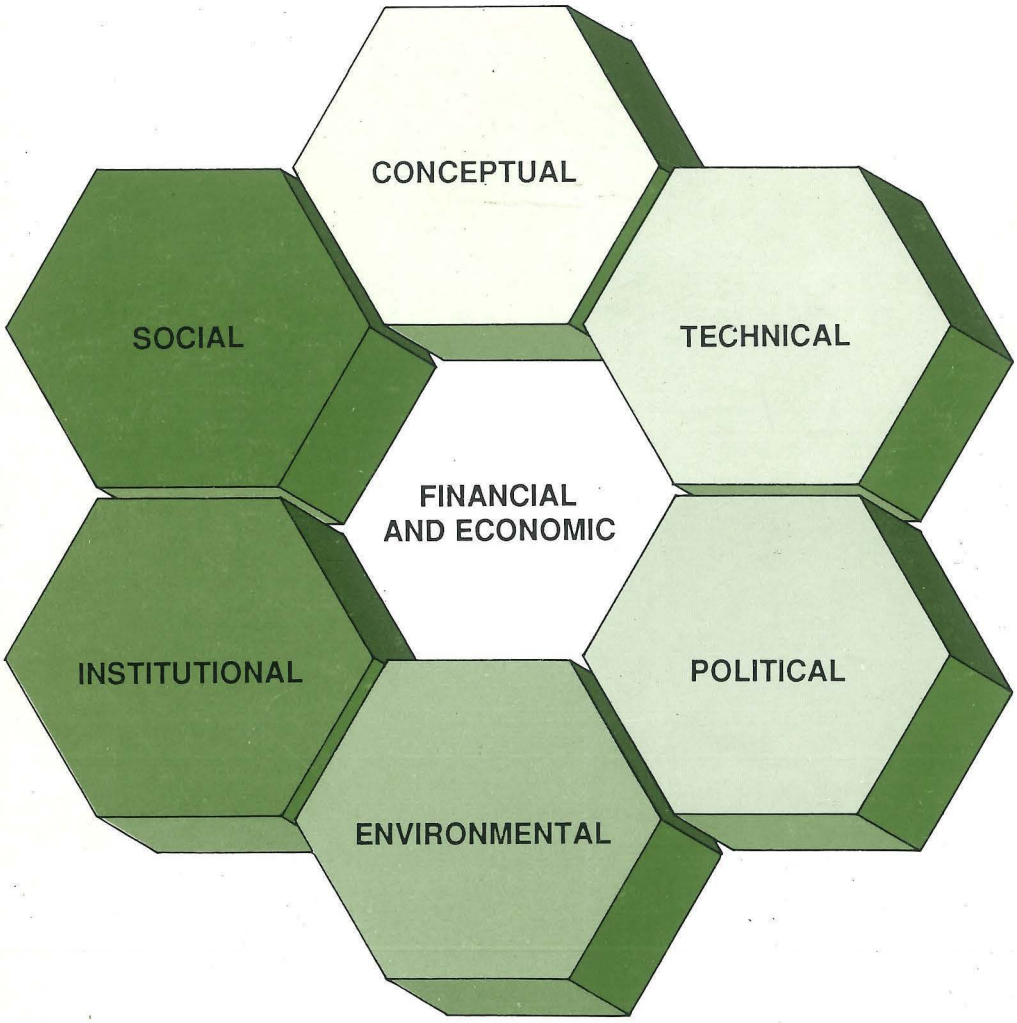
The design of agricultural investment projects

Lessons from experience



FAO
INVESTMENT
CENTRE
TECHNICAL
PAPER

6

FOOD
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ORGANIZATION
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Rome, 1989

THE FAO INVESTMENT CENTRE

The Investment Centre is part of FAO's Development Department. It supports member countries' programmes for agricultural sector investment, mainly through providing technical assistance in the formulation of investment projects in agriculture, including forestry, fisheries and agro-industries. Through the Investment Centre, FAO has cooperative agreements with all the major multilateral financing institutions lending for agriculture, including the World Bank, IFAD, the Regional Development Banks and the UN Capital Development Fund. Costs of the services provided by the Centre are met jointly by FAO and the cooperating financing institutions.

The Centre has a multidisciplinary staff of 110 professionals, and is fully supported by FAO's technical divisions and field staff. On average, the Investment Centre works on more than 100 investment projects, involving almost 300 missions, per year. During each of the last ten years some 40 investment projects, identified or prepared with the Centre's help, have been approved for financing. Total investments committed for these projects have amounted to about US$2, 000 million annually, of which about 60 percent is in loans from financing institutions, the balance being provided by the recipient countries.

Further information on the Investment Centre and its activities can be obtained either from the Director, Investment Centre, FAO, Terme di Caracalla, 00100 Rome, Italy, or from FAO representatives in member countries.

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THE DESIGN OF AGRICULTURAL INVESTMENT PROJECTS

LESSONS FROM EXPERIENCE

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LIST OF ABBREVIATIONS

AOP	Annual Operating Plan
AsDB	Asian Development Bank
FAO	Food and Agriculture Organisation of the United Nations
ERR	Economic Rate of Return
IBRD	International Bank for Reconstruction and Development (WB)
IC	Investment Centre (FAO)
IDA	International Development Association
IFAD	International Fund for Agricultural Development
ODR	On-Farm Development Rate
PAR	Project Adoption Rate
PCR	Project Completion Report
PERT	Programme Evaluation and Review Technique
PPAR	Project Performance Audit Report
UNCDF	United Nations Capital Development Fund
UNDP	United Nations Development Programme
T/A	Technical Assistance
TCP	Technical Cooperation Programme (FAO)
WB	World Bank

Preface

This study reviews the performance of some 70 projects prepared by the FAO Investment Centre in the 1970s and mostly implemented in the 80s. It identifies the nature and severity of problems encountered by the projects during their implementation and examines the extent to which these could be attributable to faults at the design stage or are caused by exogenous factors. Proposals are made for changes in techniques and approaches to project preparation which could contribute to improved performance.

The study was prepared largely for internal use by Investment Centre staff 1/. This was circulated in draft to the financing institutions with which the Investment Centre collaborates and to various universities and other institutions which provide training in investment project preparation work. Several reviewers have urged that the study should be put into wider circulation, and hence it is being published in the Investment Centre's series of Technical Papers. Revisions have been introduced to respond to the many useful comments made on the draft.

The Investment Centre would like to acknowledge the assistance provided by the financing institutions, particularly the World Bank (WB), the International Fund for Agricultural Development (IFAD) and the Asian Development Bank (AsDB), in making available much of the written material on project performance, on which the first part of the study is based.

1/ Case studies and subsectoral reviews were carried out by K.A. de Alwis, B. Awan, J-M. Bisson, D. Clément, M. Creek, J.B. Downs, S. Eastwood, M.A. Hameed, I. Hill, A. Mutsaers, G. Panayoti, R.G. Paterson, G. Pennisi, J. Rincon, M. Sugimura, J. Williams, B. Winkler. The study was coordinated by A.A. MacMillan who drafted the report.

THE DESIGN OF AGRICULTURAL INVESTMENT PROJECTS

LESSONS FROM EXPERIENCE

I. INTRODUCTION

Since it started operations in 1964, the FAO Investment Centre (IC) has assisted member countries in preparing some 800 agricultural development projects involving total investments of about US$38 billion. Loans from external financing institutions, totalling almost US$19 billion, have provided a substantial part of the required financing.

The ultimate measure of success is not the scale of resources mobilised for agricultural and rural development, but the lasting impact made by the investments on production, consumption and standards of living. Since the staff of the Investment Centre are engaged primarily in project design work, they have few opportunities to see projects in action and hence to assess the extent to which the objectives which they have set for projects at the time of their preparation are, in fact, being achieved. Most of the financing agencies with which the Investment Centre cooperates, however, either prepare or require borrowing countries to prepare post-evaluation reports on each project financed, in which progress is assessed against the goals set at appraisal. As these reports are usually written at the end of the disbursement period, when the project is just entering its production phase, they shed more light on implementation success than project achievements, but are nevertheless useful as indicators of performance. Such evaluations have been completed for about 210 of the 340 projects prepared with IC assistance between 1970 and 1980.

It is on the basis of such reports that each year the World Bank - the largest source of financing for projects prepared with IC assistance - publishes an "Annual Review of Project Performance Results". These Reviews assess the success of projects, by sub-sector and region, and try to detect the underlying causes of any problems which have affected project performance. The 1985 Review noted a progressive decline in the "success rate" 1/ of agricultural projects from 83% for those reviewed in 1980 to 67% for those assessed in 1985, the levels of success being particularly low in Africa (48%) 2/. The situation has not improved significantly since then.

1/ A project is regarded as unsuccessful at evaluation if it "achieves few objectives and has no foreseeable worthwhile results, or its outcome is uncertain" at that time.

2/ Annual Review of Project Performance Results 1985, Operations Evaluation Department, The World Bank.

It has not been the purpose of this study to make a methodical assessment of the incidence of success and failure for all IC-prepared projects (for many of which no post-evaluation reports have yet been issued), but it seems probable that the pattern is similar to that of the World Bank's overall agricultural loan portfolio. The steady increase in the frequency of agricultural project failure documented by the Bank must, therefore, be a cause for serious concern for Investment Centre staff, as well as for other people engaged in the preparation and appraisal of agricultural development projects.

Of still greater significance to the Investment Centre, however, is the fact that problems attributed to poor project design or appraisal have, since 1981, represented the highest proportion of all issues raised in the project post-evaluation reports. "Design problems" now represent by far the most important single reason for the unsatisfactory performance of WB-financed agricultural projects. If we are to avoid repeating past errors, it is important to understand the nature of such design problems and to explore means of minimising their incidence in the future.

This study, therefore, aims to identify problems which have occurred in the implementation of a sub-set of IC-prepared development projects, to assess the extent to which they may reasonably be attributed to errors at the time of their preparation, to seek to establish the underlying causes, and to examine some alternative approaches to project preparation and analysis which could contribute to a higher success rate.

The study was conducted by staff on "down-time" between operational assignments and covered 75 projects prepared between 1970 and 1980 for which post-evaluation studies exist (Appendix 1) 1/. The projects were deliberately selected to cover most sub-sectors in which the Investment Centre had been involved and to include, where possible, representative cases from all regions. This resulted in the inclusion of most projects which had been prepared in minor sub-sectors (eg. forestry) but only a smaller proportion of those in major sub-sectors (eg. irrigation, rural development).

Total investment costs of the projects at time of appraisal were estimated at about US$ 2.25 billion. Most of the projects were prepared for IDA and IBRD financing, but several projects financed by IFAD and AsDB have also been included in the sample. Project preparation and appraisal reports as well as mid-term reviews, project completion reports (PCRs) and project performance audit reports (PPARs) served as the principal sources of written information on project expectations and achievements.

1/ Included amongst these were five projects not prepared by the Investment Centre but which were either very closely associated with IC projects (eg. forming the second phase of an IC-prepared project) or reviewed jointly with IC-prepared projects in the same project completion report.

Although post-evaluation reports frequently attribute problems to "project design", few have made any detailed assessment of what actually went wrong at the time of project preparation and appraisal. Indeed the distinction between recommendations at preparation and decisions at time of appraisal tends to be blurred in these retrospective reviews. Hence, in practice, "design problems" have to be related to the project as appraised rather than as prepared since there is no way of assessing the possible impact of any changes introduced between preparation and appraisal. To compensate for these and other deficiencies in the post-evaluation documentation and to delve deeper into the difficulties confronted by projects and the extent to which these could be attributed to faults at the time of their preparation, group discussions were held on the basis of summary papers prepared for each of the main sub-sectors. These discussions and the sub-sectoral notes on which they were based provided much of the material from which the observations made in this paper are derived.

The study has, of course, its limitations. First, its focus on the problems into which projects have run does little justice to the apparent success attained by the substantial majority of the projects prepared with IC assistance. Secondly, the size of the sample has been constrained by the limited manpower available for the work and the sample itself cannot be claimed to be truly representative. Moreover, since the study is necessarily based on the evaluation of projects which have been fully implemented, the sample may be considered to be out of date: it is to be hoped that, since the last projects to be included were prepared in the late 70s, some improvements in approaches to project design have already been adopted!

We have also been confronted with the difficulty of distinguishing between problems which can be attributed to wrong design only with the benefit of hindsight as against those which could reasonably have been overcome or avoided in practice at the time of project identification or preparation. In addition, the study is constrained by the nature and quality of the post-evaluation material on which it is largely based. The judgments on project success given in PCRs, which are prepared as soon as the investment phase has been completed, are necessarily derived from forecasts of benefits rather than from recorded achievements. For the same reason they can only speculate on sustainability. They have the further disadvantage as source material of being variable in quality and often insufficiently analytical.

Finally, the assessment of problems into which projects have run, and their grouping into categories, is complicated by the fact that, in real life, few such problems are of a self-contained nature but are inextricably intertwined, making it difficult to distinguish between cause and effect. Thus delays in implementation which contribute to cost over-runs may stem from management problems which in turn may have their origin in lack of government commitment, but alternatively government commitment may waver because of unforeseen technical difficulties emerging in the course of implementation! It

is equally difficult to distinguish between factors affecting performance which are project-specific and those which could be considered as being of a broader sectoral nature.

In trying to cope with these complexities, the authors have accepted certain over-simplifications, in the belief that this is to be preferred to blurring the issues by a maze of qualifications and reservations.

II. PROJECT PERFORMANCE

The review has covered a total of 75 projects, divided between regions and project types, as shown in Table 1.

For those projects for which we have relevant data:

- 49% had cost over-runs of over 10% above the appraisal estimate: conversely 19% incurred costs of less than 90% of those estimated;

- 68% had time over-runs of more than one year, and for 38% of the projects, the over-run exceeded two years;

- The re-estimated economic rates of return (ERR) of 25% of the projects equalled or exceeded forecast ERRs and 33% achieved recalculated ERRs of below 10%: for 16% of the projects, the apparent ERR was less than 5%;

- Major design changes (eg. change in project area, components, engineering etc.) were introduced into 13% of the projects at time of appraisal and 34% during implementation.

At first sight, these statistics suggest that the performance of IC-prepared projects has been rather poor. Very few projects actually succeeded in achieving their original goals within the allotted time. Out of the 52 projects for which economic rates of return have been recalculated, there are only four which, without major adjustments during implementation, could be considered as "on target" in the sense that costs lay within 10% of the appraisal estimate, disbursements were completed with a time over-run of no more than six months and they were on course to achieve an ERR of over 10%.

But this is perhaps too negative an interpretation of results. The figures also support the contention that only 16% of the projects for which data exist attained re-estimated economic rates of return of less than 5%, which may be a reasonable estimate of the long-term opportunity cost of capital 1/. Moreover, fewer than 20% of the projects ran into cost over-runs of over 25%, and much of this was the result of unpredictably high rates of inflation during the period. We could thus reasonably claim that the record is astonishingly good, given the circumstances under which these projects were prepared and implemented - the unprecedented rise in rates of inflation and other side-effects of two oil crises; the extent to which we were experimenting with entirely new types of projects, and the combination of a steep increase in resource transfer targets and resultant constraints in absorptive capacity.

1/ The argument that the opportunity cost of capital in real terms is probably well below the conventionally accepted 10-12% p.a. is developed in Güsten, R. The Opportunity Cost of Capital and Related Matters (unpublished mimeo), September 10, 1986.

PROJECTS REVIEWED BY REGION AND TYPE OF PROJECT

REGION	TYPE OF PROJECT						
	RURAL DEVELOPMENT	IRRIGATION	AGRICULTURAL SERVICES	LIVESTOCK	FORESTRY	FISHERIES	TOTAL
	Number of Projects						
ASIA AND PACIFIC	7	4	9	-	6	1	27
EUROPE AND MIDDLE EAST	2	6	1	2	-	2	13
AFRICA	3	5	-	7	4	-	19
LATIN AMERICA AND THE CARIBBEAN	1	1	3	11	-	-	16
T O T A L	13	16	13	20	10	3	75

Table 1

The fact that two thirds of the projects for which an ERR has been re-calculated attained returns of 10% or more is interesting in that it corresponds closely to the 1985 World Bank Review's finding that about 70% of the agricultural projects reviewed between 1980 and 1985 were "successful". Although it would be wrong to claim that the sub-set examined is wholly representative of IC-prepared projects, this suggests that there is no major discrepancy between their success rate and that of the World Bank's overall agricultural project portfolio.

Because of the small size of the sample, comparisons between regions and sub-sectors may not be very meaningful. The project performance data summarised in Table 2, however, suggest that:

- Fisheries, irrigation and rural development projects have been especially prone to cost over-runs;

- Implementation delays have been associated particularly with rural development, livestock and irrigation projects;

- A high proportion of both livestock and rural development projects failed to achieve a 10% ERR;

- In contrast, almost 50% of the irrigation projects achieved re-estimated rates of return which were equal to or higher than those estimated at appraisal;

- Irrigation projects, however, have been more subject to significant changes in design during implementation than other types of project.

These are rather crude measures of performance that give little indication of the extent to which projects have been able to achieve their ultimate goals. They say nothing of the impact of the projects, for instance, on the earnings of the beneficiary population, on government revenues or on the balance of payments. Nor do they give any indication as to the long-term effects of the projects on income distribution, health, nutrition or education, even though these were explicit goals of many of the rural development projects. Moreover, they provide no information on the effects of projects on the environment nor of their sustainability.

The distinction between "performance" and "achievement" is important in that a project may perform well in the sense of meeting its targets during the disbursement period but still not achieve its ultimate objectives - and, occasionally, vice versa. The material on which the study is necessarily based, however, does not permit a systematic assessment of achievements and hence the focus of the analysis is on the assessment of performance and on the extent to which performance problems may be attributable to design errors. The study provides sufficient evidence of the fact that projects have generally performed less well than projected at the time of their preparation and appraisal to indicate that the reasons for this warrant serious examination.

Table 2

PROJECT PERFORMANCE INDICATORS

SUB-SECTOR	NO. OF PROJECTS	ACTUAL COSTS		TIME OVER-RUN			ACTUAL ERR		MAJOR ADJUSTMENTS	
		< 90% OF APPRAISAL	> 110% OF APPRAISAL	6 MTHS OR OVER	12 MTHS OR OVER	24 MTHS OR OVER	EQUAL OR BETTER THAN APPRAISAL	LESS THAN 10%	A 1/	I 1/
		% OF PROJECTS								
RURAL DEVELOPMENT	13	30	60	100	80	60	11	55	28	28
IRRIGATION	16	6	62	81	75	31	47	13	19	69
SERVICES	13	31	46	69	54	23	33	0	15	23
LIVESTOCK	20	15	30	90	80	47	13	53	-	25
FORESTRY	10	28	43	57	28	14	33	33	-	10
FISHERIES	3	0	100	66	66	66	0	33	33	66
T O T A L	75	19	49	81	68	38	25	33	13	34

Notes: (a) Percentages expressed as percent of those projects for which data exist on each indicator.

(b) Includes 5 projects which were not IC prepared but which have been covered by study because of their close association with other IC projects (eg. as repeaters of IC projects).

1/ A = between preparation and appraisal

I = during implementation

III. PROBLEMS IN PROJECT IMPLEMENTATION

Assessing Project Implementation Problems

An attempt has been made to identify both the nature of the problems encountered by the sample projects during their implementation and the severity of their incidence. This analysis has been confined to 70 of the projects, for which reasonable data exist. To make this classification, 22 problem types have been identified and grouped for the purposes of a preliminary assessment into seven major categories, as follows:

PROBLEM CATEGORY	PROBLEM TYPE
CONCEPTUAL	Too many or unbalanced components
	Too big
	Schedule too tight
	Non-sustainable
	Inflexible 1/
TECHNICAL	Production technology deficiency
	Poor engineering
FINANCIAL/ECONOMIC	Under-estimated costs
	Counterpart and recurrent budget shortage
	Low output prices or market problems
SOCIAL	Inequitable benefit distribution
	Slow adoption
INSTITUTIONAL	Bad management or staffing
	Unsuitable organisational structure
	Ineffective technical assistance
	Procurement difficulties
	Land acquisition difficulties
	Poor monitoring and evaluation
ENVIRONMENTAL	Natural disaster
	Resource degradation
POLITICAL	Turmoil or war
	Insufficient Government commitment

An "OTHER" category has also been used to capture minor problem types which do not fit easily into the above framework.

1/ Or, expressed differently, an absence of mechanisms intended to enable the project to respond to changing circumstances.

A subjective assessment has been made of the severity with which each project under review has been affected by each problem type and a score has been attributed as follows:

- Problem not evident 0
- Problem slight 1
- Problem significant 2
- Problem very serious 3

By aggregating the scores, it has been possible to arrive at what may be termed "problem severity ratings" for each project and sub-sectoral project group and at an assessment of the relative incidence of problem categories and types.

The methodology adopted for the analysis is fairly crude and has several flaws which must be acknowledged. First, because the analytical framework was not used in preparing the original source material (the PCRs, other evaluations and the in-house reviews of these), it is possible that some problems were overlooked or described differently and hence have not been picked up. Secondly, PCRs are prepared so soon after the completion of disbursements that they do not provide good evidence of project sustainability: they may also give disproportionate attention to certain problems (eg. the absence of effective monitoring systems) which may have impinged directly on the ease with which the PCR could be prepared but which may not have had such a significant effect in project implementation. Thirdly, problems affecting project implementation are not discrete and indeed often have a compounding effect: for example, a poorly staffed organisation can be expected to run into more procurement difficulties than one which is staffed with more experienced persons, and this in turn may lead to cost and time over-runs. Fourthly, a larger number of problem types are included in some problem categories than in others (for example five types of problems are regarded as conceptual, while the technical category covers only two types): this means that the way in which problem types are classified into categories for analytical purposes, which is necessarily subjective, tends to influence the ranking of main categories. Thus a slow rate of adoption has been classified as a social category of problem, but it could well represent a logical response by farmers to technical problems associated with the innovation, to a gloomy assessment of market prospects or to the poor performance of the support services, rather than an indication of traditional resistance to change within the farming community.

In spite of these reservations, it is believed that the resulting figures provide a reasonable and credible assessment of the nature and incidence of problems affecting projects in each of the main sub-sectors during implementation, and that the grouping of problem types into major categories may help the reader to recognize the main sources of difficulties into which the projects have run. The relatively close inverse correlation between the problem severity ratings of projects and their economic rates of return tends to confirm the validity of the assessment.

The incidence of problems according to sub-sector is presented in Table 3, and the relative importance of problem types and categories for the whole sample is shown in Figure 1. In Table 4 the problem types are listed in decreasing order of severity and an attempt is made to introduce a refined clarification which implicitly acknowledges that the underlying causes of problems faced by projects are more complex than the first categorisation tends to suggest.

Problem Severity and Incidence - An Overview

If the fisheries projects (for which the sample was very small) are excluded, the analysis suggests that livestock and rural development projects have encountered the most severe problems, and irrigation and services projects (i.e. extension, research and credit projects) the least. Forestry projects occupy the middle ground between these extremes, as is shown in Table 3.

The figures also indicate that for all types of projects except irrigation projects, the most serious problems are of an institutional nature and that the highest incidence of institutional problems lies with services projects. Somewhat surprisingly, institutional problems have emerged as being of more relative importance in forestry than rural development projects, where they are commonly held to be of greatest significance. The materials available provide frequent assessments of the effectiveness of the institutions responsible for project management but references to the performance of "grass-roots" institutions and their impact on project success are surprisingly few.

Conceptual problems, or what might be regarded as problems affecting the overall architecture of the project (eg. its size, complexity and scheduling), account for about one quarter of the problems encountered by all types of project, and represent the single most important category of problems affecting irrigation projects, mainly because of over-optimistic scheduling 1/.

