of agriculture. The most labour intensive type of agriculture is tea cultivation. Tea cultivation does contribute to wealth but more at the national level (national budget) than at the local level (wages) although the employment effect is important. However from a more generalized point of view it is doubtful whether labour intensive agriculture relates to development. High labour often means low labour productivity and hence low wages. Future wage increases for the labourers can only come from savings in the amount of labour used, eg. a reduction of the labour intensity, given yield levels, prices and the tax/subsidy structure.

5. Percentage of total area cultivated under tea and rubber

Since tea and rubber are commercial crops, a high percentage of land under tea and rubber shows the importance of commercialized agriculture. Commercialized agriculture is often related to development. Since most of the earnings of tea and rubber are taxed by the state it is doubtful whether tea and rubber cultivation contribute much to the development of the population in the region.

6. Marketable surplus of paddy as percentage of total paddy production

As for indicator 5 the marketable surplus of paddy is an indication of the commercialization of the paddy production. It is clear that the gains from the sales of paddy are retained by the rural population unlike in the case of tea and rubber.

7. Average number of persons per family

It can be expected that increased levels of living will reduce the birth rate. Since statistics relating to birth rate were not available at the Agro-ecological region level, the average number of persons per family was taken as a substitute.

8. Availability of primary schools per area and per capita in the age group of 5 - 14 years

Since adequate statistics do not existed regarding enrolment ratios, the availability of primary schools per area and availability of primary schools per capita in the age group of 5-14 years, substitutes were taken. The former is an indication for the availability schools in a geographical sense e.g. the average distance of schools to children assuming that schools and children are evenly spread over the regions. The latter is an indication of the availability of schools to the children is the particular age group assuming that schools have an equal capacity, that is to say are more or less of a standard type as in the case in general. Even if the assumptions are strictly speaking not correct, the proposed indicator still gives at least some insight into the availability of education in the absence of better indicators.

9. Percentage of total villages with electricity

This indicator gives an idea of the development of physical infrastructure in the rural areas.

10. Percentage of total number of families owning no land or less than half an acre.

This is an indicator for the land ownership distribution and a good substitute for the GINI Concentration Ratio. Since no data of the extent of land per size class were available GINI Concentration Ratios could only be calculated on certain assumptions. Under all assumptions the GINI Concentration Ratios were highly correlated with the indicator chosen here.

Table IV-1

DEFINITION OF INDICATORS OF DEVELOPMENT, RATNAPURA DISTRICT

In this table column numbers refer to the numbers employed by the ARTI/Wageningen team in the analysis of the BVS 77 data; see table II-1

1. Percentage of employed population engaged in the non-agricultural sector

$$\frac{(64a)+(64b)+(65)}{(66)} \times 100\%$$

2. Percentage of employed population engaged as gem miners

$$\frac{(64a)}{(66)} \times 100\%$$

3. Percentage of total area under cultivation

$$\frac{(5)+(6)+(7)+(8)+(9)}{(4)+(5)+(6)+(7)+(8)+(9)+(11)} \times 100\%$$

4. Number of agricultural workers per area cultivated

$$\frac{(62)+(63)}{(5)+(6)+(7)+(8)+(9)} \quad \frac{\text{man}}{\text{ha}}$$

5. Percentage of total area cultivated under tea and rubber

$$\frac{(5)+(6)}{(5)+(6)+(7)+(8)+(9)}$$

6. Marketable surplus of paddy as percentage of total paddy production

$$\frac{\left\{\{(18)+(19)+(21)+(22)\} \text{ yield of irrigated paddy} + \{(20)+(23)\} \text{yield of rainfed paddy}\right\} \text{ -home consumption}}{\left\{\{(18)+(19)+(21)+(22)\} \text{ yield of irrigated paddy} + \{(20)+(23)\} \text{ yield of rainfed paddy}\right\}}$$

In this formula home consumption is calculated as population multiplied by 100 kg of rice (consumption per year per capita), converted to paddy

7. Average number of persons per families

$$\frac{(58)+(59)}{(13)+(14)+(15)+(16)+(17)} \quad \frac{\text{persons}}{\text{families}}$$