What must be of particular concern to the Investment Centre is the relatively high incidence of problems of a technical nature. Technical problems, associated with engineering faults and with over-optimistic crop and livestock yield forecasts, represent the second most serious category of problems experienced by irrigation projects, and are very significant in both fisheries and rural development projects.

1/ It would have been interesting to examine the extent to which projects were well conceived in the sense that it could be claimed that their design was the most appropriate for meeting the objectives identified but, although this is one of the most critical aspects of project design, the materials available do not allow for such an analysis. The post-evaluation reports on which the study is heavily based examine whether a project has successfully met its goals, as defined at appraisal, but not whether the broad objectives could have been attained more successfully in a different manner.

PROBLEM INCIDENCE/SEVERITY RATINGS BY MAJOR PROBLEM CATEGORY AND SUB-SECTOR

PROBLEM CATEGORY	RURAL DEVELOPMENT	IRRIGATION	SERVICES	LIVESTOCK	FORESTRY	FISHERIES	ALL PROJECTS
	% OF PROBLEM SCORES						
CONCEPTUAL	23	26	22	24	23	26	23
TECHNICAL	17	22	11	12	13	24	16
FINANCIAL	12	20	13	18	12	20	16
SOCIAL	8	8	1	7	2	4	6
INSTITUTIONAL	31	19	50	27	37	26	31
ENVIRONMENTAL	4	2	1	4	0	0	2
POLITICAL	4	0	1	6	6	0	4
OTHER	1	3	1	2	5	0	2
T O T A L	100	100	100	100	100	100	100
PROBLEM RATING 1/	12.8	8.6	8.7	12.7	9.0	16.7	10.7

1/ Average problem incidence/severity score per project

Table 3

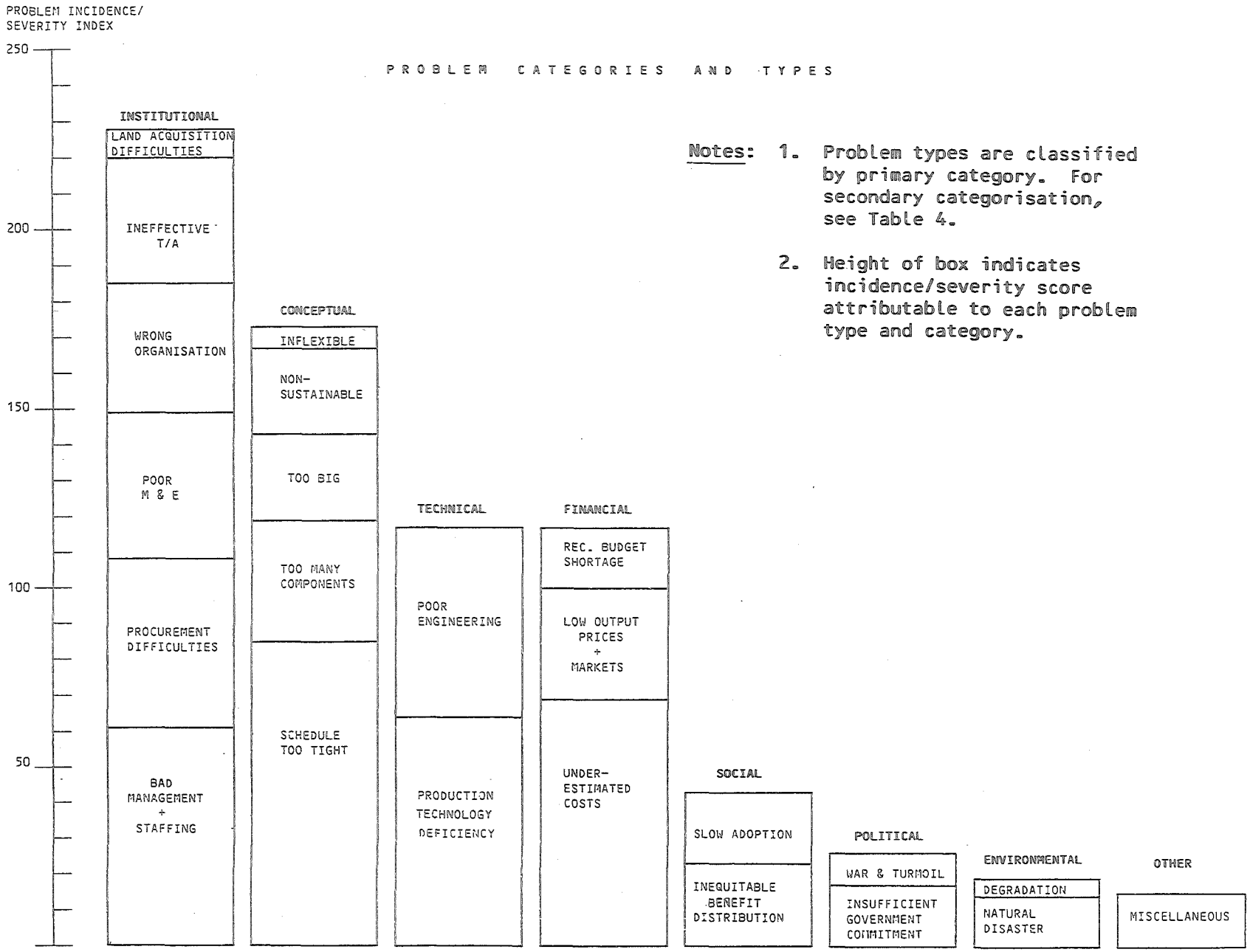
PROBLEM INCIDENCE/
SEVERITY INDEX
250
200
150
100
50
PROBLEM CATEGORIES AND TYPES
INSTITUTIONAL
LAND ACQUISITION DIFFICULTIES
INEFFECTIVE T/A
WRONG ORGANISATION
POOR M & E
PROCUREMENT DIFFICULTIES
BAD MANAGEMENT + STAFFING
CONCEPTUAL
INFLEXIBLE
NON-SUSTAINABLE
TOO BIG
TOO MANY COMPONENTS
SCHEDULE TOO TIGHT
TECHNICAL
POOR ENGINEERING
PRODUCTION TECHNOLOGY DEFICIENCY
FINANCIAL
REC. BUDGET SHORTAGE
LOW OUTPUT PRICES + MARKETS
UNDER-ESTIMATED COSTS
SOCIAL
SLOW ADOPTION
INEQUITABLE BENEFIT DISTRIBUTION
POLITICAL
WAR & TURMOIL
INSUFFICIENT GOVERNMENT COMMITMENT
ENVIRONMENTAL
DEGRADATION
NATURAL DISASTER
OTHER
MISCELLANEOUS
Notes: 1. Problem types are classified by primary category. For secondary categorisation, see Table 4.
2. Height of box indicates incidence/severity score attributable to each problem type and category.

Figure 1

Table 4

CLASSIFICATION OF PROBLEM TYPES INTO CATEGORIES

PROBLEM TYPE	PROBLEM CATEGORY						
	INSTITUTIONAL	CONCEPTUAL	TECHNICAL	FINANCIAL	SOCIAL	POLITICAL	ENVIRONMENTAL
SCHEDULE TOO TIGHT	□	■	*		//		
UNDER-ESTIMATED COSTS			□	■			
PRODUCTION TECHNOLOGY DEFICIENCY			■		□		
BAD MANAGEMENT/STAFFING	■					□	
POOR ENGINEERING			■				
PROCUREMENT DIFFICULTIES	■		□				
POOR MONITORING EVALUATION	■						
WRONG ORGANISATIONAL STRUCTURE	■	□					
INEFFECTIVE TECHNICAL ASSISTANCE	■					□	
TOO MANY COMPONENTS	□	■					
LOW OUTPUT PRICES/MARKET PROBLEMS				■			
TOO BIG	//	■		□			
NON-SUSTAINABLE	//	■	*	□	*	*	*
INEQUITABLE BENEFIT DISTRIBUTION		□	*		■	//	
SLOW ADOPTION	*		□	//	■		
INSUFFICIENT GOVERNMENT COMMITMENT		//		□		■	
RECURRENT BUDGET SHORTFALL	//	*		■		□	
NATURAL DISASTER			□				■
POLITICAL TURMOIL/WAR					□	■	
LAND ACQUISITION DIFFICULTIES	■		□			*	
INFLEXIBLE		■		□			
RESOURCE DEGRADATION		*	□		//		■

NOTES: 1. Problem types listed in decreasing order of severity
2. Classification into categories as follows:

■ = Primary category □ = Secondary category

// = Tertiary category, and * = also related

Given the unpredictability of the oil price rise in 1973 and its far-reaching repercussions, it is hardly surprising that many of the projects under review ran into financial problems. Part of the under-estimation of costs, however, appears also to be due to implementation being slower than planned during an inflationary period and to inaccurate quantity estimates.

Only two categories of social problems have been distinguished in the review, and neither has a very high incidence. Where there has been a significant reduction in the number of direct project beneficiaries below appraisal estimates, this has been recognised as a failure to meet distributional goals, and an unexpectedly slow rate of adoption of technologies being promoted by the project has also been treated as a social problem. The fact that the incidence of social problems is claimed to be low, however, is probably more a reflection of the cursory treatment of social issues both in project preparation and appraisal and in writing PCRs than of reality.

Surprisingly few projects have run into significant difficulties due to environmental problems, mainly droughts, and to political turmoil and war. This may be due, however, to the fact that until the mid 80s the evaluators were not conditioned to look out for environmental effects. The frequency with which the source material permits a claim that project performance has been negatively influenced for lack of government commitment is also lower than casual observation would suggest.

Problem Types and their Origins in Project Design

The problem categories examined briefly in the previous section are too broad and ambiguous to be of much use in the search for improved approaches to project design. This section therefore examines each of the 22 constituent "problem types" in more depth and assesses the extent to which they may be considered attributable to the design phase of projects. The problem types are listed in Table 5, ranked in descending order of incidence/severity (the sequence followed in the review). Table 5 also provides a subjective indication of the extent to which implementation problems may be attributable to design errors, suggesting that, though some are due to broader sectoral circumstances or to essentially exogenous factors, the origin of most of the difficulties into which projects have run lies partly in project preparation and appraisal.

- Schedule Too Tight

Almost three quarters of the projects examined have run into problems associated with unduly tight scheduling, as is borne out by the fact that 81% had time over-runs of more than six months and almost 40% ran into delays in completion of over two years. The average time over-run was about 20 months. While a short time over-run may not significantly affect the outcome of a project, long lags in implementation tend to contribute to cost escalation and to delays in the flow of benefits, thereby undermining project viability.

Table 5

INCIDENCE AND SEVERITY OF IMPLEMENTATION PROBLEMS AND EXTENT TO WHICH THEY MAY BE ATTRIBUTED TO DESIGN ERRORS

ORDER OF SEVERITY	PROBLEM TYPE	EXTENT ATTRIBUTABLE TO DESIGN		
		LARGE	MEDIUM	SLIGHT
1	SCHEDULE TOO TIGHT	*		
2	UNDER-ESTIMATED COSTS		*	
3	PRODUCTION. TECHNOLOGY DEFICIENCY	*		
4	BAD MANAGEMENT AND STAFFING			*
5	POOR ENGINEERING	*		
6	PROCUREMENT DIFFICULTIES		*	
7	POOR MONITORING AND EVALUATION		*	
8	WRONG ORGANISATIONAL STRUCTURE	*		
9	INEFFECTIVE TECHNICAL ASSISTANCE		*	
10	TOO MANY COMPONENTS	*		
11	LOW OUTPUT PRICES/MARKET PROBLEMS		*	
12	TOO BIG	*		
13	NON-SUSTAINABLE		*	
14	INEQUITABLE BENEFIT DISTRIBUTION		*	
15	SLOW ADOPTION	*		
16	INSUFFICIENT GOVERNMENT COMMITMENT		*	
17	RECURRENT BUDGET SHORTAGE		*	
18	NATURAL DISASTER			*
19	POLITICAL TURMOIL/WAR			*
20	LAND ACQUISITION DIFFICULTIES		*	
21	INFLEXIBLE	*		
22	RESOURCE DEGRADATION		*	

The review of project experience suggests that most of the time over-run problems stem from consistently excessive optimism during project preparation and appraisal over the time which is required to start a project up. Frequently a high level of disbursements is scheduled for the first year of a project, whereas, in practice, except in the cases of second phase projects or of projects in which retroactive financing is permitted, very little can generally be spent in this period. A more rigorous appraisal of the steps to be taken to activate a project and to commence procurement would frequently demonstrate that at least 12 months are required before any significant capital expenditure can be made (see Annex 1)1/. This is particularly so if staff have to be recruited, engineering designs completed, and sites acquired for civil works, or if enabling legislation is required for the establishment of any new institutions. Even the development and running in of the new operational procedures usually associated with a project, however, is bound to take some time.

It is sometimes argued that it is necessary to set ambitious targets since, even if it is known that they cannot be achieved, to do less would result in still lower rates of project implementation. While there may be some merit in applying such proportional achievement assumptions, this cannot be used as a justification for setting goals which are simply unattainable or which, on the basis of historical experience, are most unlikely to be achieved: to do that is merely misleading and results in the eventual disillusionment and frustration which is usually associated with the non-achievement of targets.

Not all scheduling delays are, of course, attributable to the design stage. Some have their origins in external circumstances (such as political problems), while others are due to management deficiencies or to delays in effectiveness stemming from the inability of borrowers to comply with the conditions attached to loans.

- Under-estimated Costs

Some 56% of the projects examined suffered from an under-estimation of project costs, which has resulted either in components having to be cut or in a demand for additional financing which has had to be met mainly from government funds. Even if the benefits have remained consistent with the original estimates, the rates of return have, by definition, fallen short of expectations.

1/ The World Bank has approached this problem by making a historical review of disbursement profiles by country and sub-sector and requiring that future projects conform to such profiles. While such profiles are useful guides to be taken into account in scheduling, their application may lead to unduly long disbursement periods and may also distract attention from the definition of measures aimed at overcoming past scheduling problems.

As indicated above, many of the cost over-runs were due to inflationary pressures which followed the 1973 oil price rise and which could not reasonably have been anticipated. The effects of inflation on total costs were, of course, accentuated by implementation delays but, somewhat surprisingly, there is no apparent correlation between time and cost over-runs. Frequently cost over-runs were due to an under-estimation of quantities at the time of preparation and appraisal and appear to be closely associated with poor standards of engineering studies.

- Production Technology Deficiency

One of the most worrying findings of the study is the high frequency with which projects were considered at the time of post-evaluation to be failing to achieve their forecast production goals. In 54% of the projects, the revised output estimates fell short of the original targets. Livestock, fisheries and rural development projects in rainfed areas exhibited the highest frequency of production shortfalls, while, in contrast, the output of irrigation projects generally corresponded with, or even exceeded, targets.

Outside irrigated areas projections of yields and, to a lesser extent, adoption rates (see page 27) appear to have been characterised by a pervasive optimism. One can only speculate as to the underlying reasons. Perhaps a principal contributing factor is that the technical staff responsible for projecting farmers' performance seldom have access to the findings of detailed farm management survey data but have to arrive at judgements on likely farmer performance on the basis of short, superficial, unstructured and often highly selective visits to project areas. There may also be a tendency to "think in averages" and to under-estimate inter-annual yield variations, due to weather and pests (see Annex 2); to give insufficient heed to farmers' risk-aversion reflexes, and generally to have more regard for the performance of the better rather than poorer farmers. Over-estimation of future yields could also have its origins in what appears to be a widely held perception amongst technical staff working on project preparation that they have not done their job properly unless they forecast the adoption of some yield increasing technology, even though in some locations, an expansion in crop area or in livestock numbers or an increase in yield stability could be of equal or more significance. Although the study provides no evidence to support this, some observers would argue that, in certain cases, incremental output forecasts have been raised to unrealistic levels simply to generate an "acceptable" economic rate of return.

The difficulty of projecting yields is clearly greatest when the technologies on which a project is based have not been tested on a significant scale in the project environment. Substantial yield shortfalls, for example, arose in the Indonesia Seeds Project where highly mechanised rice production methods (not yet used in the country) were to be applied on difficult soils, and in several East African livestock projects which were based on the application of commercial ranching technologies which had not been proven successful

in the socio-economic environment within which they were to be developed. Several of the South American livestock projects failed to meet their production targets because their design assumed that animal nutrition could be improved through the use of low-cost legume enriched pastures, which proved to be poorly adapted to the generally low standards of farm management, characterised by absentee ownership, prevailing in both temperate and tropical areas. Production shortfalls were also common in the West African rice projects where, because of competition for labour with upland crops, only one rice crop per year was cultivated instead of the two successive crops generally foreseen at project preparation and appraisal.

In six of the irrigation projects studied, cropping patterns turned out to be significantly different from those predicted at preparation and appraisal. In three of these (all in the Mediterranean region) however, farmers adopted farming systems which included more high value crops and intensive livestock activities than foreseen, largely in response to market forces which had not been given due recognition at preparation. In contrast, in an irrigation project in Ecuador, the feasibility of the project depended on the willingness of farmers to uproot perennial crops and replace these with irrigated arable crops, and it is hardly surprising in retrospect that this failed.

It is more understandable that the marine fisheries projects all suffered from shortfalls in production, because of the very limited data available at the time of design on the fish resource situation and the difficulty of interpreting such survey information in terms of economic catch potential. What must be of more concern is that, though most forestry projects were on course to meet their production targets, the economic viability of three (in Madagascar, Kenya and Malaysia) was jeopardised by growth rates falling significantly below those projected at preparation/appraisal. If the viability of a project depends on the performance of a single commodity, it is clearly particularly important to arrive at reliable yield projections.

It must be evident from the above examples that, even though production shortfalls have been classified as problems of a technical nature, projections of production involve a combination of judgements on not only technical but also social and behavioural issues. It is, therefore, misleading to blame inaccuracies entirely on the technicians!

- Bad Management and Staffing

Poor standards of management represent the largest single source of institutional problems faced by projects, affecting over 70% of the projects examined, but the connection between management standards and project design is at best tenuous. Nevertheless, it could be claimed that a number of projects were designed in such a way that their implementation placed excessive demands on management skills which were known to be in short supply in the country.

Rural development, services and livestock projects appear to have been particularly prone to problems of poor management. The management tasks are probably no greater or more complex than those involved in implementing irrigation projects (which were confronted with fewer management problems, possibly because many were executed either by independent authorities offering relatively good conditions of service or by contractors), but they are perhaps more diffuse and less predictable, requiring a greater capacity to arrive at operational decisions. The services projects are also almost wholly dependent for their success on the performance of the extension, research or credit staff, often dispersed over large areas with poor communications, and hence project performance is particularly susceptible to any lapse in management standards.

Special terms and conditions of service were often provided for staff serving on projects, allowing them to attract the most qualified managers available in the country in which they were set. Although PCRs have not looked at this aspect, it is possible that the success of some projects has been achieved only at the expense of non-project institutions, particularly, in the case of the agricultural sector, through weakening the regular services of the Ministries of Agriculture. The provision of privileged conditions of employment for project staff has also proven to be something of a double-edged sword in that, although it may have contributed to stronger performance during the initial implementation period, it has undermined the sustainability of project management after external funding ceases.

Even if a project succeeded in appointing appropriately qualified staff, this has not necessarily ensured that it would be well managed. The effectiveness of management may be impeded by the broader environment in which it has to operate, for instance, by bureaucratic delays in the release of resources, by institutionalised corruption or by nepotism and political interference in the selection and promotion of staff. For reasons of discretion, few evaluation reports refer specifically to the political manipulation, general venality and corruption which have a pervasive influence on public sector performance in many countries, and these factors also tend to be politely ignored in projections of managerial performance. They may, however, have a fundamental impact on project success.

Many PCRs point to the positive role which supervision missions have played in supporting project management staff and in expediting decisions affecting project performance. Indeed, well focussed supervision may provide the most cost-effective form of technical assistance to managerially weak institutions.

- Poor Engineering

Although not all projects have construction components, poor standards of engineering and related studies rank as an important source of problems faced by projects during implementation, and one which is almost wholly attributable to the formulation stage. Some 45% of the projects examined suffered from poor engineering and the fact that almost 70% of all irrigation projects examined had to go through significant modifications (mostly to the design of works) during the implementation phase must be a cause for concern.

Design problems in irrigation projects appear to have various origins. In Asia, problems arose in adapting designs to the needs for improving water management in an institutional environment in which there was scant regard for farmers' participation and their attitudes towards the acceptance of recommended practices. Problems encountered in the Mediterranean area were concerned principally with the need to adjust system layouts to address unforeseen land acquisition or consolidation difficulties.

The most serious design problems occurred in West Africa where projects suffered from inadequacy of resources data (eg. on hydrology and river water salinity), badly executed topographic surveys and poor engineering design of the flood control systems. In one project (Senegal River Polders) the design was too sophisticated, leading farmers to by-pass the system, while in the Senegal Casamance Project, dry season pumping costs turned out to be 20 times those estimated at preparation. Many of these projects were only classified as successful in economic terms because of the unforeseen rise in rice prices which occurred around the time at which they entered into production.

Engineering problems have not been confined to irrigation projects, but have also been a serious source of problems in the three fishery projects reviewed. Thus significant and very costly changes had to be made to the port facilities constructed under the Second Fisheries Project in the People's Democratic Republic of Yemen, while in Indonesia an ice-making plant was constructed which in retrospect was found to be unsuitable for tropical conditions. In the rural development and services projects, engineering problems were commonly related to unsuitable specifications for staff housing and offices as well as to problems of bore-hole design for water supply.

- Procurement Difficulties

Most of the procurement difficulties into which projects have run are attributable to the lack of familiarity of the implementing agencies with the procurement procedures of the lending institutions. Given the high frequency with which projects have encountered procurement difficulties, however, it is important to examine whether more could not be done at the time of project preparation to reduce their incidence. Some procurement difficulties are undoubtedly due to the inadequate specification of goods in the project preparation documents and to a failure to set up practical institutional arrangements for handling procurement.

- Poor Monitoring and Evaluation

For anyone assigned to write a PCR, the lack of reliable information on a project's performance is bound to be a major source of difficulty and irritation, and this may explain the reason for placing poor monitoring and evaluation as high as seventh in the ranking of problems confronted by projects. Nevertheless, poor monitoring is more or less synonymous with poor management, as it is difficult to see how good and timely decisions can be taken in the absence of satisfactory flows of relevant management information.

M&E problems are most frequently cited for rural development, services and livestock projects, and this may in part reflect the difficulty of designing satisfactory systems for generating and interpreting regular flows of information relevant to management. While it is relatively simple to measure flows of project resources, the end-objectives of such projects tend to be so broad and the results so susceptible to external factors (eg. yields to weather) that any assessment of impact is bound to be difficult and needs to be sustained over a long period if it is to generate conclusive results. Where trained manpower resources are scarce, they are likely to be concentrated on activities which are perceived as having a more directly productive impact on project performance than monitoring.

In retrospect it also seems that the concept of M&E was poorly "sold" in the 1970s, in the sense that many recipient governments may have perceived the purpose of M&E arrangements as being more to meet the information needs of the financing institutions than those of project management. Indeed, to the extent that most project actions were predefined at the stage of preparation and adjustments were not encouraged, the relevance of a good monitoring system could have legitimately been questioned.

- Wrong Organisational Structure

Although the organisation of many projects, especially rural development and extension/research projects, suffered from structural problems, these were much less a source of institutional difficulties than was sheer bad management. Many of the structural problems were concerned with the failure of mechanisms for securing effective inter-agency coordination in the more complex projects, but lack of coordinated action might in some cases have been due less to the ineffectiveness of the coordination mechanism than to the low commitment to the project goals of some of the agencies assigned an executive role. There were special difficulties in building practical linkages between extension and research.

Several projects, however, did perform below expectations because of major difficulties created by wrongly designed institutions. These included a paddylands development project in a remote area of Sulawesi in Indonesia, where no-one, located within or close to the project area, was assigned lead responsibility for day-to-day management of the project and each of the several agencies involved was left to implement its own programme more or less separately: given the interdependence of land clearing, irrigation system development and agricultural extension, it is little wonder that the project was well behind schedule at the time of its mid-term review by AsDB.

A number of projects ran into difficulties because of their dependence on parastatal organisations for their implementation (eg. Tanzania Livestock). It is difficult, however, to see how alternative arrangements could have been devised during the 70s in some of the countries concerned, where parastatals were perceived as entities which could operate with greater efficiency than the regular services of government which had formerly been charged with the tasks undertaken by parastatals.

Other structural problems are related to the general lack of formal arrangements for ensuring that the views of "beneficiaries" are taken into account in arriving at decisions. Few projects succeeded in formalising satisfactory consultative mechanisms and the relatively poor performance of some has been largely attributable to this. Many of the problems which faced the first Nepal Rural Development Project, for instance, were posed by the weakness of the Panchayat as an institution for representing farmers' views but, though this was recognized, no alternative consultative arrangements were developed. The lack of consultative mechanisms also contributed to the emotional political controversy which surrounded the Madhya Pradesh Forestry Technical Assistance Project in India.

A positive feature of the irrigation projects is that none of those reviewed is reported to have suffered from problems due to the choice of institutional arrangements.

Completion reports, however, may well under-estimate the extent of the long-term difficulties associated with the choice of institutional structures for project implementation. We are now seeing, particularly in West Africa (eg. Sierra Leone), the difficulties being faced by governments in assuming continuing responsibility for sustaining activities initiated by the specially created project authorities which were a common feature of projects designed in the 70s. Nor do the completion reports give much attention to the high recurrent costs associated with the continued operation of entities which were able to employ their staff on privileged terms and conditions 1/. The advantages of strengthening existing organisations rather than creating new ones to assume project management roles are now widely accepted, although it is not always evident that project goals are being scaled down to match institutional capacities.

- Ineffective Technical Assistance

While almost one third of the projects suffered from problems related to the use of expatriate technical assistance, these were of a very diverse nature and can only partially be attributed to the design phase of a project. The most frequent problems appear to be related to the unsuitability of the appointed individuals to fulfill their assignments, often on grounds of personality or temperament. Other staff appointed under technical assistance arrangements were unable to function effectively because of lack of authority and of competent counterpart staff or because of the understandable difficulties posed for national staff working alongside foreigners employed under vastly different terms and conditions.

1/ These issues are taken up more fully in: Sustainability of Projects: First Review of Experience. World Bank Report No. 5718, June 1985.

What is evident, however, is that, though often successful, the inclusion of technical assistance in a project is far from an infallible means of overcoming weaknesses in local management and technical skills. Furthermore, where technical assistance has been effective during the initial implementation phase of a project, its withdrawal after the cessation of external financing may jeopardise the sustainability of the project. This concern was expressed in the completion reports for several of the rice projects in West Africa which relied very heavily - perhaps too heavily - on expatriate management.

Unfortunately the sample of projects is not large enough to provide any indication of the relative advantages of different types of technical assistance (eg. short-term consultants versus resident assistance; executive versus advisory role).

- Too Many or Unbalanced Components

As might be expected this is a source of difficulty principally - though not exclusively - in rural development projects. Although it is now fashionable to argue against the inclusion of a large number of components in a project, there are several multi-component projects (eg. Sri Lanka Badulla Rural Development or Cyprus Pitsilia Rural Development) which have performed very successfully: indeed it could be argued that their positive impact on the target population was achieved largely because of the comprehensive range of facilities and services which they offered. In both these cases, the projects were implemented by well established institutions endowed with sufficient authority to secure effective inter-agency coordination. To load less mature institutions with a broad range of tasks for which they have had no prior responsibility has, predictably, led to disappointing results 1/.

What seems to happen typically when a wide range of components is included in a project is not that the success of the project as a whole is endangered, but that some components simply are not implemented or are implemented badly. This may be either because they were also treated peripherally at the time of preparation and were not thoroughly designed or because they are perceived as being of relatively low priority by the busy management - and supervisors - of the project and hence are given only subsidiary attention. In the case of the first Nepal Rural Development project, for instance, a cottage industry component, added at the time of appraisal, never commanded much management attention and failed to disburse. Similarly almost no disbursements were made in the Bangladesh Rural Development Project against minor components for pond fisheries or horticultural development.

1/ Project complexity is discussed at length in World Bank Experience with Rural Development, 1965-1986. Operations Evaluation Department, The World Bank, 1987.

Conversely some projects have run into difficulties because the range of components included has been too narrow. The effectiveness of several of the early extension projects in India, for instance, was inhibited by the lack of complementary services (eg. credit, input supplies) which resulted in farmers being unable to take up recommended technologies.

- Low Output Prices or Marketing Problems

Amongst the projects reviewed, the livestock and fisheries projects suffered most from price and marketing problems. Had the sample included more projects with export crop production components, the picture might have been different because many of these were designed on the basis of long-term price projections which were subsequently proven to be inaccurate (See Chapter IV). Instead, most of the price problems faced by the projects in the sample resulted from domestic pricing policies (eg. for meat in Kenya and some of the Latin America countries and for rice in West Africa) and exchange rate policies which tended to favour urban consumers and kept farm-gate prices below the equivalent import parity prices. Thus, even if some of the projects remained economically viable, participating farmers made losses and, in turn, the intermediary banks suffered from poor credit recoveries. Marketing problems tended to affect adoption rates negatively.

While problems of domestic pricing policy are now routinely tackled through structural adjustment or sector loans (or even, as has recently been the case in Ethiopia, by withholding new loan commitments), at the time when the projects under study were prepared, the financing institutions were less ready to exert their influence on governments to adjust such policies, particularly if this might have led to a slow-down in loan commitments. To the extent that unfavourable pricing policies prevailed at the time of project preparation and there was no sign of any willingness to change these, but the projects nevertheless went ahead, it could be argued that misjudgements were made in their design.

The marketing problems which confronted the fisheries projects in both the People's Democratic Republic of Yemen and Indonesia stemmed from optimistic assumptions, both on the proportion of high value exportable fish in the catch and on the ease with which this could be placed on the international market. The raison d'être for heavy investments in freezing plants in these projects was that they were essential for supplying fish to the international market from the remote areas in which the projects were developed, and hence the failure to break into these markets led to the gross under-utilisation of the plants.

- Over-dimensioning

One quarter of the projects under review can be considered in retrospect as being larger than was warranted at the time of project design or appraisal. While some of the projects were too large in relation to the capacity of the implementing institutions (eg. Nepal Rural Development, Indonesia Extension and Research I), generally it

has been projects which have been based on technology which has been insufficiently tested in a "real life" setting (eg. Kenya Livestock I and II, and forestry projects in Kenya and Madagascar) which have been classified as too big. For quite a number of projects, it may be claimed with the benefit of hindsight that a pilot level operation, aimed both at refining institutional arrangements and technical "packages" and at testing farmer reactions to proposed innovations, would have been more appropriate than a full size project - and indeed most of the small-scale projects in the sample (eg. Niger Forestry) were claimed to have been successful and to have provided a satisfactory basis for succeeding larger projects. The pressures to make large loan commitments may all too often have over-ridden prudence in establishing the size of projects, as is implied in a recent World Bank retrospective review of rural development project experience in which it is claimed that "As many as a third of the audited development projects approved after 1974 ... had originally been intended as pilot projects but were expanded during preparation and appraisal into multicomponent projects, covering large and diverse rural areas." 1/

Problems of setting an appropriate scale for projects clearly still remain, and there are difficulties in reconciling the interest of both the lending institutions and borrowing countries in large commitments with the degree of confidence which can be placed in the applicability of the innovations on which the success of the project may depend. There continues to be an awkward gap in size between the relatively small-scale projects financed by grants from such sources as UNDP, UNCDF and FAO/TCP and the typically larger lending operations of the multilateral banks.

- Non-Sustainability

The nature of the evaluation material, written so soon after disbursements have been completed, means that few judgements can be made about the sustainability of the projects studied. Nevertheless, questions are raised about the sustainability of about 20 (28%) of the projects covered by the study. The underlying causes of non-sustainability are closely linked with other problems confronted by the projects and seem to be related mostly to:

- Excessive dependence on expatriate managerial assistance (eg. Senegal River Polders Project);

- Difficulty of maintaining budgetary allocations at levels needed to meet recurrent costs (eg. Philippines Mindoro Project);

- Problems associated with continuing the operation of anomalous institutional arrangements (eg. First Bangladesh Rural Development Project);

- Insufficient government commitment to the project concept (eg. India Bihar Extension and Research Project).

1/ Op. Cit

These problems are mostly of an institutional and budgetary nature and affect the capacity of governments to sustain the supply of inputs necessary for continued project success. Other sustainability problems arise through reductions in the flow of benefits, either because of resource degradation (see Environmental Problems, below) or because of the non-reliability of the technology upon which production increases were to be based (eg. Brazil and Uruguay Livestock Projects).

Clearly only some of these causes of non-sustainability can be attributed to misjudgements at the time of design.

- Inequitable Benefit Distribution

This has been treated as a problem only when a project has either failed by a significant margin to reach the number of beneficiaries foreseen at the time of preparation/appraisal (whether or not the project had explicit social equity goals) or led to an inequitable distribution of benefits between sexes. Many of the livestock projects in Latin America were addressed principally to large farmers but nevertheless several of them resulted in significantly fewer beneficiaries than originally intended. In Turkey, loans to farmers for the purchase of livestock tended to contribute towards a concentration of wealth amongst the elite who had access to credit; it was also claimed that the rural elite succeeded in securing a disproportionate share of the benefits of the First Bangladesh Rural Development Project.

One of the most serious oversights in the preparation of agricultural projects in West Africa (Gambia, Senegal, Cameroon in particular) was to disregard the dominant role of women in rice cultivation and hence the need to ensure their access to institutional credit. Although this was rectified during the implementation of the projects, it threatened initially to undermine the feasibility of several.

A particularly serious case of inequitable benefit distribution occurred in the Karnataka Irrigation Project in India where the problem of resettling people displaced from the reservoir site by rising water was largely disregarded at the time of preparation and appraisal.

- Slow Adoption

Forecasts of production are the result of judgements on both the benefits to be obtained from the technologies being promoted by the project and on the rate at which these will be adopted by farmers. The rate of adoption will, of course, be dependent to a large extent on farmers' perceptions of the benefits and hence, if yields or prices have been predicted at too high a level, the adoption rate is likely to be lower than expected. The main justification for investment in extension services is that they should accelerate the rate of adoption.

In the absence of good monitoring systems, it is difficult to record the rate at which of innovations have been taken up, but in several projects it was clearly far below expectations at time of preparation. These include the Magbosi Rural Development Project in Sierra Leone where the technologies both for intensifying cultivation of upland crops and for growing swamp rice were tested by a large number of farmers but permanently adopted by many fewer than expected. In India, farmers, accustomed to livestock rearing and rainfed cultivation, were slow to pick up water management practices when provided with irrigation under the Drought-Prone Areas Project. Drovers in Tanzania failed to use the stock routes developed under a livestock project, largely because of justifiable concerns over the vulnerability of their stock to predators.

These examples suggest that it is extremely difficult to predict the rate at which an innovation will be adopted in the absence of precedent, and tend to reinforce the view that, when the success of a project depends on many farmers adopting innovations which have not been thoroughly tested in the proposed project area, a pilot phase would be appropriate (see Annex 3).

- Insufficient Government Commitment

Although lack of government commitment is frequently cited informally as a cause of poor project performance, it has been explicitly noted as a problem in only 12 (17%) of the projects studied, perhaps because it is difficult to identify except from indirect indications. In the case of the first Rural Development Project in Bangladesh, lack of Government commitment to the underlying concept of the project and to the necessary changes in organisation was documented as an issue at time of preparation, was not resolved at appraisal and continued to plague the project during its implementation. In the Livestock Projects in Brazil, Government commitment seems to have been eroded in the course of the long-drawn out arguments with the World Bank on the basis for indexation of loans. In the case of the Rural Development Project in Nepal, commitment was strong at the time of formulation but faded in the course of implementation in response to changes in domestic politico-administrative arrangements.

The reported incidence of low commitment is surprisingly small in the case of the rural development projects, for many of these were prepared in response to the international banks' determination to address rural poverty problems in a direct manner which was often far from consistent with the prevailing domestic policies of the countries in which the projects were set.

It is perhaps relevant to observe that in none of the cases examined was the lack of government commitment attributed to the mode of project preparation or to a lack of understanding within the government of the concept of the project. This does not necessarily imply, however, that a fuller involvement of governments in the process of project preparation would not contribute to a still stronger sense of commitment.

- Recurrent Budget Shortage

While shortage of recurrent funds to sustain a project's activities after the cessation of external financing is now acknowledged as a problem affecting many projects, it has not always become evident at the time of preparing completion reports. These only indicate where shortages of counterpart funds - usually applied to cover recurrent costs - have affected project implementation. Of the projects examined, the most seriously affected have been the livestock projects, but there does not seem to be any particular reason why this should be so. If a project is starved of counterpart funds this may reflect a lack of government commitment but appears to be generally due to over-riding macro-economic difficulties faced by the countries involved, which have forced them to adopt austerity measures. Many of such macro-economic problems were simply not predictable in the early 70s but seriously affected projects prepared at that time.

- Other Problems

Political and Natural Disasters. Livestock projects also seem to have been much more prone to the effects of political turmoil, civil war and natural disaster than projects in other sectors. While the fact that countries in which such projects were set had more than their fair share of political problems must be purely coincidental, the relatively high susceptibility of livestock projects to natural disaster is presumably because projects were often designed to promote livestock improvement in the marginal semi-arid areas of Africa which were particularly hard hit by the droughts of the late 1970s and early 80s. Although any predictions of the timing of such droughts obviously lay outside the domain of the project preparation teams, it could be contended in some cases that the technologies being promoted were inappropriate for drought-prone areas through their encouragement of intensification and increases in stock numbers.

Land Acquisition Difficulties. Difficulties in acquiring land for project works seriously delayed the rate of development of two irrigation projects in Greece and led to the need to adjust system layout. These were problems which were recognised but under-rated at the time of project preparation.

Inflexibility. The review assigns a very low ranking to inflexibility in design as a source of problems faced by projects. What seems to happen is that, though projects are generally designed with a high degree of apparent precision, pragmatism prevails during their implementation and major departures are made from the original plans if it is thought that these will enhance project performance. Some of these changes, however, may be admitted with undue delay because of a reluctance amongst all parties to depart from the original blue-print. The fact that changes are frequently made is borne out in the figures on project performance which show that over one third of the projects underwent major design changes after appraisal. Many of the post-evaluation reports point to the very important role that supervision missions have played in agreeing to or instigating such adjustments. In some of the projects reviewed, the

changes have been of a fundamental nature and saved them from what otherwise would have been failure. In the Casamance Rice Project in Senegal, for instance, most of the project benefits resulted from a decision by the project management to concentrate development on an area of highly fertile grey soils which had been largely excluded from the project area at time of preparation, rather than on irrigated swamp lands as originally planned. In Cameroon, the Semry Rice Project achieved far higher returns than expected because management was successful in promoting transplanting of rice (rather than broadcasting, foreseen at preparation) and more double-cropping than expected.

There are many such examples of adaptation during project implementation, but there is little evidence that it was ever intended in the design of the projects, where the emphasis seems to have been on "accuracy". It seems reasonable to question whether - if adaptability is desirable - there is not room for reducing the effort put into making rather detailed projections at the time of project preparation, and applying additional resources to supervision with the principal objective of adjusting the project to respond in a timely manner to emerging requirements and information 1/.

Environmental Problems. The final problem type considered is that of land degradation or what might now be included in the broader category of adverse environmental side effects. Once again, livestock projects have the highest frequency of adverse effects, generally because they led to higher stocking of marginal lands (eg. Syria, Mauritania). Had more settlement projects been included in the sample, these too would probably have led (as in the case of Caquetã in Colombia) to an increase in the recorded frequency of such problems. It must also be recognized that international concern over environmental issues is a recent phenomenon and hence environmental problems could well have passed undetected in the projects examined in this study.

1/ The dilemma, however, is that, however desirable it may be, from the point of view of project implementation, to have "looser" designs, most financing institutions and government budgetary authorities expect to be provided with apparently firm projections of both costs and benefits at the time at which they commit themselves to project funding.

IV. EXOGENOUS FACTORS AFFECTING PROJECT PERFORMANCE

The relatively high frequency with which projects have failed to hit their targets could be taken as an indictment of the present approaches to project design, and, indeed, must be a cause for concern. Any long-term predictions of economic behaviour, however, are prone to inaccuracy, but this does not invalidate the use of forecasting techniques in arriving at decisions on resource allocations.

What may distinguish project preparation from other forms of economic forecasting is the apparent precision which has been conventionally built into the estimates of costs and benefits. In spite of the historical evidence that expected goals are seldom met, the architects and proponents of projects still tend to attach an unusually high level of confidence in the accuracy of their predictions, and much of the recent work on improving project preparation methodologies has sought to sharpen analytical tools. It is unfortunate that the possibilities offered by increasingly powerful data processing equipment have not yet been widely applied to analysing the probable outcome of a range of different possible project scenarios, and instead have tended to be used principally to generate an increasing number of seemingly definitive models.

Back in 1970, few people could have predicted the rise in oil price which occurred in 1973 and set off a chain reaction of reduced economic growth, inflation, unemployment and protectionism in the developed countries, which in turn led to shrinking markets for the exports of developing countries. Given the ubiquitous impact of the oil price shock-wave, it is hardly surprising that so few projects prepared in the 1970s were on target. It suggests, however, that the designers of a project must acknowledge that its fortunes will not be determined only by its inherent features but also by events - often completely unpredictable - which lie totally beyond their control or influence.

How to approach the unpredictable - whether through building in resilience or a capacity for adaptation - is such an important issue, that the next section examines selected factors affecting project performance which have lain largely outside the designer's control 1/. The chapter will go on to consider problems which are inherent in the use of projects as vehicles for financing agricultural development.

1/ The distinction between project preparation and sector planning is becoming increasingly blurred with sector conditionalities frequently being attached to projects and projects being identified through broader sectoral studies: to imply that all broader sectoral issues lie outside of the scope of project design is thus misleading.

International Commodity Prices

As noted above, several rice production projects, prepared by the Investment Centre for West African countries, did not meet their production targets because of errors in engineering studies and a failure to recognise the special needs of women farmers for access to credit. Yet, because of the favourable growth in international rice prices in the later 1970s, these projects were mostly adjudged successful. Conversely, projects for the production of export crops such as rubber, cocoa, coffee or sugar, prepared in the late 70s, may have performed well in technical terms but nevertheless often failed to meet their economic goals because of unforeseen falls in international commodity market prices. The behaviour of international markets has a profound impact on the viability of most agricultural projects, but yet lies almost entirely outside the control or influence of the project designer.

The project analyst needs a common reference price for the main traded inputs and outputs and hence conventionally uses the World Bank's international price forecasts in making projections. What must be of concern, given their poor record of accuracy, is the very considerable influence wielded by the forecasts on the selection of projects and on the predictions of their viability, as well as more recently in the formulation of policy recommendations with which non-project lending is increasingly becoming associated. Intended originally mainly to ensure uniform treatment of prices between countries and projects in the Bank's internal processing of projects, they have now become the universally accepted basis for price estimation in the design of projects and adjustment programmes 1/.

In spite of the evident problems of using the Bank's price projections as a point of reference, there are no valid alternative sources of price information, and hence they will continue to be used. The testing of a project's sensitivity to changes in future prices would seem prudent under these circumstances.

Domestic Policies

Before the emergence of structural adjustment and sectoral lending instruments aimed at addressing policy anomalies, projects were conventionally designed to work within rather than to change the domestic policy environment. Many of the projects covered by this study were prepared and implemented in a period during which the domestic environment of most developing countries came to be characterised by currency over-valuation, high rates of inflation, subsidisation of urban food prices, and a rapid growth in the role and scale of public sector and parastatal institutions.

1/ A recent World Bank report (Philippines: Agricultural Sector Strategy Review) makes the point that "It is impossible to forecast the future world price of rice with any confidence. Neither economic models nor attempts to read trends from past price data provide good enough guides to future prices to justify using their results for project justification or policy setting."

If we accept that adjustments to the policy environment lay largely beyond the field of vision of project designers in the 1970s, the issue is whether due account was taken of its probable influence on the performance of projects when they were being prepared. Would, for instance, a more thorough assessment of the domestic marketing policies which favoured urban consumers have led to doubts over the financial incentives for ranchers in Kenya to invest in expanding beef production? Or would a deeper review of Argentina's credit policies have demonstrated that there would have been no demand from cattle farmers for loans advanced at positive rates of interest?

The 70s saw an increase in lending pressure from the internatinal financing institutions, coupled with better articulated policies on lending priorities which were not always consistent with the borrowers' perceptions of priorities. These discrepancies were most evident in the field of rural development. The goals of improving social equity, securing beneficiary participation in planning and decentralising services which were implicit in rural development projects were frequently at odds with the elitist and authoritarian styles of government in the countries in which they were set. While some such projects, as in Sri Lanka or Colombia, contributed through their example to changes in policy, it is hardly surprising that elsewhere others failed to secure the degree of government commitment necessary for their successful execution or replication.

What may be concluded from the experience of both rural development and extension projects is that projects can become powerful instruments in bringing about changes in policies, but only if there is a strong commitment both in the lending agency and at very high political levels in government. Without such a shared commitment, attempts to introduce policy changes, for instance through loan agreement covenants, will generally not succeed: this is well illustrated in the often fruitless attempts made by the financing institutions to insist on full cost recovery from the beneficiaries of irrigation projects, and it may well be that the current attempts of donors to introduce concerns about women, food security, poverty alleviation and the environment will run into similar difficulties in some countries.

Problems Inherent to the Use of Projects for Financing Agricultural Development

Although projects have many advantages as vehicles for mobilising funds for financing agricultural development, they also have their limitations. Projects are particularly suitable for financing finite tasks, such as the building of a dam or a large irrigation system, which lend themselves, and indeed require, accurate pre-specification and for which it is important to secure an up-front commitment of all the resources needed to complete the works within a given time-frame. Although the project mechanism has been used to finance an increasingly wide range of interventions in agriculture, its use, without major adaptation, imposes constraints on planners which may be reflected ultimately in poor achievements. The more obvious limitations are touched on below.

Rigidity. Typically the preparation of an agricultural project takes about two or three years and disbursements may be completed over a further five years. The combination of such a long period for the commitment of resources with the convention that expenditures should be predicted with considerable apparent accuracy, makes most projects inherently rigid. This has the advantage of "shock-proofing" the programmes supported by projects (for instance, through improving the chances of a stable flow of funds in times of fiscal stringency), but may lead to the pre-planned investments becoming of diminishing relevance, unless deliberate provision is made for their adaptation to changing circumstances and to improving knowledge. While it would be going too far to suggest that a successful project must, by definition, be executed in a different way than expected by its designers, it does seem important that projects should be amenable to periodic adjustments which take account of the relative success or failure of the activities which they support.

Many of the projects examined in the study represented the first concerted attempt to promote rural development in a particular area. While it was feasible to gather - if time was allowed - reliable information on the physical resources of the area and to assess their development potential as well as to carry out socio-economic surveys, any judgements on the rate at which the people would adopt the proposed innovations or respond to other stimuli offered by the project were still necessarily subjective. Yet, the success of most projects depended heavily on the accuracy of such predictions, made at a time when, by definition, the information on which they were based was rudimentary.

While the financing institutions have attached considerable importance to project monitoring and evaluation, it is surprising how little attention has yet been given to adapting approaches to project design so as to increase responsiveness to the findings of the monitoring systems. Constraints in the administrative budgets of the financing institutions have perhaps contributed to the slow adoption of more "open-ended" project designs which would require a heavier supervision manpower input.