8. Availability primary schools per area and per capita in the age group of 5-14 years

$$\frac{(70)}{(4)+(5)+(6)+(7)+(8)+(9)+(11)} \times \frac{(70)}{(54)} \times 10^6 \frac{(\text{Schools})^2}{\text{ha} \times \text{persons}}$$

9. Percentage of total number of villages with electricity

$$\frac{(2)}{\text{total number of villages}} \times 100\%$$

10. Percentage of total number of families owning no land or less than half an acre

$$\frac{(13)+(14)}{(13)+(14)+(15)+(16)+(17)} \times 100\%$$

Table IV-1

TEN POSSIBLE INDICATORS OF STATE OF DEVELOPMENT : VALUES PER AGRO ECOLOGICAL REGIONS AND THEIR RANKINGS, MATARA DISTRICT 1977

	AGRO ECOLOGICAL REGION	NON-AGRICULTURAL EMPLOYMENT		EMPLOYMENT AS GEM MINERS		AREA CULTIVATED		LABOUR/ LAND INTENSITY		AREA UNDER TEA/ RUBBER		SURPLUS PADDY PRODUCTION		FAMILY SIZE		AVAIL. PRIMARY SCHOOLS[2]		AVAIL. ELECTRICITY		FAMILIES WITH NONE OR < ½ ACRE LAND	
		%	RANK	%	RANK	%	RANK	MAN/HA	RANK	%	RANK	%	RANK	MAN/FAM	RANK	HA.MAN	RANK	%	RANK	%	RANK
1	WL_1	46.1	1	15.1	1	87.9	2	0.50	8	67.0	1	66.1	3	4.93	2	2.28	6	16.8	1	62.6	2
2	WL_2	28.1	6	9.5	2	90.2	1	1.11	2	59.4	4	68.3	2	4.82	1	2.96	4	7.5	5	69.1	1
3	WM_1 south	29.3	4	8.9	3	71.2	8	0.63	7	50.9	5	54.6	4	5.10	6	1.66	8	10.0	4	46.2	6
4	WU_1 south	14.5	10	4.0	5	74.3	5.5	0.68	6	26.8	8	16.0	10	5.39	8	2.95	5	--	10.5	49.7	5
5	WM_3	36.5	3	1.4	9	78.8	4	0.81	4	40.3	7	47.6	6	5.09	5	3.69	3	10.6	3	51.0	4
6	WM_1 north	23.7	8	3.7	6	79.3	3	0.45	9	59.8	3	41.5	7	4.97	4	1.70	7	4.1	7	58.0	3
7	WU_1 north	28.4	5	- -	11	66.4	9	0.87	3	64.2	2	50.7	5	5.37	7	8.94	1	--	10.5	40.1	9
8	IU_2	24.9	7	0.5	10	74.3	5.5	1.16	1	50.6	6	33.2	8	4.94	3	8.86	2	6.3	6	44.0	7
9	IM_2	19.4	9	2.3	8	54.8	10	0.69	5	11.9	9	--	11	5.40	9	1.26	9	3.0	8	39.3	10
10	IL_1	13.9	11	2.8	7	45.0	11	0.42	10	0.1	10.5	17.6	9	5.45	10	0.72	11	2.9	9	40.3	8
11	DL_1	41.8	2	8.0	4	71.4	7	0.39	11	0.1	10.5	82.0	1	5.56	11	1.24	10	16.7	2	32.8	11
12	District Average	35.3		9.2		75.6		0.53		48.1		60.5		5.05		1.98		9.3		55.6	

The relation between the distribution of land ownership and development is ambitious. Often it is observed that development has a result a skewer distribution of assets. This can also be observed from the correlation coefficients in table IV-4. However the distribution of land ownership is slightly negatively correlated with the yardstick for development which the project finally had chosen on capita income.

The ambitions nature of relation between the land ownership distribution and the state of development means that this indicator is less suitable for aggregation with the other indicators.

This of course applies also to indicators 1,2,3,4, and 5. The remaining indicators (6,7,8 and 9) have intuitively a better relationship with development but are only related to particular aspects of development.

The project therefore decided, as stated earlier, not to base the selection of key regions on the above indicators, but to use per capita income as a yeardstick.

The results presented here will indicate to the reader the nature of ranking and groupings that would have emerged, if the above indicators were used.