Lending Targets. As the project emerged as the main vehicle for the transfer of external finance from the multilateral banks to developing countries and the macro-economic justification for such transfers became stronger, pressures grew in the 1970s to increase the scale of funding commitments to projects. Between 1970 and 1980 multilateral commitments for assistance to agriculture rose from about $700 million to $6.7 billion per annum. Lending targets increasingly came to be set largely on the basis of resource transfer considerations prior to any detailed assessment either of the inherent financing needs of each project or of the absorption capacity of the institutions charged with implementation responsibility. To reduce such notional funding allocations, once the evidence of real "requirements" was assembled, met - and still continues to meet - with strong resistance. The cynical observer might claim that such resistance was due in part to the perception of staff within the lending institutions that their career advancement depended on their

ability to clinch large deals and in part to the discovery by officials in borrowing countries of the personal advantages of association with externally financed projects. There were then - and still are - too few checks and balances to ensure that due attention is given to appeals for prudence or modesty of scale, still less to proposals to abort the processing of a project once it has been assigned a place in a lending programme.

Probably the most serious effect of such pressures to lend on the design of projects has been for these to include the large-scale application of insufficiently tested technologies or unproven institutional models, when it would have been more prudent to make commitments only for pilot scale activities. These problems emerged dramatically in the South American livestock projects, the feasibility of which depended heavily on the successful transfer and adaptation of technologies originally developed in New Zealand and tropical Australia but which had not been locally tested under farm conditions. In these and other cases, however, there is no documentary evidence of the extent to which such over-dimensioning was due simply to a resigned attitude of all parties involved towards lending programme pressures or also to more fundamental misjudgements on technical and social issues.

There is, however, a consensus amongst practitioners that the target dates for loans, which were often set before the complexity of the preparation task could be appreciated, tended to exclude some necessary investigations. The constraints imposed by the tight scheduling of loan processing dates have been compounded by restrictions on the manpower used for preparing projects. Typically as little as 40-50 man weeks are allocated by financing agencies for the preparation of multi-component projects involving investments of US$10-50 million 1/. If around two thirds of this time is spent in analysis and in writing of the feasibility study, the remaining time available for field investigations (often in areas of difficult access), gathering of information from secondary sources (often of dubious accuracy), the review of different options, and consultation with sponsoring agencies and beneficiaries has been so limited that it is hardly surprising that significant errors of judgement have occurred, and will continue to occur as long as short-term efficiency concerns outweigh quality considerations in decisions on time and manpower allocation for project preparation 2/.

1/ For the FAO/World Bank Cooperative Programme, the total cost of projects prepared and financed rose from $12.3 million to $58.2 million per staff member per year between 1970 and 1978.

2/ This is not to imply that there is not room for efficiency improvements. The iterative process of project preparation, appraisal and supervision and its heavy dependence on consecutive short-term missions is cumbersome and has high costs: if these were to be accounted for fully, they could probably not be justified for small projects.

Possibly one of the most serious effects of the rush to lend has been that it left little opportunity for a proper appreciation by borrowing governments, let alone by the ultimate beneficiaries, of the nature of the projects which were being readied for financing. While the shift in attitude of the multilateral banks from one of apparently reluctant lenders to one of aggressive loan peddlars which occurred in the 1970s contributed to a major increase in financial resource flows to developing countries, it may well have led to a reduced commitment on the part of governments to make projects successful.

Lending Policies and Fashions. Although much attention is now given to establishing the consistency between projects and national planning goals, most projects continue to be identified on ad hoc basis. There is seldom a sufficiently large array of well developed project ideas to allow an objective assessment or ranking of priorities and so the selection has to be made on largely subjective grounds, taking into account the policies of both the government and the lending institution. While some financing institutions (eg. IFAD, UNCDF) have a well-specified mandate within which their funding policies are clearly defined, larger multilateral agencies have a much broader role in promoting development and - to prevent undue dissipation of effort and to incorporate the lessons of past experience - often revise their priorities. As a result, new lending policies are constantly evolving and new financing instruments are emerging. While many of these changes are derived from thorough study and have merit, the speed with which the new ideas are seized upon and previous policies discarded can contribute to confusion on the domestic policy front in borrowing countries. Thus, those countries which were induced to embark on rural development projects in the 1970s (when these were claimed to offer the best means for reducing rural poverty) and eventually adapted their administrative systems to accomodate the needs for effective inter-agency coordination at a decentralised level, now find that funding for such projects is difficult to obtain, as the lending agencies' priorities and styles have changed. To borrow for agricultural extension services (provided that the institutional arrangements are consistent with a "proven" model), research, forestry or food security is now relatively easy and any proposal for privatisation of activities previously operated by parastatals gets a good reception, whereas the prospects of securing funding for livestock development or new irrigation construction are not very promising! Historical experience suggests that lending fashions tend to be short-lived, and that their potential benefits tend to be overstated by their protagonists.

This could imply that the rapidly evolving global policies of the major lending institutions are given undue weight vis-à-vis the domestic policies of borrowing countries in the selection and design of projects, and that this in turn may contribute to undermining government commitment and sustainability. Perhaps the long-term record of achievement of the international financing agencies would be better if more sustained energy was devoted to making past development commitments work successfully rather than to generating a sometimes bewildering flow of new thrusts and initiatives. It is certain that the chances of project success would be enhanced by more sympathetic attention to government policies, albeit within the bounds of financial orthodoxy.

Donor Competition. In spite of the fact that resource flows into developing countries generally remain well below targetted levels, there is paradoxically intense competition in a growing number of countries between financing agencies - bilateral and multilateral - to fund a limited set of feasible projects. Often these are clustered within relatively narrow but fashionable fields. If the capacity exists in a country to orchestrate donor activities, then such competition can be turned to advantage. Too often, however, the situation seems to get out of hand, and each "donor", operating more or less independently, lays claim to a piece of territory or to a sub-sector in which to apply its funds and policies in a manner which may or may not coincide with national aspirations; this is almost certain to accentuate the demands on already overstretched institutional capacities. While some progress has been made in external aid coordination through "round table" discussions and in arranging inter-agency cofinancing packages for major development programmes, most financing agencies still appear to be concerned at the lack of visibility which cofinancing implies and prefer to "do their own thing" 1/. The need for projects to be designed in a way which conforms to the particular policies and presentational requirements of each source of finance imposes added demands on those involved in their preparation.

1/ Most financing agencies with which the Investment Centre cooperates are reluctant to associate themselves with general project identification missions, with the result that all too often the Centre has to mount consecutive missions to the same country to identify projects on behalf of specific institutions: this is patently wasteful in staff resources, places unnecessarily demands on the already overburdened institutions of member countries and does little to contribute to a rational selection of priority projects.

V. APPROACHES TO IMPROVING PROJECT DESIGN

Introduction

While the review of post-evaluation material has allowed us to identify the nature of the principal problems affecting project implementation, their severity and the extent to which they would seem subject to influence at the stage of project preparation, the material provides very little in the way of practical suggestions as to how the design of projects can be improved. Indeed there is seldom any direct reference in PCRs, for instance, to the mode of preparation and its possible influence on project performance, or to the adequacy or inadequacy of analyses made at the time of project formulation. This chapter is, therefore, somewhat speculative. It is intended to outline several possible approaches to reducing the incidence of the most serious problems which have been identified as adversely affecting project performance, as well as of problems which are believed to be more severe than implied by the analyses. Proposals are made on the assumption that the time and manpower resources which can be allocated for preparing projects will remain limited.

This paper will have achieved its basic objective if it merely leads people who are engaged in agricultural project preparation to be more aware of the kinds of problems into which projects have run and be more vigilant in safeguarding against their recurrence in future. Many of the problems seem to stem from placing excessive confidence in intuition as a substitute for more rigorous and systematic analysis of available information. It may be useful, however, to go beyond this and explore the broader possible implications of the findings on approaches to project preparation. This chapter, therefore, examines:

- The options for modifying conventional approaches to project design and financing to build in greater adaptability;

- Possible changes in project preparation techniques which could lead to more realistic predictions of expenditure and benefit profiles and which could, at the same time, speed up project implementation;

- Options for adjusting the operational approaches adopted by external assistance agencies to project formulation in order to secure greater government commitment, fuller beneficiary participation and, indirectly, greater project sustainability.

The chapter deliberately excludes any consideration of approaches to the adjustment of economic and sectoral policies to create an improved national environment in which projects can operate. This is a topic which has been taken up in many recent publications and one which lies beyond the bounds of this paper.

Incorporating Greater Adaptability in Projects

There has been a tendency over the past years to focus attention on improving the apparent accuracy of the projections, estimates and analyses on which project designs are based. This has been encouraged by the use of computers which have made it easier to handle large numbers of figures. A considerable effort has also gone into refining economic analysis methodologies, and, indeed much of the training offered in agricultural project preparation has been focussed on improving the application of such techniques.

Past experience, as we have seen, is that - at least for complex and "soft" projects - ex-ante projections of costs and benefits tend not to be very accurate. The longer the period over which predictions have to be made, the greater will be the danger of inaccuracy. Reasons for this include:

(i) Predictions must usually be made for a very large number of variables, often related to the behavioural response of many individuals to a range of socio-economic stimuli, over a long time horizon - typically, for disbursements, as much as seven or eight years from the time of project identification and, for benefits, a much longer period;

(ii) Information available at the time of project preparation which should provide the basis from which projections can be made, is often incomplete and inherently inaccurate: alarmingly large gaps in information have to be plugged by judgements, often made on the basis of only cursory observation;

(iii) Unpredictable factors external to the project and often to the country in which it is located may have fundamental effects on project performance.

While accurate predictions of quantities and costs are possible and indeed necessary for projects centred on the construction of major engineering works, it seems that a rather different approach, deliberately aimed at enabling projects to adapt to changing circumstances, may have advantages for most other types of projects, particularly the "softer" ones.

What appears to be required is to design these projects in such a way that they can - within generally agreed and clearly defined objectives - adapt themselves to:

- improvements in information;
- findings of monitoring work;
- perceptions of emerging new opportunities/comparative advantages;
- changing political or economic circumstances;
- unpredictable events, particularly, for the agricultural sector, those of weather-induced origin.

This implies loosening design, and deliberately devolving more responsibility for decisions on the allocation of resources and changes in implementation policy to the management of the project.

Various approaches to building increased flexibility into project design have been tried but would appear to warrant more frequent application. These include:

- Use of "programme loans" and "funds", from which finance can be drawn to pay for a range of activities which are not tightly pre-specified but are consistent with the general objectives of the project and meet agreed approval criteria: such approaches have proven useful in projects for minor rural works, (eg. Niger, Burkina Faso), small and medium scale irrigation (eg. Morocco), agricultural input supply (eg. Philippines, Pakistan) and research, but may also be applicable for other project types especially in countries with relatively well developed sectoral institutions;

- Adoption of annual operating planning (AOP) arrangements: while a fairly tight prediction of expenditure would be made for the first year or two of a project, based on agreed work plans, estimates for later years would be of an indicative nature (possibly with defined upper and lower limits). They would be subject to confirmation or adjustment in annual operating plans to be prepared by project management, in response to the findings of monitoring systems and changing circumstances. Such AOPs would be submitted for approval by the financing institutions as represented by supervision missions. This approach has been applied in a number of rural development projects (eg. in North East Brazil), and has the advantage that it not only fits in well with normal government budgeting procedures and cycles but also enables project management to respond expeditiously to proposals made by beneficiaries;

- Provision for in-depth mid-term reviews, aimed to provide for course corrections in projects with relatively long disbursement periods: for such reviews to be effective they must be associated with prior studies planned to provide reliable information on which to base decisions on changes;

- Commitment in principle to sustain financing for a thoroughly appraised programme over a long period, but with actual funding commitments being made for a series of short-term tranches or time-slices, each conditional upon a short-cut appraisal: apart from allowing for regular fine-tuning of the project actions, this has the additional advantage, from the borrower's point of view, of reducing commitment fees.

While all of these approaches imply a need for less accurate long-term projections of costs according to component, they place other demands on project preparation. In particular, they require:

(i) A very clear definition of project objectives;

(ii) Particular attention to defining project management arrangements and procedures, especially for monitoring (and responding to the findings emerging from monitoring mechanisms) and, in the case of the second approach, for the preparation and processing of AOPs;

(iii) Careful definition of unambiguous criteria for approval of releases of funds;

(iv) Prior proof of the inherent viability of an array of specimen investment proposals, potentially subject to project financing;

(v) An analysis of a range of possible outcomes, and of the extent of risk that some objectives may not be met, supported by a critical review of the main potential sources of such risks.

It is also clear that any of the above approaches will place heavier demands both on project management skills and on supervision, and this may explain why some financing institutions show little apparent enthusiasm for incorporating greater flexibility in projects. To overcome this, the extent to which the additional supervision manpower input could be financed through the projects as "project implementation assistance", rather than from the administrative budgets of the financing institutions, would appear to warrant exploration.

Adjusting Project Preparation Techniques

There are four principal areas of potential improvement in project preparation techniques which would contribute to better projects. The first is to use conventional analytical techniques better, especially through interpreting the conclusions of the analyses in ways which better enable decision-makers to appreciate the strengths and weaknesses of project proposals. The second area to which greater attention clearly needs to be given is that of institutional analysis, particularly the assessment of skilled manpower availability to meet the new demands created by projects. There is a need also, we believe, to give more weight to analyses thirdly of the technical and fourthly of the social feasibility of proposed projects.

The common feature of the suggested approaches is that they are intended to add greater pragmatism to a process which has too often become somewhat detached from reality and conducted in a rather automatic manner. What is being advocated is a more focussed and rigorous analysis of those aspects of project design which this study suggests most frequently contribute to a failure to meet targets and ultimately achieve their goals. Tightening up on these areas of analysis would not be incompatible with the moves towards introducing greater flexibility suggested above.

Upgrading Current Analytical Work. The principal problem with most conventionally applied analyses is that they tend to be directed towards presenting a quantitative proof of a project's feasibility rather than towards contributing to improvements in the underlying concept and design of the project. Typically a project preparation report contains several models to demonstrate the financial impact of the project on the ultimate beneficiaries - usually farmers - and an analysis of the effect of the project on the economy. When these analyses are carried out correctly and on the basis of well-founded cost and benefit streams, there can be no doubt as to their value as contributions to judgements on the feasibility of projects. In practice, however, established methodologies are frequently applied wrongly, the terms in which the analyses are carried out may be of little relevance (for example, a financial rate of return is probably no guide to the future behaviour of a subsistence farmer), and the projected cost and benefit streams on which the calculations are based are - as we have seen in this review - seldom accurate enough to support detailed quantitative analysis. Even when the methodologies are correctly applied, little weight can be placed on the results of an economic analysis when there is a high probability of significant flaws in the underlying projections of costs, implementation schedules and output attributable to project interventions. What must be of concern is that, even though the weaknesses of these analyses are widely acknowledged, the bottom-line of such cost-benefit calculations continues to carry disproportionate weight in decisions on a project's feasibility.

There would seem to be considerable room for providing decision-makers with a more informative basis on which to arrive at judgements on the feasibility of projects. Economists have sought to address the need for incorporating distributional considerations in cost-benefit analysis through weighting techniques, but it might be advantageous to give greater attention to methods which implicitly leave the weighting of the various considerations to the decision-making bodies. This would imply that project feasibility studies should include not so much a proof of feasibility expressed largely in economic terms, though this is important, as a broad but systematic review of benefits (and any negative side effects) in terms of their consistency with national, political, economic, social, nutritional or environmental objectives. For instance, rather than have distributional effects represented as a weight in the analysis, a qualitative assessment of the extent to which a project improves or exacerbates the income distribution situation would be more informative.

The decision-maker should also be provided with the means of assessing the chances of achieving - or not achieving - the forecast benefits: this implies a need to identify the major critical assumptions/parameters on which the design of the project is based (and to which benefits are most sensitive) and to review explicitly the degree of confidence (or conversely risk) associated with each. In looking at risk, it is important to differentiate between risk as perceived by the "beneficiaries" (i.e. the probability of attaining an

estimated level of income or financial return on investment) and the risks to the economy of embarking on the project. Sensitivity analyses techniques are useful (if not applied too mechanically) in throwing light on the nature and extent of such notional risks.

It must also be obvious that analytical work is of greatest value if it leads to the incorporation in the design of a project of measures to address the weaknesses and problems on which it sheds light. If it is accepted that the identification of a project usually must be based largely upon subjective judgements, then the analyses carried out during preparation have the objective of confirming, refuting or leading to a modification of the initial hypotheses. Project preparation is essentially an iterative process which permits the introduction of modifications in the light of emerging information and the conclusions which may be drawn from analytical work, and full advantage must be taken of this feature.

Institutional Issues. At the outset of Chapter III, it was claimed that institutional problems represented the most serious source of difficulties experienced by the projects under review. These were disaggregated, albeit with some overlap, into:

- Bad management and staffing;
- Procurement difficulties;
- Poor monitoring and evaluation;
- Wrong organisational arrangements or structure; and
- Ineffective or insufficient technical assistance.

Several of the problem types, classified for the purposes of the discussion as "conceptual", also clearly have important institutional implications. These include:

- Schedule too tight;
- Too many components;
- Non-sustainability.

For a project to be institutionally feasible, there must be a matching between the tasks to be carried out, the time-frame over which they are to be implemented and the institutional capability to execute them. If projects have failed to meet their targets in terms of timely task implementation, it is either because the magnitude of the management implications of carrying out the task has been under-estimated or because managerial capabilities have been over-stated - or a combination of both. The frequent inclusion of unduly high disbursement targets for the first year of a project provides the clearest evidence of the need to make a methodical assessment of the scheduling implications and demands on management implied by each important project "task". As a corollary, it is clearly also necessary to be much more specific in identifying the exact nature of institutional weaknesses which need to be overcome if implementation is to be feasible, and to examine the comparative benefits of different approaches to overcoming these. Superficiality in diagnosing areas of institutional weakness is all too common, and the subsequent recommendations for institutional strengthening are often couched in amateurish terms, which take little advantage of the

accumulated experience of the management sciences. The mere provision of a modification in organisational structures, the creation of a coordinating committee and the inclusion of a dollop of expatriate technical assistance - although frequently advocated - is, as we have seen, not a sure recipe for overcoming institutional problems.

- Task Analysis. As one step towards improving the realism of scheduling and the appreciation of the magnitude of the demands that a project places on management, staff and skills, it would seem useful to extend the application of "task analysis" techniques to most types of projects. At the moment, the use of scheduling tools, such as critical path analysis, network analysis or PERT (Programme Evaluation and Review Technique), tends to be reserved for projects with complex and large investments in civil works. The application of such formal scheduling techniques not only identifies the time frame required to execute a given series of actions and the optimum sequencing, but also generates material of special use to project management. The techniques, however, are seen by many project analysts as unduly complicated and time-consuming in their application, and hence are not widely used.

The wider application of formal scheduling techniques in project preparation will probably depend on the extent to which they can be simplified. There would be much to be gained by using less structured techniques simply to confirm or refute the validity of the implicit judgements on which most timing estimates tend to be based. This could simply involve listing the key tasks implied by each of a project's main components, placing these in an operational sequence (for instance on a bar chart), estimating the likely time required for each step, listing demands on management staff or skills in potentially short supply, and noting other potential constraints or risks. From such a simple exercise, it is possible to derive a reasonably accurate expenditure profile for each component over time, to assess critical demands on management and staff, and identify needs for coordination between components or with activities outside the project (see Annex 1).

- Skill Gap Analysis. If a logical sequence is followed, the next step involves reconciling the staff demands implied by such an analysis with institutional capabilities. If these do not match, either the scope of the tasks must be reduced (for example, by dropping peripheral components with heavy demands on management) or the institution must be reinforced to the point at which it can be realistically expected to cope with demands.

According to the review of project implementation problems in Chapter III, the most serious institutional problems into which projects have run stem not so much from the structure of the implementing agencies but from problems of a staffing origin. This would suggest that greater attention should be directed during project design to matching staff capabilities with the tasks implied by the project. Once a first approximation has been made of the project components, it is possible to conduct a skills gap analysis and, on the basis of its findings, assess the institutional feasibility of the preliminary proposals, adjust them as necessary to conform with staff capabilities, and identify recruitment, training and technical assistance needs.

Skills gap analysis techniques, as currently recommended, however, have the disadvantage of being very time-consuming and of concerning themselves largely with the critical examination of only one of the factors affecting institutional performance. Many organisations may have staff with all the skills required for project implementation but still not perform well, and hence a broader assessment of institutional capability, which gives special attention to decision-making processes and administrative procedures, may be warranted. Some measure of the likely performance of institutions can be made by identifying the lapsed time which they take to complete standard management tasks, such as staff recruitment actions, local purchase of materials, clearance of imports through customs, international procurement of goods through competitive bidding etc. Many of the problems identified may not be inherent to the institutions immediately involved with the project, but, even though external, are bound to affect performance. Problems of an internal nature may be due to style of management but more often are attributable to archaic or cumbersome procedures which are susceptible to improvement.

- Manuals. Most project preparation reports tend to give some attention to the structural aspects of institutions, usually including an organogram, a list of functions and an estimate of staff requirements (whether or not this is supported by a skills gap analysis), and generally more than adequate provision is made for the means to work (buildings, vehicles, equipment and allowances). It is unusual, however, for such reports to address what might be termed "institutional dynamics" - or how the institution and its component elements will operate. Institutional strengthening plans thus tend to be analogous to engineering plans for irrigation system improvement which are not accompanied by complementary proposals on water management. We all know from our own work experience how important it is, if we are to use our time in a cost-effective manner, that there must be no ambiguity about what we are expected to do, to whom we are to report and the extent of authority which we enjoy. This suggests that an integral part of the institutional design of a project must - at least if there have been any significant structural or staffing changes - be the preparation of a manual which clearly sets out the functions of different units and posts (including terms of reference for technical assistance staff) as well as the operating procedures to be followed within the institution. In the absence of such a manual and of training in the application of new procedures, a new organisation or one which has undergone significant changes will tend to grope, at least in the initial years of a project, and much of its limited staff skills will not be efficiently deployed. While the main management processes should be determined in the course of project preparation, probably the best time for the compilation of detailed manuals is between appraisal and loan effectiveness.

Technical and Social Issues. One of the more disturbing findings of the review of problem incidence was the relatively high severity ratings attached to technical misjudgements, both on engineering matters and on crop and livestock performance. Although slow rate of adoption has been classified as a social problem, it frequently also has its origins in the weakness or inappropriateness of the technologies being promoted and hence it may conveniently be addressed alongside means of overcoming technical problems.

Several lessons, which, though apparently obvious, are often disregarded in practice, are reinforced from the study.

(i) A high standard of resource and topographical surveys is essential for the accurate design of engineering projects. Although this is bound to require heavier manpower inputs, surveys must be thoroughly field-checked if serious and costly engineering mistakes are to be avoided;

(ii) If there are no successful precedents for applying a new or improved farming technology under farmer conditions in or near a project area, any project which depends significantly for its success on the application of that technology - however promising it may seem on the research station or in farm models - should be of a modest or pilot scale: such pilot projects should, if they are to provide replicable results, test promising technologies under "real-life" conditions and must be given time to achieve results before being superseded by larger projects. The Project Preparation Facilities of the financing institutions and FAO's Technical Cooperation Programme can be readily used to finance pilot activities (eg. Mauritania, Oasis Project) which provide the precedents on which larger subsequent projects can be prepared with confidence.

(iii) The feasibility of projects must not depend on the future up-take of the findings expected to emerge from simultaneous research activities. The gestation period required for investments in research to generate results which could be applicable on a significant scale is simply too long;

(iv) Projects to assist independent farmers in rainfed areas, with low population pressure on the land resources or where climatic risks are relatively high, are unlikely to be feasible if they depend on the application of significantly more intensive farming practices (other than irrigation in low rainfall areas) than those currently being applied.

The relatively high frequency with which production targets - whether for crops, fish or livestock - fail to be met could probably be significantly reduced if we reminded ourselves of these lessons, but these are, of course, far from exclusive and not applicable to all types of projects. What seems to be required generally is a more rigorous analysis of the underlying assumptions on which output forecasts are based. It is not enough to show that a given technical change would be in the farmers' interest to adopt: it must also be shown that the wherewithal (services, inputs, credit, markets) needed for this will be amply available.

For crops, increases in production are the product of increases in yield per unit area and changes in the area over which such yields are obtained. Yield may respond significantly to changes in technology but is also affected by a range of environmental, biological and managerial factors which contribute to variability in yield attainment between seasons and between farmers. In communities of independent producers, average yields will be affected by the extent to which farmers adopt - in whole or in part - the recommended technology and by the rate of adoption in the community as a whole.

Thus predictions of increased farm output represent the outcome of an inter-related group of judgements not simply on technical issues but also on farmer behaviour. Conventional project preparation practice involves the construction of a series of crop, livestock or farm models, claimed to be representative of various agro-ecological situations, to illustrate the impact on production and farm incomes of investments and related changes in farming technology. Judgements have to be made on farmer uptake rates and on this basis the models are aggregated to provide the key inputs into the cost and benefit streams from which the assessments of a project's economic viability are derived. The models are conventionally analysed to calculate a financial rate of return and a net return per man day of family labour (in the case of small farmers), and are used to demonstrate that, if credit is involved, the borrower has the means to repay his debt. Tests of sensitivity to changes in the relative levels of costs and benefits are normally carried out both at the level of the model and on the aggregate totals.

The approach outlined above has the merit of simplicity and may be quite adequate for predicting agricultural output under relatively stable environmental conditions (eg. in irrigation projects with reliable water supplies) and where there are recorded precedents for the adoption of analogous innovations, from which credible forecasts of adoption rates can be derived. In other circumstances, particularly when the viability of a project is heavily dependent on incremental farm output from small farmers in rainfed areas, some selective deepening of the analysis would appear to be necessary if a proper appreciation of the probable results is to be provided to those persons who ultimately have to decide whether or not to commit resources to the project.

There appear to be two principal areas on which such extended analyses should focus - on gaining a better appreciation of the range or probability of yield variations between farmers and between seasons/years in the "with" or "without" project situations and on developing a better understanding of the factors affecting farmers' decisions on adoption. These are, of course, inter-related in the sense that aversion to risk (particularly risks associated with yield variability, but also perceived risks associated with markets, investment exposure, borrowing etc.) is often one of the main factors making farmers reluctant to adopt innovations.

- Yield Variability Assessment. One of the reasons for the relatively limited attention which has been directed towards analyses of yield variability is that a comprehensive probability analysis places demands not only on reliable time series data both on yields and on the factors contributing to variation (which are seldom available) but also on sophisticated statistical analysis skills. Even if it may not, therefore, always be feasible to complete a statistical analysis of yield frequency distributions and probabilities, a qualitative assessment of yield prospects would be valuable in focussing attention on the underlying causes of risks, and ensuring that these are given due weight in the design of the project and the assessment of its feasibility. A short note on simple methodologies for yield variability predictions and their presentation is attached as Annex 2.

- Adoption Rate Assessment. What seems to be required to arrive at more realistic estimates of adoption rates is a better understanding of how the farmers would perceive the innovations proposed for promotion under the project, and how their behaviour could be influenced by various stimuli (eg. extension services, availability of inputs, credit, subsidies, guaranteed prices, security of tenure etc.). While the assessment of net returns per day of incremental family labour input may be one useful indicator of the financial incentive to small-scale farmers of adopting an innovation, provided that it can be compared with the returns which might be earned on alternative uses of the same labour resource, the conventional assessment of an internal financial rate of return is of little relevance to interpreting small farmer motivation. Indeed, even a potential increase in the return per man day of family labour may not be seen by the farmer as bringing benefits if it is merely the result of capital-intensive labour saving innovations in an environment with few alternative employment opportunities, or if it leads to a reduction in the net annual income accruing to the household, when land is in short supply. For anticipating farmer attitudes to technical change, it would be useful to make a routine pre-project assessment of the relative importance apparently given to returns on land, labour and cash in determining behaviour, as well as to containing risks, maintaining diversity or enhancing status in the community. If one knows which are more important, one can design technical and institutional approaches accordingly.

There is clearly room for ensuring that financial analysis is more obviously focussed on those aspects which really matter to farmers (or fishermen), and on acquiring a better understanding of the nature and extent of risks as perceived by the farmer (and means of reducing them to tolerable levels). But adoption rates are seldom influenced only by economic factors. Nutritional and taste considerations may play an important role in determining farmer response to new crop varieties, and social factors, such as age or religion and the sex differentiation of tasks and decision making within the household, may also be significant: it is interesting that the success of several rice production projects in West Africa was jeopardised by a failure at preparation and appraisal to recognise the need for special measures to ensure that women (who took the lead in

rice cultivation) could have access to credit. Similarly, a farm income analysis alone is of little relevance in reviewing livestock intensification programmes in communities in which stock holding represents an important source of savings.

A fuller discussion of systematic but relatively simple approaches to improving the prediction of adoption rates is given in Annex 3.

Improving Operational Approaches to Project Formulation

Raising Goverment Commitment. We cannot claim that the review demonstrates any relationship between either project performance or problem severity and the way in which project preparation was conducted. Although it is frequently claimed that commitment to a project can be enhanced by greater substantive government involvement in its preparation, a relatively low frequency is ascribed to "lack of government commitment" as a source of project problems - and usually such diminished commitment has been attributable to domestic political concerns or to disagreements on policy issues between the government and the financing institutions.

If any conclusions were to be drawn on the advantages and disadvantages of various levels of substantive government involvement in the project preparation process, a different sample of projects, comparing those prepared wholly by governments with ones prepared largely by external sources (including the Investment Centre) would have to be examined. There can be no doubt that it is easier to secure a higher degree of government identification with a project if senior government officials are fully involved in its preparation, but such involvement need not imply engaging them in the detailed aspects of preparing feasibility studies (which, in any case, is work which tends to be delegated to junior staff or specialised institutes which have no project implementation responsibilities). What is important is that they should subscribe or come to subscribe to the basic concepts on which the design of the project is based, and such a commitment is probably more efficiently secured through the thorough discussion of important issues than through the full participation of high-ranking staff in the nuts-and-bolts of project preparation.

Undoubtedly when a project preparation document is written outside the country, it is likely to reflect thinking which has evolved within the responsible team since its departure from the country and after it had reached a preliminary understanding on the project concept with the borrower. If such changes are significant or if a report betrays misunderstandings of technical or economic issues or of national policies, it could contribute to a reduced commitment to the project. It would seem that, even though such misreadings could be corrected at the time of appraisal, a thorough joint review of final preparation reports (as is done under the FAO Investment Centre programme with the Asian Development Bank) would offer one of the best means of strengthening government understanding and commitment to a project's goals. More use of this mechanism, of

post-preparation seminars within the country and occasionally of involving senior government officials in headquarters reviews of draft documents, would all appear to offer attractive means of increasing government commitment to projects.

Building National Project Preparation Capacities. This is not to imply that there is not room for developing greater indigenous project preparation capacities in borrower countries and, indeed, given the importance of the project as a vehicle for mobilising external finance, it is surprising that so few countries have yet succeeded in creating the necessary institutions. Amongst the reasons for this could be the focus given to the training of individuals (who quickly become upwardly mobile) rather than to the broader aspects of institutional development, but it may also be that the heavy emphasis assigned in most training activities to economic analysis fails to equip people with the wider range of skills required for project identification and preparation work. The discrete nature of projects and the relative ease with which their preparation can be contracted out may also contribute to a low priority being accorded to developing national capacity for such work. Where political conditions permit durable institutional arrangements for project preparation to be built up, this can only be done with a strong and sustained commitment by both the concerned government and the various financing institutions with which it is working. Recruitment and training plans need to be drawn up to address the long-term staffing needs of the institution and inputs of technical assistance need to be carefully orchestrated to fill gaps rather than to substitute for locally available staff. To expect the mere association of national staff with project preparation missions to have a significant training spin-off is, however, wishful thinking, and only a more purposeful and sustained approach to institutional development can be expected to bring about improvements in domestic project preparation capacities.

Increasing Beneficiary Participation. The issue of securing beneficiary participation in project design is still more complicated. In certain countries where there is a well institutionalised consultative structure (for example in the "organised" sector of the Yugoslav economy), it is quite easy to obtain formal approval for the contents of a project proposal from the principal beneficiaries. In most countries, however, there are few ready means of consulting systematically with the many small farmers who ultimately make up the typical beneficiaries of agricultural and rural development projects, and their views on priorities and the feasibility of different development options can only be assessed through the application of rapid rural appraisal techniques. Much has been done in recent years to improve these techniques, and there appears to be room for deliberately increasing their use in project identification work.

While the substantive involvement of beneficiaries in project preparation is a laudable but seldom very practical objective, particularly given the time frame in which project preparation so often takes place, the feasibility of projects often depends on the development of arrangements for securing the genuine involvement of beneficiaries in planning and decision-making during project implementation. If workable arrangements for this are to be

developed, it requires at the time of project preparation a heavy investment in socio-economic investigation 1/ and in designing and field testing models, an exercise which can also contribute to a deeper understanding on the part of the preparation team of the practical options for development. Several attempts have been made in recent years to combine the testing of participative or consultative mechanisms (to be applied during project implementation) with the generation of data on which to base project design assumptions, and it would seem opportune to distil some lessons from the experience.

The Project Preparation Environment

Although some of the activities set out above can be carried out by a reallocation of staff time between tasks or simply by using existing time commitments more efficiently by focussing systematically on essentials, most of the suggested approaches to improving the standards of project preparation require that more time be assigned for the work. It is also likely that, if the additional analyses were to be made, they would lead to more cautious assessments of investment requirements and hence to fewer and certainly smaller projects. As long as the major financing institutions are inclined to give greater weight in the evaluation of their performance and that of their staff to the number and size of loans advanced rather than to the ultimate results of the investments made, any proposal which increases administrative costs, contributes to delays in meeting loan processing target dates or reduces the size of justifiable loan commitments is not likely to attract the necessary management and financial support. The implication is that if the improvement of project preparation standards involves higher costs, it can only come about if the financing agencies and governments place a higher value on the success rate of projects than on the volume of loans committed, and are prepared to reflect this in their budgets 2/. If the administrative budgets of the financing institutions are over-stretched, then options for ensuring that borrowing countries assume a greater share of the financial costs of project preparation clearly have to be explored.

1/ Operational approaches to such work are proposed in Carloni, Alice: Briefing Paper on the Role of Sociological Analysis in Investment Centre Work for IFAD. Report No.104/89 DDC-GEN 14 SP.

2/ In spite of the importance attached to cost-benefit analysis in project justification, it tends to be ignored in assessing the marginal utility of investments in project preparation. Given the typically low cost of preparation relative to the size of loan commitments, a substantially increased expenditure could be justified by relatively small reductions in project costs or improvements in benefits.

The serious consideration currently being given to "de-linking" resource transfer concerns from commitments to specific projects could do much to reduce the dangers of over-dimensioning. The project preparation facilities of the financing institutions and FAO's Technical Cooperation Programme also offer useful mechanisms for funding pilot activities before the launching of large projects. However, as long as emphasis is given to speed in preparing projects and the very tight manpower allocations prevail, this will tend to inhibit the introduction of any improvements in project preparation techniques and hence continue to:

- Reduce the thoroughness with which alternative options are reviewed prior to the hardening of most aspects of project design;

- Preclude apparently necessary investigations and analyses;

- Make it difficult to carry the government and, still more, the beneficiaries along with a rapidly evolving project concept; and

- Restrict the range of disciplines that can be represented in the project preparation team to one which precludes specialised treatment of all major components.

Even if these restrictions were to be relieved, however, there are other aspects of the project preparation environment which tend to have an adverse effect on project quality and ultimately contribute to a disappointing performance. The most serious is the almost irresistible pressure for optimism on project feasibility which makes it nearly impossible to abort a project once it has been conceived and has found a place in a project pipeline. This is a complex problem which appears to have its origins not only in the importance attached within both governments and the financing institutions to achieving agreed lending targets but also in the perceptions of the individuals involved in the processing of projects that it is in their interest to ensure a successful outcome! Sometimes the very process of project preparation tends to generate amongst those most closely involved an enthusiasm and commitment to a successful result which leads to an under-estimation of the associated difficulties and risks.

VI. SOME OPERATIONAL IMPLICATIONS

This study has shown that there is considerable room for "designing out" many of the problems which agricultural development projects have encountered during their implementation. Other problems stem from the inherent uncertainties associated with any long-term projections of human and economic behaviour and from exogenous factors which may have a significant bearing on project performance.

In order to focus attention on those aspects of project performance which are susceptible to improvement at the design stage, and to summarise the main conclusions of the study, the checklist which follows at the end of this section has been prepared. It seeks to relate identified problems to their underlying causes and to possible means of reducing their incidence, to be applied at the time of project preparation.

The checklist contains few original proposals. What it calls for is a more rigorous analysis of those variables which experience suggests have the greatest impact on project performance levels. As long as project preparation is largely financed out of the limited administrative and technical assistance budgets of the financing institutions, some desirable investigations and analyses will have to be foregone. Not all the recommendations, however, call for a net increase in manpower allocations for project preparation. By deliberately building more flexibility into project design, for instance, some of the costly investigations conventionally required during project preparation may be avoided at that stage. Similarly there is room for shifting resources away from detailed economic analysis towards studies which increase the degree of confidence which can be placed in the cost and benefit streams on which the assessments of economic viability are based. In the same way the systematic application of rapid rural appraisal techniques could do much to improve the efficiency of field studies as well as the level of confidence to be placed in the findings. If used judiciously, computers should not only reduce the manpower needed for all quantitative analytical work but also make it possible to carry out additional relevant analyses with ease.

The study should not, therefore, be interpreted as a plea for the blanket allocation of extra resources for the preparation of agricultural development projects - though these could be put to good use. Its purpose is to ensure that the work which is undertaken is more accurately focussed on those aspects of project design which past experience suggests have a critical bearing on project performance and, by extension, on the achievement of ultimate goals.

A CHECKLIST OF PROBLEMS AND POSSIBLE REMEDIES

PROBLEM TYPE	PROBLEM SOURCES	POSSIBLE MEANS TO REDUCE PROBLEM AT PREPARATION
SCHEDULE TOO TIGHT	- Pervasive optimism 1/ - Use of intuitive approaches to setting schedules	- Evaluation of precedents & disbursement profiles - Task analysis (see Annex 1) - Critical path analysis (more complex projects)
UNDER-ESTIMATED COSTS	- Inaccurate specifications - Insufficient allowance for the unforeseen - Insufficient allowance for inflation	- Careful review of specifications and unit cost assumptions - especially for larger expenditure categories - Provide for adequate physical and price contingencies
PRODUCTION TECHNOLOGY DEFICIENCY	- Over-estimate of production intensity - Over-estimate of yields - Dependence on insufficiently locally tested technology - Over-estimate of adoption rate	- Thorough land evaluation studies - Check on population: land resources ratio - Check on constraints in proposed farming system (eg. peak labour demand, irregular input supply) - Assess precedents for assumed production increasing measures, ideally over several seasons, examining variability and implications on farm income - Analyse farm budgets and models from farmer's perspective - If insufficient precedents, propose pilot programme

1/ Pervasive optimism is a source of many of the problems faced by projects but only referred to explicitly under scheduling to avoid undue repetition.

A CHECKLIST OF PROBLEMS AND POSSIBLE REMEDIES

PROBLEM TYPE	PROBLEM SOURCES	POSSIBLE MEANS TO REDUCE PROBLEM AT PREPARATION
BAD MANAGEMENT AND STAFFING	- Tasks beyond capability of institutions - Endemic corruption or political interference	- Task and skill gap analysis - Training and technical assistance - Preparation of operating manuals to clarify responsibilities and procedures - Scale down or re-phase project to match managerial capacities and institutional environment
POOR ENGINEERING	- Poorly executed site surveys - Insufficiently detailed designs - Conceptually inappropriate design (eg. excessive complexity, insufficient robustness)	- On-site checking of basic surveys (topography, hydrology, water quality, etc.) - Completion of detailed designs for all major structures prior to final preparation - Matching designs to prevailing maintenance and operating standards
PROCUREMENT DIFFICULTIES	- Poor specification of items to be procured - Institutional inexperience with procurement under rules of financing institution	- Detailed specification of all major expenditure categories - Provision for tender document preparation during period between project appraisal and effectiveness - Training and technical assistance in procurement procedures

A CHECKLIST OF PROBLEMS AND POSSIBLE REMEDIES

PROBLEM TYPE	PROBLEM SOURCES	POSSIBLE MEANS TO REDUCE PROBLEM AT PREPARATION
POOR MONITORING AND EVALUATION	- Lack of clarity over objectives and indicators - Higher priority attached to implementation than monitoring/ evaluation - Inappropriate institutional arrangements	- Specification of key performance indicators - Design of institutions to be responsive to feed-back
WRONG ORGANISATIONAL STRUCTURE	- Insufficient authority or range of functions to implement project - Inter-agency coordination difficulties - Lack of motivation for staff	- Use professional management consultant to complete details of any significant exercise in institutional restructuring - Reduce needs for coordination by dropping peripheral components - Review terms and conditions of service
INEFFECTIVE TECHNICAL ASSISTANCE	- Lack of clarity of functions and institutional arrangements - Lack of counterpart staff - T/A staff unsuitable for assignment - Jealousies over differential terms and conditions of service	- Full specification of institutional location, role, terms of reference, required experience and selection procedures - Scale down project to fit national institutional capacity and minimise dependence on T/A (particularly long-term resident T/A)
TOO MANY COMPONENTS	- Inter-agency coordination difficulties - Differential levels of preparation and commitment	- Exclude potential components of peripheral importance or small scale - Use separate parallel or sequential projects rather than comprehensive projects to tackle wide ranging problems - Simplify decision-making system (especially through decentralisation)

A CHECKLIST OF PROBLEMS AND POSSIBLE REMEDIES

PROBLEM TYPE	PROBLEM SOURCES	POSSIBLE MEANS TO REDUCE PROBLEM AT PREPARATION
LOW OUTPUT PRICES AND MARKET PROBLEMS	- Over-production relative to potential growth in national demand - High transaction costs in marketing - Instability in international commodity markets - Overvalued exchange rate	- Market and price studies for major products - Assessment of comparative advantage - Diversification of output - Relate the project to structural adjustment processes
TOO BIG	- International lending pressures and national political considerations - Institutional incompetence - Budgetary non-sustainability	- Delinking of projects from resource transfer considerations - Careful appraisal of absorption capacity (assessment of institutional, budgetary, social constraints) - Minimise post-project recurrent costs
NON-SUSTAINABILITY	- Insufficient government and beneficiary commitment - Excessive dependence on T/A - High and non-recoverable recurrent and maintenance costs - Non-sustainable agricultural systems	- Application of participative planning methods - Improve means to work rather than increase staff numbers - Scale project down to reduce dependence on T/A - Design effective cost recovery system or transfer maintenance responsibility to beneficiaries - Assess resilience of proposed farming systems to adverse conditions

A CHECKLIST OF PROBLEMS AND POSSIBLE REMEDIES

PROBLEM TYPE	PROBLEM SOURCES	POSSIBLE MEANS TO REDUCE PROBLEM AT PREPARATION
INEQUITABLE BENEFIT DISTRIBUTION	- Elitist access to resources and services - Corruption and patronage	- Careful identification of target group and criteria for eligibility of access to project-financed goods - Setting of ceilings on levels of per caput project investments - Use of scale-neutral technologies - Promotion of beneficiary-run institutions
SLOW ADOPTION	- Non-viable or high risk technology - Social factor inhibiting change - Weaknesses in support services - Marketing difficulties	- Thorough evaluation of proposed technologies, including systematic assessment of risks (Annex 2 and 3) - Application of participative planning methods - Design of improvements in support services (extension, input supply, credit, land allocation etc.) - Thorough assessment of demand and market access for all main products
INSUFFICIENT GOVERNMENT COMMITMENT	- Irrelevance to national development strategies and political, social and economic situation - Disagreement between financing agency and government on key aspects of project design (or on broader policy issues)	- Increase government involvement in project identification (lead responsibility to be assumed by government, longer lead-times, seminars on project concept etc.) - Abort preparation when signs emerge of disagreement on fundamental aspects of design
RECURRENT BUDGET SHORTAGE	- Failure to provide counterpart funding - Failure to sustain funding for project after disbursement period	- Careful assessment of recurrent budget implications - Minimise staffing increases - Introduce self-financing mechanisms - Privatise services

A CHECKLIST OF PROBLEMS AND POSSIBLE REMEDIES

PROBLEM TYPE	PROBLEM SOURCES	POSSIBLE MEANS TO REDUCE PROBLEM AT PREPARATION
NATURAL DISASTER	- Project failure due to natural causes (eg. drought, flood, earthquake)	- Probability analysis of climatic and hydrological records - Selection of resilient technologies
POLITICAL TURMOIL/WAR	- Project failure due to collapse of institutional and economic environment	- Country risk assessment
LAND ACQUISITION DIFFICULTIES	- Non-availability of land for project works	- Review of land acquisition legislation and powers - Application of participative planning methods - Include land acquisition as condition of project effectiveness
INFLEXIBILITY	- Inability to adapt project to emerging information and changing circumstances	- Use of open-ended project formulation methodologies: . Annual operating plans . Mid-term reviews . "Funds" - Establishment of effective monitoring system and response capacity - Increase supervision inputs
RESOURCE DEGRADATION	- Over-exploitation of natural resources	- Environmental impact assessment studies

THE DESIGN OF AGRICULTURAL INVESTMENT PROJECTS

LESSONS FROM EXPERIENCE

SUMMARY CHARACTERISTICS OF REVIEWED PROJECTS

1 - Rural Development Projects

2 - Irrigation Projects

3 - Services Projects

4 - Livestock Projects

5 - Forestry Projects

6 - Fisheries Projects

SUMMARY CHARACTERISTICS OF REVIEWED PROJECTS

1 - RURAL DEVELOPMENT PROJECTS

COUNTRY AND PROJECT	FINANCING AGENCY	APPRAISAL COST (US $M)	ACTUAL COST (US $ M)	ACTUAL AS % OF APPRAISAL COST %	TIME OVER-RUN (YRS)	ERR AT APPRAISAL (%)	ACTUAL ERR (%)	MAJOR ADJUST-MENTS 1/	REMARKS
ASIA									
BANGLADESH: 1st Rural Development	IDA	24.7	18.4	75	2.5	40	12	I	Not yet complete
INDIA: Drought-Prone Areas	IBRD/IDA	102.7	84.3	82	1.0	12-23	Neg.-30	-	
INDONESIA: Sulawesi Paddy Land Dev.	IFAD	13.7	N.A.	N.A.	N.A.	N.A.	N.A.	A,I	
MALAYSIA: N.W. Selangor Int.Ag.Dev.	IBRD/IDA	60.0	87.0	145	2.0	21	8	I	
NEPAL: Rural Dev. (Nuwakot+Rasuwa)	IBRD/IDA	10.9	13.4	123	2.3	14	N.A.	A	
PHILIPPINES: Mindoro Rural Dev.	IBRD/IDA	50.0	64.0	128	3.0	18	15	-	
SRI LANKA: Badulla Rural Dev.	IFAD	11.2	N.A.	N.A.	N.A.	N.A.	N.A.	-	Not yet complete
EMENA									
CYPRUS: Pitsilia Int. Rur. Dev.	IBRD/IDA	21.0	24.3	116	1.0	12	16	A	
PDRY: Wadi Hadramaut Agric.	IBRD/IDA	7.7	11.2	145	3.0	17	8	-	
AFRICA									
GAMBIA: Rural Development	IBRD/IDA	11.7	15.9	186	0.5	27	7	-	
SENEGAL: 2nd Sedhiou	IDA/CCCE	11.9	9.0	76	0.8	23	6	I	
SIERRA LEONE: Magbosi IADP	IFAD	11.3	-	N.A.	N.A.	N.A.	N.A.	A	
LAC									
COLOMBIA: Caqueta Settlement	IBRD	37.1	40.4	109	3.2	13.8	11.0	-	