The reader is invited to inspect the different indicators and compare the rankings of the agro-ecological regions with the ranking on the basis of income per capita. In general the rankings are not similer. This highlighted by table IV-4 which shows the correlation coefficient based on the standarized indicators shown in table IV-3. Hellwig (1974) developed a method for the selection of indicators, based on the clustering of variables by means of a taxonomic method. For details of this method the reader is referred to the above mentioned publication, and to table IV-5 where the relevant part of this publication is cited. The "d" coefficients necessary for this method are given in table IV-6. Applying this method to the 10 indicators would give the result as given in table IV-7.

Table IV-3

STANDARIZED VALUES OF INDICATORS AND INCOME PER CAPITA, RATNAPURA DISTRICT 1977

	AGRO-ECO-LOGICAL REGION	Indicators: 1 NON-AGRICULTURAL EMPLOYMENT	2 EMPLOYMENT AS GEM MINERS	3 AREA CULTIVATED	4 LABOUR INTENSITY	5 AREA UNDER TEA/RUBBER	6 SURPLUS UNDER PADDY PRODUCTION	7 FAMILY SIZE	8 AVAILABILITY PRIMARY SCHOOLS	9 AVAILABILITY ELECTRICITY	10 FAMILIES WITH LAND OF 0.5 ACRES	INCOME PER CAPITA
1	WL_1	0.26	0.29	0.28	- 0.09	0.22	0.06	0.13	0.03	0.37	0.17	- 0.01
2	WL_2	- 0.18	0.01	0.34	57	0.13	0.08	0.25	0.10	0.09	0.32	- 0.03
3	WM_1 south	- 0.15	- 0.01	- 0.10	0.05	0.03	- 0.06	- 0.05	- 0.03	0.03	- 0.22	- 0.09
4	WU_1 south	- 0.51	- 0.26	- 0.03	0.11	- 0.25	- 0.46	- 0.37	0.10	- 0.46	- 0.14	- 0.31
5	WM_3	0.03	- 0.39	0.07	0.25	- 0.09	- 0.13	- 0.04	0.17	0.06	- 0.11	- 0.26
6	WM_1 north	- 0.28	- 0.27	0.09	- 0.14	0.14	- 0.20	- 0.09	- 0.03	- 0.26	0.06	- 0.06
7	WU_1 north	- 0.17	- 0.46	- 0.21	0.71	0.19	- 0.10	- 0.35	0.68	- 0.46	- 0.37	- 0.34
8	IU_2	- 0.25	- 0.34	- 0.03	0.62	0.03	- 0.28	0.12	0.68	- 0.15	- 0.26	- 0.15
9	IM_2	- 0.39	- 0.3	- 0.48	0.12	- 0.42	- 0.62	- 0.38	- 0.07	- 0.31	- 0.39	- 0.11
10	IL_1	- 0.52	- 0.32	- 0.71	- 0.17	- 0.56	- 0.44	- 0.43	- 0.12	- 0.32	- 0.36	0.60
11	I_1	0.16	- 0.06	0.10	- 0.20	- 0.56	0.22	- 0.55	- 0.07	0.37	- 0.54	0.56
	District	0	0	0	0	0	0	0	0	0	0	0

Table IV-4

CORRELATION COEFFICIENTS BETWEEN DEVELOPMENT INDICATORS AND INCOME PER CAPITA, RATNAPURA DISTRICT 1977

INDICATORS	1 NON-AGRICULTURAL EMPLOYMENT	2 EMPLOYMENT AS GEM MINERS	3 AREA CULTIVATED	4 LABOUR INTENSITY	5 AREA UNDER TEA/RUBBER	6 SURPLUS UNDER PADDY PRODUCTION	7 FAMILY SIZE	8 AVAILABILITY PRIMARY SCHOOLS	9 AVAILABILITY ELECTRICITY	10 FAMILIES WITH LAND OF <.5 ACRES	INCOME PER CAPITA
1	0	.61	.57	- .14	.53	.84	-.29	- .01	.08	.21	.08
2		0	.54	- .27	.26	.62	.41	- .44	.73	.53	.24
3			0	.31	.71	.64	.73	.14	.46	.77	- .40
4				0	.42	- .05	.52	.72	.01	.22	- .57
5					0	.38	.77	.46	.04	.68	- .55
6						0	.35	.00	- .74	= .30	.20
7							0	.21	.29	.82	- .38
8								0	- .31	- .12	- .54
9									0	.16	.37
10										0	- .31
Income per capita											0

Table IV - 5

Citation from Hellweg (1974: 15-16) describing his taxonomic method for clustering variables

5. VARIABLES CLUSTERING BY MEANS OF THE TAXONOMIC METHOD

To make the method more easily understandable we shall in the course of its presentation illustrate it with numerical examples.