1/ A = between preparation and appraisal
I = during implementation

SUMMARY CHARACTERISTICS OF REVIEWED PROJECTS

2 - IRRIGATION PROJECTS

COUNTRY AND PROJECT	FINANCING AGENCY	APPRAISAL COST (US $ M)	ACTUAL COST (US $ M)	ACTUAL AS % OF APPRAISAL COST %	TIME OVER-RUN (YRS)	ERR AT APPRAISAL (%)	ACTUAL ERR (%)	MAJOR ADJUST-MENTS 1/	REMARKS
ASIA									
INDIA: Chambal CAD (Rajasthan)	IBRD	91.5	98.2	107	1.0	19	17	I	
INDIA: Chambal CAD (M. Pradesh)	IBRD	46.6	43.4	93	1.5	22	21	-	
INDIA: Karnataka Irrigation	IDA	284.4	478.6	168	4.5	16	NA	I	
KOREA: Yong Sang Gang Irrigation	IBRD	88.6	172.3	194	2.0	13	12	A,I	
EMENA									
GREECE: Yannitsa Irrigation	IBRD	50.8	100.0	197	3.5	14	11	I	
GREECE: East Vermion Irrigation	IBRD	89.8	104.6	116	6.5	18	15	A,I	
MOROCCO: Doukkala I Irrigation	IBRD	94.4	85.0	90	1.0	11	20	-	
MOROCCO: Souss Groundwater	IBRD	39.0	44.5	115	1.3	10	14	I	
TUNISIA: Medjerda/Nebhana Irrig.	IBRD	23.8	23.0	97	1.0	28	32	A,I	
YAR: Tihama Irrigation	IBRD/IDA	17.5	39.22	224	1.5	13	22	I	
AFRICA									
CAMEROON: Semry Rice	IDA/FAC/CCCE	9.8	9.3	95	0.1	11	23	-	
GAMBIA: Rice	IDA	1.5	1.6	109	1.5	30	22	-	
MALI: Mopti Rice	IDA/FAC	9.4	13.1	139	0.7	14	17	-	
SENEGAL: River Polders	IDA	7.4	14.4	195	1.6	14	Neg to 6	I	
SENEGAL: Casamance Rice	IDA	4.9	5.4	110	-	18	23	I	
LAC									
ECUADOR: Milagro Irrigation	IBRD	10.2	15.0	147	5.0	16	3	I	

1/ A = between preparation and appraisal
I = during implementation

SUMMARY CHARACTERISTICS OF REVIEWED PROJECTS

3 - SERVICES PROJECTS

COUNTRY AND PROJECT		FINANCING AGENCY	APPRAISAL COST (US $ M)	ACTUAL COST (US $ M)	ACTUAL AS % OF APPRAISAL COST %	TIME OVER-RUN (YRS)	ERR AT APPRAISAL (%)	ACTUAL ERR (%)	MAJOR ADJUST-MENTS 1/	REMARKS
ASIA										
BANGLADESH:	Extn. & Research I	IDA	16.3	14.2	87	1.6	50	over 20	A	
INDONESIA:	Seeds I	IDA	12.0	22.7	189	1.3	58	11	I	
INDIA:	Tarai Seeds	IBRD	22.4	21.8	97	3.8	17	18	-	
INDIA:	Extension Projects									
	. Composite	IBRD	53.0	77.5	145	0.5	NA	NA	-	Not CP
	. Orissa	IBRD	40.0	35.3	71	0.5	NA	NA	-	
	. Mahdya Pradesh	IBRD	20.8	18.4	89	-	NA	NA	-	Not CP
	. Assam	IBRD	16.4	11.6	71	-	NA	NA	-	
	. Bihar	IDA	16.0	27.0	169	1.4	50	NA	I	
MALAYSIA:	Agr. Research + Extn.	IBRD	108.5	119.5	110	2.3	NA	NA	I	Reappraised
EMENA										
SPAIN:	Agr. Research	IBRD	26.0	30.3	116	3.5	NA	NA	A	
LAC										
COSTA RICA:	Agr. Credit + Dev.	IBRD	37.6	35.6	95	1.6	16	16	-	
HONDURAS:	2nd Agr. Credit	IBRD	38.5	38.4	99	-	55	29-33	-	
PARAGUAY:	Small Farmer Cred. + Dev.	IBRD	15.8	25.2	159	-	13	12	-	

1/ A = between preparation and appraisal
I = during implementation

SUMMARY CHARACTERISTICS OF REVIEWED PROJECTS

4 - LIVESTOCK PROJECTS

COUNTRY AND PROJECT		FINANCING AGENCY	APPRAISAL COST (US $ M)	ACTUAL COST (US $ M)	ACTUAL AS % OF APPRAISAL COST %	TIME OVER-RUN (YRS)	ERR AT APPRAISAL (%)	ACTUAL ERR (%)	MAJOR ADJUST-MENTS 1/	REMARKS
EMENA										
SYRIA:	Livestock I	WB	34.5	46.7	135	1.0	21	±21	-	
TURKEY:	Livestock II	WB	28.3	28.3	100	3.0	20	23	-	
AFRICA										
CHAD:	Livestock	IDA	3.4	2.7	79	3.4	11	neg.	I	Drought/war
KENYA:	Livestock I	IDA	11.4	11.5	101	N.A.	N.A.	low	-	
KENYA:	Livestock II	IDA/WB	59.0	69.8	117	2.0	25	0	-	Not CP
MADAGASCAR:	1st Vill. Livestock	IDA	9.6	8.1	84	4.0	69	19	-	
MAURITANIA:	Livestock Development	IDA	5.9	5.9	100	2.0	20	N.A.	I	Drought
TANZANIA:	Livestock II	IDA	24.7	49.0	198	1.0	N.A.	neg.	I	
ZAIRE:	Livestock I	IDA	15.0	12.9	86	3.0	N.A.	N.A.	-	
LAC										
BOLIVIA:	Livestock III	IDA	11.0	15.9	144	0.5	18	10	-	Not CP
BOLIVIA:	Agr. Credit I	IDA/WB	11.0	11.3	103	1.5	22	10-15	-	
BRAZIL:	Livestock I	WB	80.0	81.8	102	1.3	23	8	-	
BRAZIL:	Livestock II	WB	52.0	52.0	100	0.8	18	8	-	
CHILE:	Livestock/Fruits	WB	62.5	62.5	100	0.3	29	over 20	-	
GUATEMALA:	Livestock Development	IDA	7.8	10.7	138	2.5	13	12	I	
HONDURAS:	Livestock II	IDA	11.0	12.6	114	1.0	N.A.	N.A.	I	
PANAMA:	Livestock I.	WB	13.5	12.7	94	2.3	15	8	-	
PARAGUAY:	Livestock/R.D.	WB	25.9	26.4	102	1.0	15	12	-	
PARAGUAY:	Livestock VI	WB	60.0	60.5	101	0	32	N.A.	-	
URUGUAY:	Livestock V	WB	37.7	30.4	93	2.0	N.A.	N.A.	-	

1/ A = between preparation and appraisal
I = during implementation

SUMMARY CHARACTERISTICS OF REVIEWED PROJECTS

5 - FORESTRY PROJECTS

COUNTRY AND PROJECT		FINANCING AGENCY	APPRAISAL COST (US $ M)	ACTUAL COST (US $ M)	ACTUAL AS % OF APPRAISAL COST %	TIME OVER-RUN (YRS)	ERR AT APPRAISAL (%)	ACTUAL ERR (%)	MAJOR ADJUST-MENTS 1/	REMARKS
ASIA										
BANGLADESH:	Community Forestry	AsDB	16.8	N.A.	N.A.	N.A.	N.A.	N.A.	-	
BANGLADESH:	Mangrove Afforestation	IDA	17.2	10.9	64	0.5	21	18	-	
BURMA:	1st Forestry	IDA	35.8	42.6	119	2.5	100+	100+	-	
INDIA:	Madhya Pradesh Forestry	IDA	8.2	6.0	73	1.7	N.A.	N.A.	-	
INDIA:	Uttar Pradesh Forestry	IDA	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	-	
MALAYSIA:	Jengka Forestry	IBRD	12.4	N.A.	N.A.	N.A.	29	Neg.	-	
AFRICA										
KENYA:	2nd Forestry	IBRD/IDA	55.5	62.0	112	0	18-23	9-13	I	
MADAGASCAR:	1st Mangoro Forestry	IBRD/IDA	17.2	20.2	117	0	13	7	-	
NIGER:	1st Forestry	IDA	5.3	5.3	0	0.6	12	6	-	
TANZANIA:	Sao Hill Forestry	IBRD	8.1	8.0	98	0	13.5	21	-	

1/ A = between preparation and appraisal
I = during implementation

SUMMARY CHARACTERISTICS OF REVIEWED PROJECTS

6 - FISHERIES PROJECTS

COUNTRY AND PROJECT	FINANCING AGENCY	APPRAISAL COST (US $ M)	ACTUAL COST (US $ M)	ACTUAL AS % OF APPRAISAL COST %	TIME OVER-RUN (YRS)	ERR AT APPRAISAL (%)	ACTUAL ERR (%)	MAJOR ADJUST-MENTS 1/	REMARKS
ASIA									
INDONESIA: Fisheries I	IDA	4.3	8.3	193	3.9	26	Neg.	I	
EMENA									
PDRY: Fisheries I	IDA	4.3	6.2	147	2.7	30	13	A	
PDRY: Fisheries II	IDA	32.0	48.4	151.3	0	27	14	I	

1/ A = between preparation and appraisal
I = during implementation

THE DESIGN OF AGRICULTURAL INVESTMENT PROJECTS

LESSONS FROM EXPERIENCE

TASK ANALYSIS AND ACTIVITY SCHEDULING 1/

Introduction

This study has shown that the most frequent problem encountered by the agricultural projects which it has reviewed was that they fell behind schedule, often by as much as several years. The delays which occurred implied major changes in the timing of both costs and benefits and hence in the economic viability of the investments. A prolongation of disbursement periods also contributed to increased administrative costs for the financing agencies because of the need to extend the period during which projects were subject to supervision.

It seems that the main reason for disbursements lagging behind targets was that the targets themselves were unrealistic. In contrast to the considerable effort made in analysing the economic and financial benefits of projects, only cursory attention is conventionally given to making an analysis of the time needed to carry out the actions implied by the project and to relate this to the projection of disbursement schedules.

There are, of course, exceptions to such a generalisation, and considerable attention is usually given to scheduling in major construction projects. Various forms of network analysis and critical path analysis have been developed in recent years as an aid to planning and management. These methods of analysis - of which the mostly widely used is PERT (Programme Evaluation and Review Technique) - result in a graphical representation of the flow of actions required to attain a given objective, in the sequence in which they are to be carried out, and indicate the ways in which they depend on each other. By identifying the "critical path" - i.e. the succession of activities on which the completion date for the whole project depends - such methods focus management attention on those aspects which are most important for the timely achievement of objectives.

Such methods of analysis could usefully be applied more widely in project preparation, but their application takes time and may require skills not always available to the preparation team. They may also not be necessary in many cases. Rather, what appears to be generally required is simply to shift from an intuitive approach to

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1/ Derived from a working paper prepared by J. Chabloz (FAO Investment Centre).

scheduling to a more disciplined method of "thinking through" what steps are implied in implementing each project component, attributing a time period for the accomplishment of each step which is close to the norms prevailing in the country in which the project is located.

The purpose of this Annex is to suggest very simple approaches to scheduling which could lead to significant improvements in project design without placing exceptional demands on time or special skills.

Steps in Task Analysis

Task analysis is essentially an iterative process, but its application to project preparation may be usefully considered as involving four steps.

1. Definition of objectives and components.

2. Analysis of activities.

3. Identification of prerequisites.

4. Integration.

Defining Objectives and Components

The starting point, not only for task analysis but also for the preparation of cost estimates and eventual economic analyses, is a clear definition of a project's objectives and the components which will contribute to the achievement of these objectives. Thus, for example, a country might adopt the objective of increasing foreign exchange earnings through the increasing tea production. Components through which this would be achieved could consist of rehabilitation of tea grown by small-holders on 1,500 ha and new tea planting by parastatals on 1,000 ha.

Components may in turn be broken down into sub-components: for the small-holder component, for instance, there could be sub-components for farm development, supply of planting material and provision of extension services.

Once components and sub-components have been defined, activities need to be distinguished. In investment projects these can conveniently be related to the categories of expenditure 1/, which would be incurred. In the above example, for instance, the sub-component for improving the extension services could include expenditure categories for:

1/ This terminology and the suggested analytical framework deliberately correspond with that used in COSTAB, a computer programme developed by the World Bank for the presentation of project costs.

(a) civil works (eg. construction of an office)
(b) equipment (eg.office equipment and vehicles)
(c) staff training
(d) technical assistance
(e) incremental operating costs associated with recruitment of additional staff.

Analysing Activities

Analysis of the activities can be carried out in two steps: first to identify the tasks or actions involved in completing each activity, the time required for each task to be completed and the responsibility for carring it out, and secondly to establish a logical sequence between tasks under each component or sub-component.

Still using the tea production project as an example, the time taken to complete the construction of the office, from the date on which the decision to proceed was taken, could be derived as follows:

(a) Task definition

Activity: Construct Office

Task	Time Required (months)	Responsibility
Complete architectural drawing	3	Consulting Firm
Prepare tender documents	1	Administration
Tendering/award of contract	3	Administration
Construction	4	Contractors
Land survey and acquisition	6	Administration

(b) Task sequencing

This is most readily done in the form of a bar chart, for instance as follows:

Task — Time Required (months)

	0	3	6	9	12	15
Complete drawings		-------				
Tender documents			---			
Tender/award contract				------		
Construction					---------	
Land survey/acquisition	----------					

Task analysis to this level of detail is, of course, often quite unnecessary because there are accepted national norms for the time required to complete certain types of activities. For instance, it may be accepted as a norm that it takes 12 to 15 months to organise and complete the construction of an office. As there is often pervasive optimism surrounding estimates of the time required to carry out activities, some checking on precedents as well as clarification of exactly what in implied the norms may, however, contribute to realistic scheduling. In the example above, for instance it would be correct to say that only four months are required to construct an office but, in practice, the lapsed time from the decision to construct until the commissioning of the building is 3.5 times as long!

(c) Activity sequencing

For any project component or sub-component, there must be an optimum scheduling of activities, with costs implied in any departure from it. In the case of the small-holder tea extension service, for instance:

- recruitment of staff must precede training;
- unless alternative accomodation can be provided, staff cannot be mobilised until office space is available;
- vehicles must be available for field staff to be able to operate, once recruited;
- if the objective of technical assistance is to help in staff training, this, too, should be provided after staff are in place;
- and so on.

If these considerations are taken into account an activity schedule could be assembled, as follows;

Sub-component: Extension Service

	Time Required (months)				
Activity	0	6	12	18	24
Office construction	----------				
Equipment/vehicles procurement		----------			
Staff recruitment			----------		
Technical assistance			----------		
Commence effective operation					

Identifying Prerequisites

Not all actions required to make a project operable are specific to its components or directly related to the completion of the activities being financed. Constraints may be present in the overall policy, institutional or legal environment which have to be addressed before any specific actions can be taken by the project. For instance, a legislative act establishing a new institution may have to be drafted and subjected to a parliamentary vote before the institution is empowered to appoint staff. Alternatively a project might be dependent on progress in other projects lying beyond its influence (eg. the improvement of an irrigation system being dependent on supplies of water from an independently constructed hydroelectric scheme). Sometimes there are seasonal constraints on certain types of activity (especially construction).

The identification of such prerequisite factors and estimates of the time likely to be required to remove any constraints imposed on the project are clearly important elements in realistic scheduling.

Integration

As in the case of task/activity analysis, the simplest way of illustrating integrated schedules for a project's various components is through the use of bar charts. Although far less informative than more comprehensive forms of network analysis, their use obliges the project analyst to make considered judgements on questions of phasing. Moreover, they are sufficiently accurate to provide a reasonable basis from which the annual requirements for financial allocations can readily be derived.

Whatever method of presentation is adopted, the essential requirement is to define the key parameters to be used in establishing a realistic schedule. For the example to which we have already made reference, we could set the following phasing criteria.

(a) Prerequisites: Enabling legislation for setting up specialised small holder tea development agency - time required nine months, of which six months would be before loan effectiveness;

(b) small farm development to proceed only after extension service has been set up and staff trained. One year required for land preparation before replanting takes place;

(c) eighteen months required between establishment of nurseries and production of clonal planting material;

(d) Parastatal component operates independently of the new institution and uses its own existing sources of planting material.

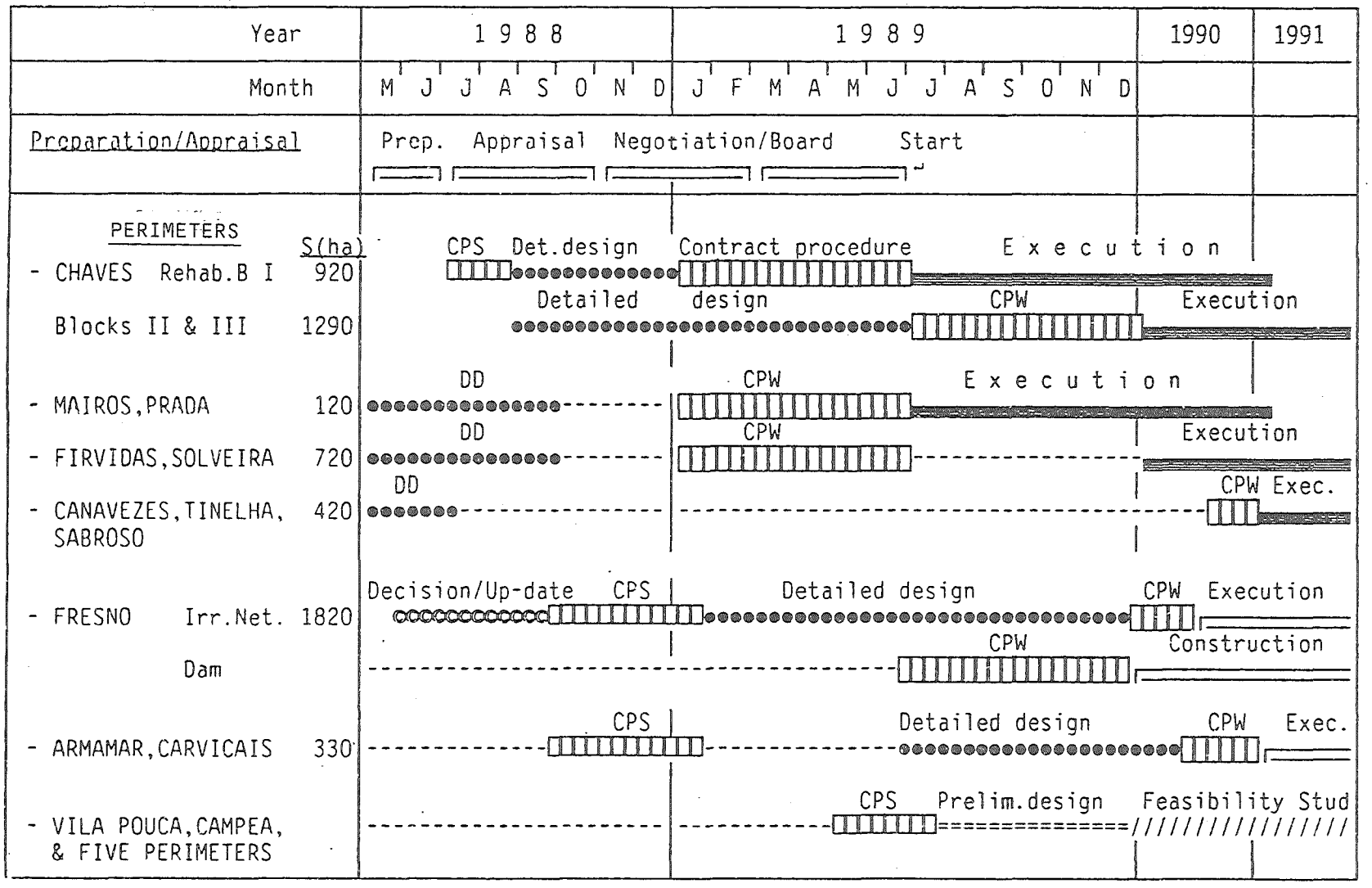
If these parameters are applied, a bar chart consolidating the phasing of the main components and sub-components of the project, can be prepared as follows:

	Implementation Schedule					
			Year			
Component/Sub-component	0	1	2	3	4	5
(a) Small-holder tea rehabilitation						
Legislation for new agency	----					
Extension service development		----------				
Nursery development/ operation			----------	----------		
Farm development						
- land preparation			----	----		
- planting				----	----	
(b) Parastatal tea replanting	----	----	----	----	----	

Such a chart represents a crude but simple approach to depicting scheduling, but leads to forecasts which are undoubtedly useful in preparing estimates of disbursements.

With relatively small increase in preparation efforts, more sophisticated schedules can be prepared, which are considerably more informative. Table 1 is a more refined bar-chart, indicating the proposed timing of a series of studies in relation to the project preparation and appraisal schedule for a series of irrigation projects. Tables 2 and 3 are examples of a logical network and the derived time schedule for the commissioning of an irrigation scheme. They have the advantages of not only leading to the construction of a realistic time schedule but also of indicating organisational responsibilities and the "critical path" on which the achievement of target dates depends.