(i) The algorithm starts with a correlation matrix R (n x n) where n stands for the number of variables ~~(see Table 1)~~. SEE HERE TABLE IV-4

(ii) In the second step the following transformation is effected $d_{ij} = 1 - | r_{ij} |$
by means of which the matrix R is mapped into a new matrix D ~~(see Table 2)~~. This matrix is also of (n x n) type, symetrical and with elements d_{ij}
where $i, j = 1, 2, \ldots$ and $d_{ij} \geqslant 0$) SEE TABLE IV-7

(iii) Now the smallest element has to be found in each row of the matrix D. If we denote these elements by d_i then $d_i = \min_j d_{ij}$

(iv) After having found d_i in the i^{th} row, one finds the number of the column which forms with the given row a cross-cell containing the value d_i. In this way one gets n pairs of indices:
$(1, j_1), (2, j_2), \ldots\ldots (n, j_n)$
Let us now define a few terms. The terminology will be very simple. Each of our pairs of indices will be called a *link* whereas i and j_i in (i, j_i) are *nodes*. The first node is the *beginning* of the link which ends with the second node. The links may therefore be called oriented links. When we draw a graph all nodes will be represented by points and all links by arrows. The number of arrows pointing at a given node will be called the *power* of that node

(v) The node with the highest power is next found. If there are more than one with the highest power the choice will fall on the one to which corresponds the smallest value of
$$d_i = \frac{1}{n} \sum_{j=1}^{n} d_{ij}$$

(vi) Now all nodes which are beginnings of links pointing towards the node of the highest power are to be linked with this node. All nodes attached to the node of the highest power can be now looked upon as the ends of some other nodes which are in to be linked with all these ends. By continuing this process of joining together all the nodes related to the node of the highest power, one obtains a certain family of nodes which can be referred to as the "first concentration" of nodes, or as the first *cluster* of points.

(vii) Next, one finds all the clusters which correspond to the nodes with powers below the highest one, in a decreasing order of magnitude.

(viii) The node with the highest power in a cluster is termed the centre of the cluster. If in a cluster nodes of the highest order number more than one, we select the one to which corresponds the highest value of d_j. The centre of a cluster can be looked upon as the representative of variables belonging to this cluster. The set of representatives of all clusters will be referred to as a *set of core variables*.

(ix) The range of variation of the parameters d_i should now be divided into three parts:

$$d_i \quad d_i - s_d, \quad d - s_d \leq d_i \leq d + s_d, \quad d_i > d + s_d$$

where $d = \frac{1}{n} \sum_{i=1}^{n} d_i$; $s_d = \left[\frac{1}{n} \sum_{i=1}^{n} (d_i - d)^2 \right]^{\frac{1}{2}}$

All nodes which are beginnings of some links the length d_j of which belongs to the first interval can be removed from the graph and the corresponding variables may be called *redundant*. Nodes which are beginnings of some other links the length d_i of which falls in the third interval can also be elimmated and the respective variables may be referred to as *irrelevant*. All remaining variables would form the "compact" set. All the steps which lead to the obtention of particular clusters, the core variables as well as the "compact" set of variables are summarized and illustrated in the diagrams which follow.

The procedure which has been described is simple and liable to easy interpretation. It is equally applicable to variables which are continuous, discrete or categorial. If however one is put off by, or is suspicious of, its great simplicity, there are more sophisticated methods available, like for example, the principal components method, which will provide good solutions to the problem as it has been posed above, but at much greater cost.