PORTUGAL - Northern Regional Development Project - NEW IRRIGATION SCHEMES - Phasing of studies

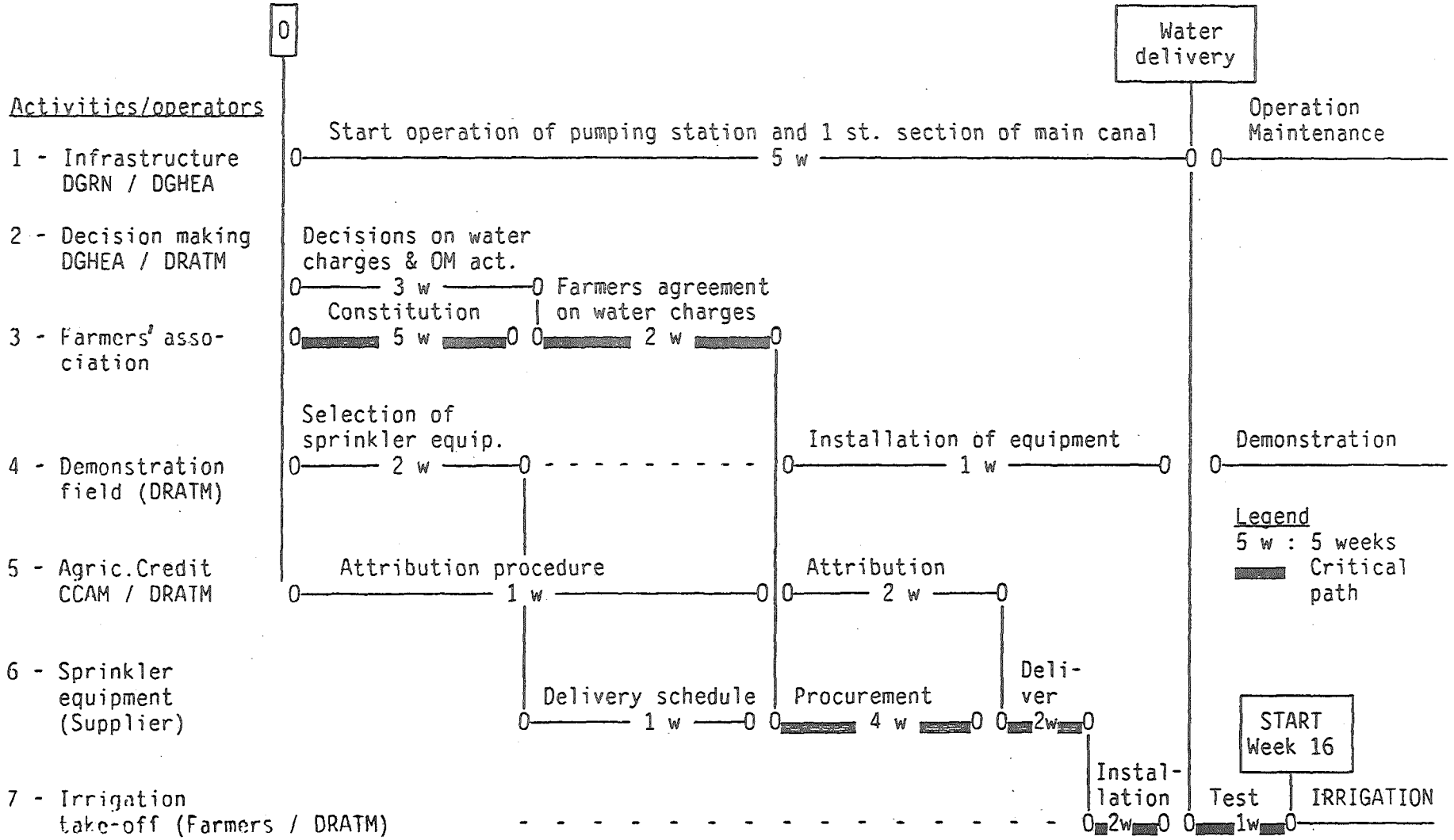


Legend: CPS Contract procedure for studies - CPW Contract procedure for works - DD Detailed designs

ANNEX 1
Table 1

PORTUGAL - Northern Regional Development Project

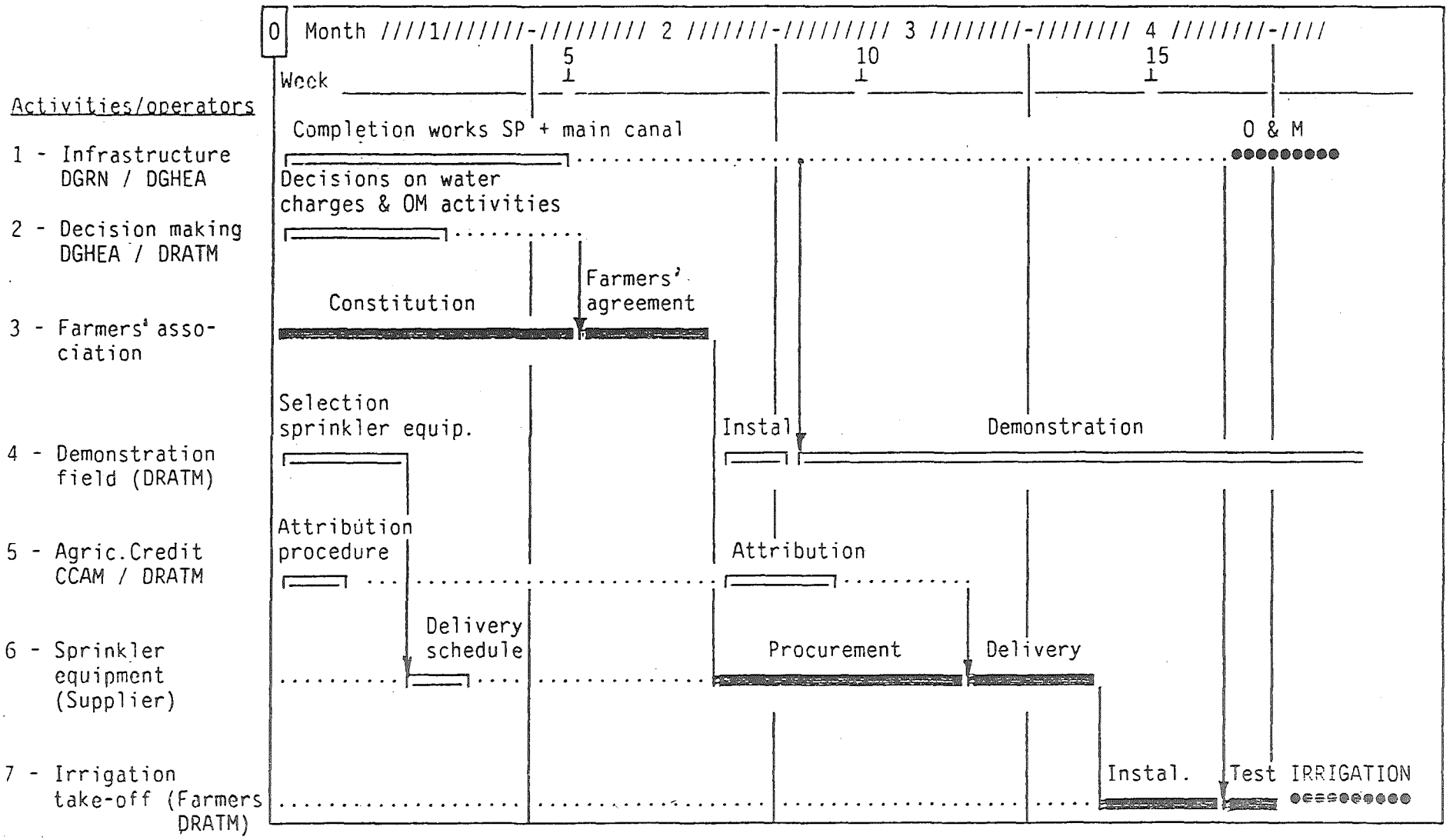
MACEDO PERIMETER (Azibo River) - Irrigation take-off - Logical network



ANNEX 1
Table 2

PORTUGAL - Northern Regional Development Project

MACEDO PERIMETER (Azibo River) - Irrigation take-off Time schedule



ANNEX 1
Table 3

THE DESIGN OF AGRICULTURAL INVESTMENT PROJECTS

LESSONS FROM EXPERIENCE

ROUGH CROP YIELD VARIABILITY PREDICTIONS

Introduction

Conventionally in agricultural project preparation work the analysis of farm budgets and of projects is based on the implied assumption that all farmers will attain certain projected "average" yields. While the economic viability of a project is sometimes tested for its sensitivity to potential shortfalls in aggregate production, similar tests are seldom, if ever, made at the level of the farm model.

One reason for the lack of attention given to establishing the probable extent of farm income variability is that risk analysis in general tends to be complex and the estimation of the extent of risk exposure of the individual farmer has usually to be hypothetical, for lack of complete data.

Yield variability is undoubtedly a main cause of variation in the financial performance of individual farmers. As such, it is probably also a principal cause for the non-repayment of agricultural credit, the progressive increase in the number of farmers disqualified from access to credit and the consequent poor performance of rural credit institutions. In addition, farmers' own assessments of potential yield variations may make them reluctant to take up recommended technologies (see Annex 3).

This is not to imply that net income variations due to price fluctuations are not also of importance as a source of financial problems at the farm level - especially when farms are geared to producing high value perishable commodities. Price changes, however, tend, at least under free market conditions, to compensate in part for between-crop-cycle yield variations.

The purpose of this note is to question whether, under certain circumstances, it would not be prudent to test the results of farm models for their sensitivity to crop yield variability (especially in the earlier years of a project) so as to identify probable levels of failure as well as possible remedial measures. While recognizing that actuarial techniques exist which could provide an accurate assessment of risk in a given population of farmers, the note explores more "rough and ready" means of predicting production variability which require only a limited amount of data collection and analysis.

Sources and Extent of Yield Variability

It may be useful to visualize yield and production variability as occurring:

(a) between farmers within the same crop cycle period;

(b) between successive crop cycle periods.

Even under the most homogenous physical conditions, there is generally a considerable range between farms in yields of the same variety of the same crop, which reflects variations in farming skills - particularly the timeliness of operations, quality of seed bed preparation, frequency of weeding etc. At a time when a new technology is being introduced, the variations in performance between farmers will tend to increase: once the situation has again become stable, the inter-farm range in yields is likely to be greater in absolute and often proportionate terms with the new technology than with the comparable traditional technology. This may be illustrated by figures for rainfed maize from the Philippines.

Variety	Min. Yield	Max. Yield	Mean Yield
	.....	(kg/ha)	
Local Variety (Zamboanga) a/	560	1,000	690
Improved Variety (Zamboanga) a/	125	3,625	1,230
Hybrid (Government forecast) b/	1,500	7,000	4,500

Source: a/ PADAP Project (actual)
b/ Maisagana Programme

It must also be obvious that, as the range of soil and topographical conditions widens, so must the variability in crop performance between farmers. For short-term crops variability is predictably lowest in reliably irrigated areas and highest in rainfed areas with low average rainfall. For example, yields obtained by 36 farmers for hybrid corn grown on deep soils under partial irrigation and ideal rainfall conditions at Coronadal (Mindanao - Philippines) varied by as little as from 4,000 to 5,500 kg per ha during the same season.

Yield variability between farms is also likely to be less for permanent than short-term crops. Similarly, variability in the aggregate value of production will tend to be lower both between farmers and between years when farms are diversified rather than concentrating on the production of a single crop.

The main source of inter-cyclical crop performance variation is environmental and particularly meteorological. Although occasionally events of meteorological origin (eg. flash floods, hail storms, tornadoes) may affect only a limited number of farmers, generally their effects are widespread. Typical meteorological causes of crop performance variation are differences in rainfall amounts and their distribution in time, changes in timing of first and last frosts, typhoon incidence etc. Pest and disease incidence is also frequently accentuated by adverse meteorological conditions.

Where only one of these factors has a major determining influence on yields, prediction is relatively simple. For example, rainfed wheat yields in low rainfall areas may often be roughly correlated with rainfall levels during the growing season. A more sophisticated risk analysis, however, was considered necessary in order to identify the optimum areas for planting cotton in the Philippines and the level of incentive for the farmer to grow the crop, in which account was taken of the probability of damage by typhoons, flood, drought and pests 1/.

The main causes of production variability referred to above may be summarised as follows:

Sources of High Variability	Sources of Low Variability
Intra-cyclical	
Rainfed conditions	Irrigation
Low rainfall	High rainfall
Short-term crops	Long-term crops
Monocrops	Mixed farming
"Modern" technology	Traditional technology
Shallow soils	Deep soils
Inter-cyclical	
Disaster proneness (low rainfall, typhoon, flood etc.)	Benign environment

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1/ See: Philippines: Cotton Development Project Preparation Mission Report, FAO Investment Centre.

Measurement of Variability

Yield variability may readily be described statistically by means of frequency distributions. Various formulae are available for translating frequency distributions into mathematical terms, which indicate the extent of dispersion and the degree of skewness. The simplest indicator of the range (or extent of dispersion) of yields is the coefficient of variance which is a way of expressing standard deviation as a percentage of the arithmetic mean of a given set of data. The higher the coefficient of variance, the wider the spread of results about the mean and hence the larger the proportion of the sample population which will not attain the average yields predicted. An illustration of calculated standard deviations and coefficients of variance, drawn from the Philippines Cotton Development Project report, is given in Table 1.

Visual inspection of the table suggests inter alia that there is a much greater degree of risk of not achieving the mean yield of tobacco than, say, corn; and that, for most crops, except for vegetables, production in Luzon is more susceptible to risk of gross income fluctuation than elsewhere in the Philippines.

Measures of skewness broadly indicate the extent to which the arithmetic mean is above or below the median in any set of values. When the distribution is positively skewed (i.e. the arithmetic mean is above the median value), this implies that a few high values are pulling up the arithmetic mean and hence that more than 50% of the population fail to achieve the mean yield. Skewness can be expressed mathematically ($3\ 1\frac{1}{N}(x - AM)\ 3$), but the resultant figures may be difficult for the layman to interpret.

It is largely because of the problems which many of us have with understanding and applying mathematical methods of statistical analysis, that there would appear to be advantages in resorting to graphical forms of presentation. Frequency distributions can be either presented in absolute or cumulative terms, as is illustrated with data from the PADAP project in Zamboanga (Philippines). Figure 1 shows the absolute distribution of farmer yields for four different crops, while the data for rice are expressed in Figure 2 in cumulative terms 1/. Presentation as in Figure 1 provides a clear visual impression of both dispersion and skewness (as is well-illustrated by the comparison between mungbean for phase 3 and phase 4). The use of a cumulative form of presentation, however, permits a more ready analysis of the implications of the frequency distribution. Where large variations in yield occur, there may be advantages in using log paper for illustrative purposes.

1/ Original data not available, and hence cumulative data have been derived from Figure 1.

Thus, with a knowledge of the typical costs and returns associated with a given production system, it is possible to derive estimates from Figure 2 of the proportion of farmers which have been able to cover their production costs. In this particular case, the price of rice was P1.19 per kg: cash expenditure was P1,900 per ha, and the imputed value of family labour P582 per ha. By converting these costs to kg of rice equivalent, it may be demonstrated that only about 11.5% of farmers would not normally cover their cash costs and that about 85% of farmers could be expected to cover their total production costs (including family labour) from returns in the year to which the data refer - suggesting that the cultivation of upland rice was relatively free of risk.

The assessment of yield variability and risk of loss would, of course, be more accurate if it were based on records of the performance of individual farmers over several successive crop seasons, but data on this are seldom available. A rough estimate (which it is contended is better than no assessment at all) could be made by establishing the approximate frequency of adverse environmental events and the recollected extent of crop failure usually found to occur as a result of such events. Thus, if it was assumed that, in the Philippines rice crop example, the base data referred to a normal year but that a serious typhoon affected the area every five years, resulting in a total crop loss for 30% of the farmers, the frequency curve could be shifted downwards and to the right, to originate on the base line, at a point corresponding to 6% (i.e. 30% of 20%). Under such assumptions, the proportion of farmers failing to cover total costs would have risen from about 15% to 22% (Figure 2, Curve B).

A second set of data, drawn from an FAO/UNDP project which developed new cropping systems for upland areas in South Sumatra (Indonesia), is given in Figures 3 and 4. Figure 3 illustrates the range in gross value of production (expressed in kg rice equivalent) between farms over a one year period under a traditional cropping system and under two new systems. Within each group, all farmers have used more or less the same level of inputs. Among the observations which can readily be derived from this graph are the following:

- Although the traditional cropping pattern (cv 11.8%) is much lower yielding than either of the improved cropping patterns (ICP 1 and 2), it is significantly more reliable.

- ICP 1 (cv 16%) is a more stable system than ICP 2 (cv 26.8%), and higher yielding overall: however, the average yield of ICP 1 is significantly affected by the exceptionally high performance of a few farmers (positively skewed) and hence as many as 72% of farmers do not achieve average yields (compared to 61% of farmers who do not achieve average yields with ICP 2).

- The minimum yields of all systems are sufficient to cover all material costs (BEPM - break-even point, materials); however, the materials costs of the new systems are about eight times as high as those of the traditional system.

- If all costs (including labour) were calculated at market rates (BEPT), no farmers would cover their costs under the traditional system, and just over half the farmers adopting the new systems would not have sufficient production to cover total costs. (This analysis could be extended, for instance, to show that if all labour over and above that provided under the traditional system was to be hired, the break-even point would be met by all farmers adopting ICP 2 but not by about 6.5% of the farmers adopting ICP 1).

Figure 4 applies similar graphical techniques to highlight the features of the components of ICP 1, and shows (as would be expected) that each of the components of ICP 1 is much more prone to yield variability than the cropping system as a whole.

Apart from emphasising the advantages of diversification as a means of reducing risk at the farm level, the illustration also prompts questions about the soundness of the conventional rural credit institution practice of financing specific crops (eg. rice - cv 29.6%) rather than crop combinations (eg. ICP 1 - cv 16%).

Data Requirements

The data required to permit the kinds of analyses outlined above are modest. Cost and price data are normally collected and computed in the course of project preparation work. Extremely crude estimates of yield variability for a crop may be derived from judgements on likely minimum, maximum and average yields, and various hypotheses tested on the shape of the distribution curve. The shape (particularly the skewness) of the frequency distribution curve can only be determined with some certainty, however, once data have been drawn from a sufficiently large sample to permit the definition of values for the median and the standard deviation. For all our purposes proof of statistical accuracy is not important, and it should be possible in most cases to establish sufficiently representative curves by questioning 20-30 farmers in order to identify yield levels for major crops in "normal" years, the frequency of "adverse events" and the impact on yields of such events.

Applicability

A subjective assessment of production variability and related risks is necessary in the review of the financial and economic benefits of most agricultural projects, and it has become conventional

to test the sensitivity of projects at the aggregate level to the effects of changes in yield and price assumptions. The application of formal risk analysis techniques is probably only justified (because of the large data requirements and the time needed) for a very small proportion of projects. It is suggested, however, that the use of an intermediate form of analysis such as that outlined above might be justified in the preparation of most projects as a rough means of assessing the extent of risk at the farm level and the validity of possible means of reducing this.

The obvious priority candidates for such analysis are projects which support the intensification of rainfed farming based on a narrow range of short-term crops, grown by small farmers with few sources of off-farm income.

PHILIPPINES

COTTON DEVELOPMENT PROJECT

RISK ANALYSIS

Expected Gross 1979 Trend Return per Planted Ha., Standard Deviation of Return per Ha (Residuals from Trend), and Percent Coefficient of Variation

Expected Gross Return per Ha. (P/Ha)

Crop	Phillip.	Ilocos	Cagayan Valley	Central Luzon	South Tagalog	Western Visayas	Mindanao
Palay (Rice)	1704	1722	1826	2197	1676	1598	1948
Corn	854	660	908	826	1127	724	1166
Vegetables	12377	11765	7479	10675	12071	25668	11374
Tobacco	4045	5922	2773	1220	2946	-	2327

Standard Deviation of Gross Return per Planted Ha (P/Ha)

Palay	197	272	178	365	223	250	84
Corn	75	89	67	83	61	56	104
Vegetables	1846	1952	1334	2803	1091	2585	1474
Tobacco	528	1009	610	500	1045	-	709

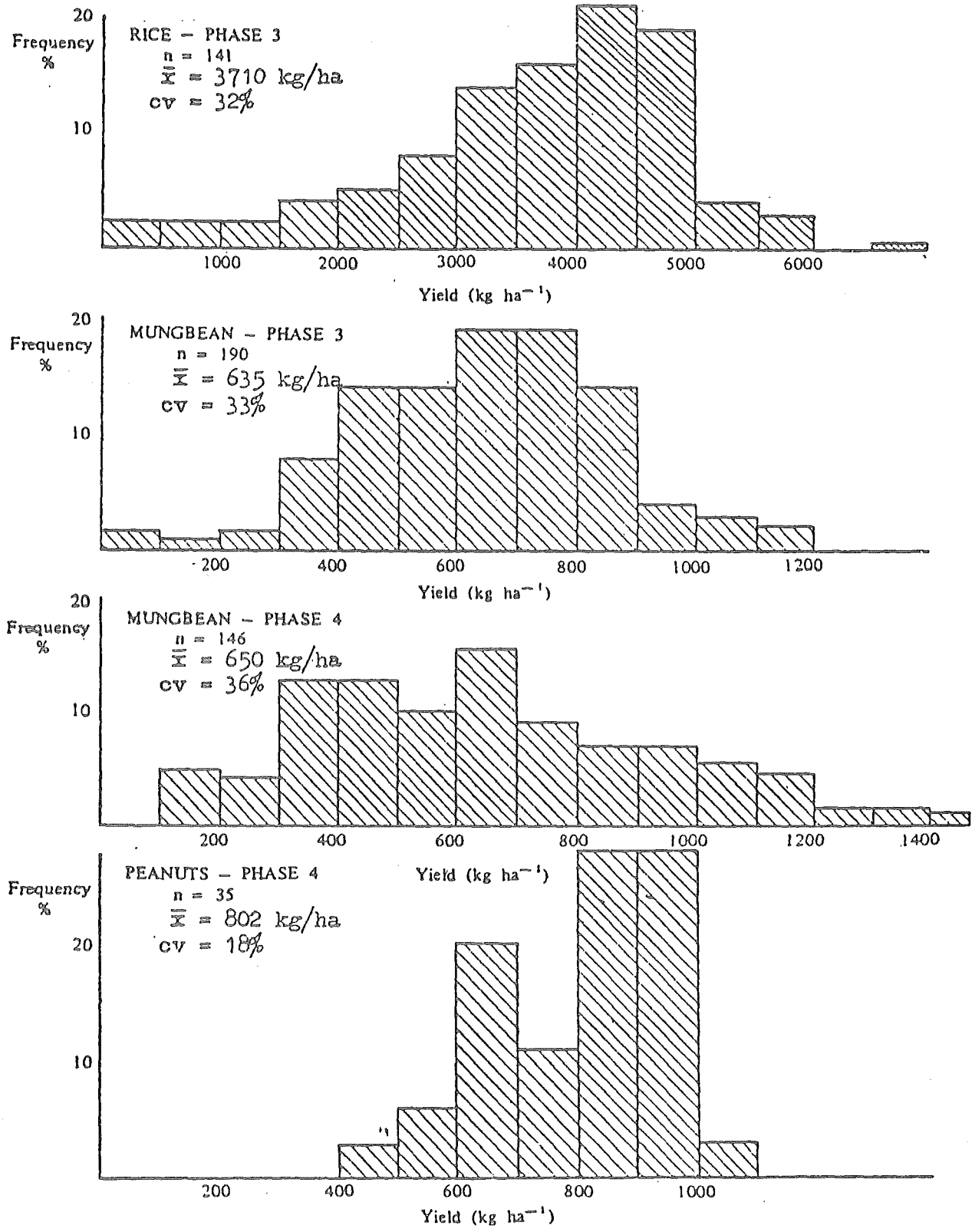
Percent Coefficient of Variation

Palay	11.56	15.80	9.75	16.61	13.31	15.98	4.31
Corn	8.78	13.48	7.38	10.05	5.41	7.73	8.91
Vegetables	14.91	15.69	26.10	12.51	9.04	10.07	12.96
Tobacco	13.05	17.04	22.00	40.98	35.47	-	30.47

Source: FAO Investment Centre: Philippines
Cotton Development Project Preparation Report

MULTIPLE CROPPING PRODUCTION PROGRAM

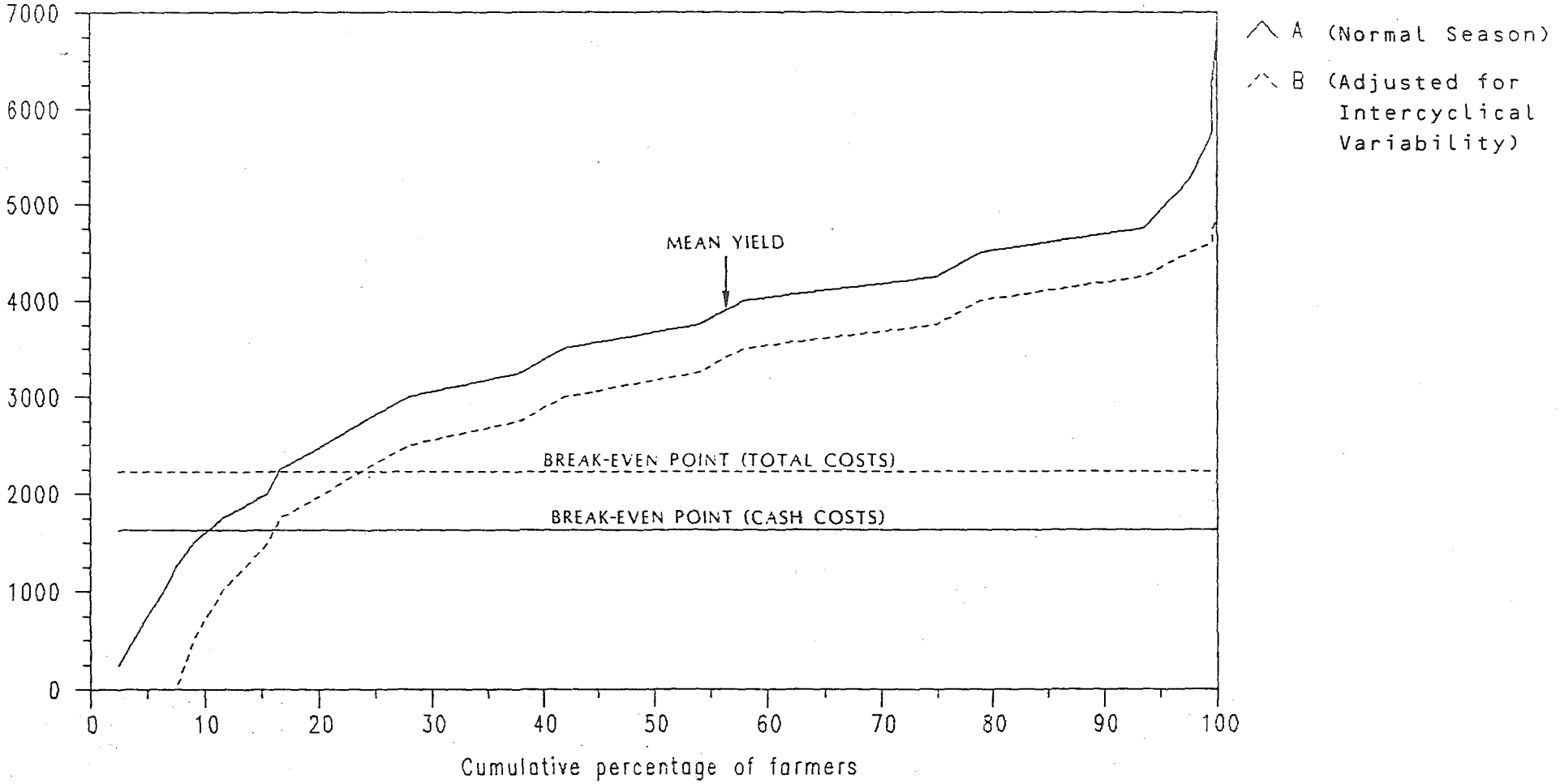
Yield distribution



Source: Philippines, PADAP Project Reports

PHILIPPINES --- Rice

Yield Distribution (Cumulative)
Yield (Kg/ha).