Table IV-6

"d" COEFFICIENTS FOR SELECTION OF INDICATORS BY THE METHOD OF HELLWIG, RATNAPURA 1977

INDICATORS	1 NON-AGRICULTURAL EMPLOYMENT	2 EMPLOYMENT AS GEM MINERS	3 AREA CULTIVATED	4 LABOUR INTENSITY	5 AREA UNDER TEA/RUBBER	6 SURPLUS UNDER PADDY PRODUCTION	7 FAMILY SIZE	8 AVAILABILITY PRIMARY SCHOOLS	9 AVAILABILITY ELECTRICITY	10 FAMILIES WITH LAND 0 < < 5 ACRES	Average of dij in each row
1	0	.39	.43	.86	.67	.16	.71	.99	(.12)	.79	.51
2		0	.46	.73	.74	.38	.59	.56	(.27)	.47	.46
3			0	.69	.29	.36	.27	.86	.54	.23	.41
4				0	.58	.95	.48	(.28)	.99	.78	.64
5					0	.62	(.23)	.54	.96	.50	.50
6	(.16)					0	.65	1.00	.26	.70	.51
7					.23		0	.79	.71	(.18)	.47
8				(.28)				0	.59	.88	.66
9	(.12)								)	.84	.54
10							(.18)			0	.51

inclusion of indicator 10:	exclusion of indicator 10:
$\bar{d} = i/n \sum d_i = .20$; d_i = min dij in each row (in brackets)	$\bar{d} = i/n \sum d_i = .22$; d_i = min dij in eacl row (underlined)
$S_d = .6$: d_i .14 (redundant) ; $.14 < d_i < .26$ (compact; $d > .6$ (irrelevant)	$S_d = .6$: $d_i < .16$ (redundant) $.16 < d_i < .28$ (compact) ; $d_i > 28$ (irrelevant)

Table IV-7

Classification of indicators of development into clusters indicators

Clusters	Redundant Indicators	Compact set of indicators	irrelevant indicators
A		7,10,5,3	
B	9	1,6	2
C		4	8

Of the compact sets of indicators the first is the so called core variables which is representive for the set.

The result of this analysis is that the regions could best be described with the help of the indicators 7,10,5,3,1,6 and 4. If the tenth indicator (percentage of families owning no land or less than half an acre) is excluded from the analysis for the reasons given earlier the best indicators whould be 7,5,3,1,6,4 and 8.

One way to obtain a ranking of the Agro-ecological Regions is to sum the standarized scores on the individual indicators. This involves a weighting of indicators. Simply summing would mean that each indicator has equal weight. Whether this is resonable or not will not be discussed here suffices to say that each form of weighing involves subjective judgements on the importance of an indicator. The reader is refered to the literature mentioned in section 3.2.2. The results of the scores for the two sets of indicators are given in table IV-8.

Table IV-8

Added-up Scores and Rankings of Agro-ecological Regions

	Scores Indicators (1,3,4,5,6,7,10)	Rank	Scores Indicators (1,3,4,5,6,7,8)	Rank
WL_1	1.03	2	0.89	2.5
WL_2	1.51	1	1.29	1
WM_1 South	- 0.50	6	-0.31	5
WU_1 South	- 1.65	9	-1.41	9
WM_3	- 0.02	3	-0.26	4
WM_1 North	- 0.42	5	-0.51	6
WU_1 North	- 0.70	7	-0.65	7
IU_2	- 0.05	4	-0.89	2.5
IM_2	- 2.56	10	-2.24	10
IL_1	- 3.19	11	-2.95	11
DL_1	- 1.57	8	-1.10	8

As can be observed from table IV-8 the ranking of agro-ecological regions is quite similar for each of the set of indicators. This is also true whether one uses all the indicators or only the three core indicators 7,1, and 4.

With some imagination and simplification one could say that, in general the Wet Zone Low Country Regions (WL_1 and WL_2) are doing more than average with regard to these indicators and that the Wet Zone Mid and Up country Regions (WM_1 south, WU_1 south, WM_3 , WM_1 north, and WU_1 north) and the Intermediate Zone Up Country Region (IU_2) are doing average while the Intermediate Zone Mid and Low Country Regions (IM_2 and IL_1) and the Dry Zone Low Country Region (DL_1) are doing less than average.

It might be worthwhile to research with more sophisticated methods to ascertain whether the above simplified grouping really emerges. This of course goes beyond the scope of this annex. It is important, however, to stress again that the obtained ranking does not correlate at all with the ranking on the basis of income per capita as can be observed from Table 4.1 and table IV-8, and from the low or negative correlation coefficients given in table IV-4. More future research in regard to the causes why this discrepancy occurs is certainly warranted.