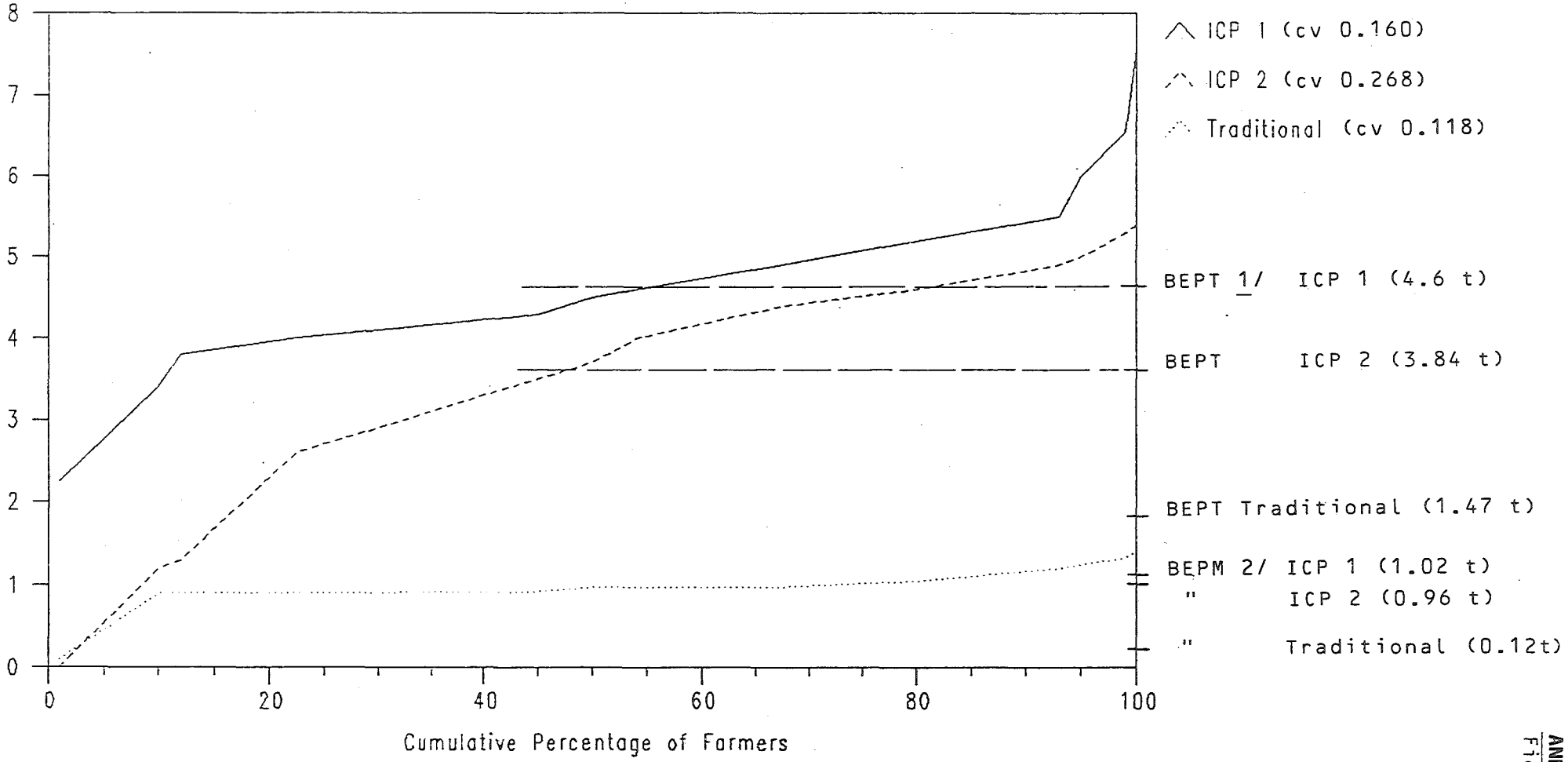


ANNEX 2
Figure 2

INDONESIA --- Rainfed Crop Trials

Yield Variability (3 Cropping Systems)

Yield in (t/ha) Rice equivalent



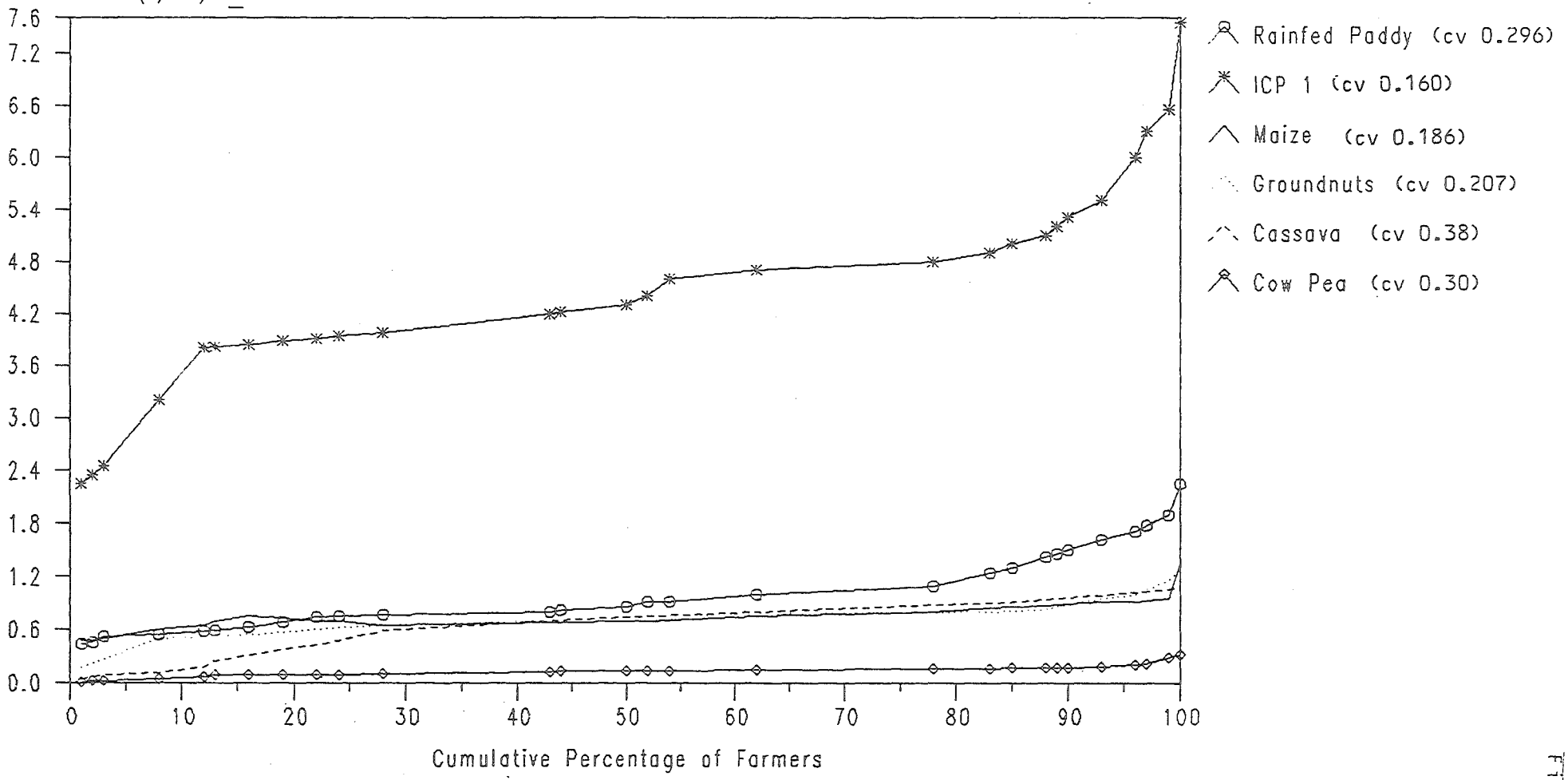
1/ Break-even point - total cost.

2/ Break-even point - materials cost.

ANNEX 2
Figure 3

INDONESIA --- Rainfed Crop Trials

Yield Variability (Improved Cropping System I Components)



1/ Note: Yield of ICP 1 to be multiplied by 4 and expressed as rice equivalent: cassava to be multiplied by 10.

ANNEX 2
Figure 4

ANNEX 3
Appendix 1
Table 1

Total Production Over 20 Year Period

	No. Farmers	3	4	9	15	20	19	15	9	4	2	Total
Predicted Yield t/ha	Yr.1	1370										
	Yr.2	1710										
	Yr.3	1830										
	Yr.4	1920										
	Yr.5	2090										
Total Production	Yr 1	4110										4110
	2	5130	5480									10610
	3	5490	6840	12330								24660
	4	5760	7320	15390	20550							49020
	5	6000	7680	16470	25650	27400						83200
	6	6000	8040	17280	27450	34200	26030					118960
	7	6000	8000	18000	28800	36600	32490	20550				150440
	8	6000	8000	18000	30000	38400	34770	25650	12330			173150
	9	6000	8000	18000	30000	40000	36480	27450	15390	5480		186800
	10	6000	8000	18000	30000	40000	38000	28800	16470	6840	2740	194850
	11	6000	8000	18000	30000	40000	38000	30000	17280	7320	3420	198020
	12	6000	8000	18000	30000	40000	38000	30000	18000	7680	3660	199340
	13	6000	8000	18000	30000	40000	38000	30000	18000	8000	3840	199840
	14	6000	8000	18000	30000	40000	38000	30000	18000	8000	4000	200000
	15	6000	8000	18000	30000	40000	38000	30000	18000	8000	4000	200000
	16	6000	8000	18000	30000	40000	38000	30000	18000	8000	4000	200000
	17	6000	8000	18000	30000	40000	38000	30000	18000	8000	4000	200000
	18	6000	8000	18000	30000	40000	38000	30000	18000	8000	4000	200000
	19	6000	8000	18000	30000	40000	38000	30000	18000	8000	4000	200000
	20	6000	8000	18000	30000	40000	38000	30000	18000	8000	4000	200000
											TOTAL	2993600

THE DESIGN OF AGRICULTURAL INVESTMENT PROJECTS

LESSONS FROM EXPERIENCE

FORECASTING ADOPTION RATES 1/

Introduction

Most agricultural development projects may be regarded as instruments of change. The increases in production from which the predictions of benefits are derived usually result from the successful application of improved or new technologies. The economic and financial viability of projects involving large numbers of individual farmers is extremely sensitive to the rate and manner in which the recommended technologies are adopted. This study suggests that there is considerable room for improving forecasts on adoption rates at the time of project formulation.

Currently it seems that most assessments of expected adoption rates are made largely on an intuitive and somewhat arbitrary basis, drawing on previous experience or on extrapolations from other projects. It is believed that the accuracy of predictions could be increased if more systematic consideration was to be given to each of the principal factors affecting adoption rates. Such systematic treatment could involve the development of simulation models, but this would be time-consuming and high in its demands on information and specialised expertise. A more practical approach may be simply to assess the possible influence of each factor in a systematic if still subjective way, as outlined in the third section of this Annex.

This Annex draws on ideas presented in a recent World Bank Staff Working Paper (No.542) which reviewed various studies on the adoption of agricultural innovation and contains a lengthy bibliography of recent work on the subject. It is also influenced by two Investment Centre staff papers on the subject: these examine the theoretical basis for the frequent shortfall in adoption rates found in projects addressed to small farmers and relate this to farmers' behaviour vis-à-vis institutional sources of farm credit 2/.

1/ Derived from an internal discussion paper, prepared by Ian Hill (FAO Investment Centre).

2/ Pantanali, R. Factors Affecting Farmers' Adoption Rates in a Subsistence Economy, March 1987, mimeo.
Pantanali, R. Financing Adoption of Technological Innovations by Small Farmers, April 1987, mimeo.

Terminology. The World Bank paper distinguishes between individual and aggregate adoption. Individual adoption is defined as "the degree of use of a new technology in long-run equilibrium when the farmer has full information about the new technology and its potential". This might also be usefully referred to as the On-Farm Development Rate (ODR). Aggregate adoption is defined as "the process of spread of a new technology within a region". This could be referred to as the Project Adoption Rate (PAR), reflecting the rate of increase in the numbers of farmers entering a project and using the proposed technical package.

Factors Affecting Adoption Rates

The main factors commonly affecting adoption rates can be conveniently considered in three groups - those concerned with the nature of the potential adopters, with the nature of the technology on offer and with the motivation for adoption, or more simply the "who", "what" and "why" of adoption. These groups of factors are discussed briefly below and summarised in Table 1.

(a) The Nature of the Adopters

- Who Takes Decisions. There is a tendency to assume that all decisions on adoption are taken by male heads of families. In practice in many cultures farming decisions are taken by women (eg. on livestock management in Yemen or rice cultivation in Senegal) or by the family unit as a whole, extended or otherwise. Customary village and tribal organisations may play a dominant role in decisions on land allocation and improvements or changes in crop or livestock husbandry systems. An appreciation of the mechanisms through which decisions will be taken on any specific innovation is clearly fundamental to the projection of adoption behaviour.

- "Progressive" and "Traditional" Farmers. Most studies of adoption rates have found a correlation between the level of education of farmers and the speed with which they pick up an innovation. Younger farmers are also usually found to be more innovative than older ones. There are, however, dangers in over-simplification and in some cases variations in adoption rates may not be related so much to the progressiveness of farmers as to the relative productivity of the land which they cultivate.

- Labour Availability. Adoption of a technological change may be sensitive to the extent that it affects demand for labour, both in the aggregate and at certain seasons of the year. Thus, labour-intensive technologies are unlikely to be adopted either in areas where there is a low population density unless this can be

overcome by seasonal inflows of migrant labour, or in areas where there are attractive alternative employment opportunities. Investment Centre experience suggests that project designs are frequently based on over-estimation of available farm labour because insufficient time is allocated in labour budgets to household demands (eg. fetching wood and water), more remunerative off-farm work or social occasions.

- Land Availability and Farm Size. As long as ample good quality land resources are available and labour is relatively cheap, adoption of intensification measures can be expected to be slow. It must also be obvious that technologies with large fixed indivisible costs are least readily adopted by small farmers, although technological lumpiness may be offset by hired services, for example for pumps or tractors. Very small farmers and farmers on rainfed lands tend to be slower in adopting even scale-neutral technologies because of the perceived risks (see C below). Farm size and adoption rates, however, are not directly correlated as adoption also tends to be slow on very large holdings, particularly those run by absentee owners.

- Land Tenure. Land tenure arrangements may have a critical impact on adoption patterns. Attempts to improve communally held rangelands, for instance, have frequently been unsuccessful because of the difficulty of ensuring an equitable distribution of the benefits and costs among those with rights of access. Share cropping arrangements need to be carefully examined to understand the way in which the responsibility for supplying any additional inputs is divided between the landlord and the farm operator and how the resultant increase in harvest is split. Length and security of tenure clearly have an impact on farmers' decisions on fixed investments (eg. soil conservation structures, drainage), on planting perennial crops and on planting forest species. Certain forms of tenure may inhibit access to institutional credit and hence indirectly affect adoption practices.

(b) The Nature of the Technology

- Complexity. The complexity of a technology proposed for introduction and the extent to which it differs from conventional practice will affect adoption rates. Although many projects seek to promote an integrated "package" of new technology, observations suggest that, in practice, farmers are selective, adopting either only parts of the package or phasing the completion of the adoption process over a relatively long period. Farmers tend to adapt rather than to adopt.

- Reliability. Although many proposed technological changes may be shown to have a potential for increasing production and farm incomes on the average, intensifying technologies are often less resilient to adverse events than traditional technologies (see Annex 2). Technologies which do not exhibit yield stability levels comparable to those of current practices are likely to have low acceptability amongst farmers (see Perceptions of Risks below).

- Relative Costs. A major increase in the costs of production over current practices - particularly if it requires up-front cash pay-outs - may be expected to inhibit adoption. A systematic comparison of "with" and "without" production costs, especially cash costs, provides a useful indicator.

- External Dependence. If an innovation is dependent on the use of externally supplied inputs, adoption behaviour will be affected by farmers' past experience with suppliers, particularly in terms of availability, quality, timeliness and price. To the extent that access to capital may be necessary for financing the adoption of a technology, experience suggests that large farmers enjoy easier access to institutional credit than small farmers, and this may be reflected in different adoption rates.

(c) Motives for Adoption and Non-Adoption

- Knowledge. The main argument for improvements in agricultural extension services is that they can accelerate the pace of adoption by improving the farmers' knowledge and appreciation of improved practices. Knowledge of innovations can, of course, be diffused through the farming community without dependence on the face-to-face contact which characterises most agricultural extension systems, but the rate of diffusion may be different. The speed of diffusion is probably most strongly influenced by a combination of the extent of comparative advantage of the innovation vis-à-vis current practices and of the effectiveness of the extension effort.

- Financial Benefits. The use of farm models in feasibility studies to demonstrate the viability of proposed changes in technology furnishes useful material on which to base an assessment of the incentives to farmers to adopt the changes. Care, however, must be taken in interpreting the models to ensure that the analyses made reflect farmers' perceptions of incentives. For instance the often calculated internal financial rate of return is a poor indicator of attractiveness, whereas a financial rate of return calculated on the farmers' equity contribution to investment might prove useful in assessing the likely response of large farmers to a proposed

innovation. For small farmers a better measurement of incentive could be the net return after payment of costs per incremental day of family labour invested, but even this may not be a sufficient measure: in cases of labour-displacing mechanisation, for instance, substantial increases in return per labour day may be obtained, but, if there are no alternative opportunities for employment, these are of no worth to the displaced individual.

Particular caution must be exercised in estimating adoption rates among farmers attaining levels of production which correspond more or less with their subsistence needs. In such cases the increase in cash expenditure required to adopt yield increasing technologies may not be met by a rise in saleable surpluses, if all or most incremental output is consumed at home.

- Demands on Labour. Even if the return per day of labour invested can be shown to be attractive relative to current levels of income, any very substantial increase in labour demand associated with the proposed innovations can be expected to contribute to a reduced interest in adoption: not many farmers will commit themselves to a massive increase in labour demand - even it it can be met from their family resources - whatever the theoretical benefits.

- Perceptions of Risk. Probably the single most important factor contributing to rates of adoption which are slower than might be implied by the technical and financial viability of the proposed innovation, is the farmer's or community's perception of the nature and extent of the associated risks. One of the problems with conventional farm budget analysis is that it tends to deal with average situations and gives little attention to the probability with which average levels of production will in practice be attained.

For most farmers, especially those in rainfed areas, the primary source of risk is inter-seasonal yield variability due to climatic influences, and a careful study of historical changes in key parameters (temperature, rainfall, hail, etc.) may serve as a useful starting point for any assessment of perceived risk. Yields, of course, will also be sensitive to management standards, and susceptibility to pests and diseases (see Annex 2).

The farmer's assessment of risk will also be affected by his interpretation of the reliability of input supplies as well, of course, as by the prospects for marketing the incremental output at remunerative prices. The existence of guaranteed markets and prices may reduce perceived risks from this source.

- Other Factors. Many other factors which have little to do with costs, benefits or risks are likely to affect adoption rates. Some innovations, for instance, may be excluded from possible consideration for adoption on religious, moral or caste grounds. Others may be unacceptable - particularly when they concern staple foods - on grounds of inferior palatability.

Systematic Assessment of Adoption Rates

(a) On-Farm Development Rate (ODR)

The forecast on-farm development rate is a function of the factors discussed above and is a measure of the expected acceptability to individual farmers of the proposed technical innovations. In order to make a systematic assessment of ODR, the factors reviewed above can be subjectively rated as exerting a major, moderate, minor or nil limitation to adoption of a proposed set of technologies by representative farmers. ODR can then be assessed as high, medium or low, depending on the number and severity of limitations.

Experience suggests that a technically sound innovation will be fully applied on a farm within a period of three years or less, if none of the limiting factors reviewed above are present, or if they are present only to a slight degree. It can be more or less arbitrarily assumed that innovations would be fully taken up in less than six years if there are no more than two minor or one moderately significant limitation present. On-farm adoption, however, is likely to exceed six years and in fact may never be completed if there is any single major inhibiting factor or a combination of several less severe limitations.

(b) Project Adoption Rate (PAR)

The PAR depends on an assessment of the number of farmers who will accept the technical package over a given time period. It is likely that only a few farmers will adopt the new technology in the early years of a project and that the number will grow when the technology is shown to be effective, tailing off in the final years; that is, adoption follows a Sigmoid curve. The steepness of possible S-curves is dependent on a variety of social and other factors which are extremely difficult to quantify, but data obtained from precedents would help to identify the appropriate functions.

An example illustrating the application of these methods is given in Attachment 1.

ADOPTION RATES AND PRODUCTION

The significance of adoption rates in project preparation is the effect they have on projections of production attributable to the project. Total production is dependent on both the ODR and the PAR.

For any given ODR, which is the rate at whicha typical farmer is likely to adopt a new technology, build-up of production on-farm will depend on the nature of the technical package. For most projects, this build-up of production, that is the yearly yield increment achieved by a farmer over the on-farm development period, is assessed subjectively. The assessment is based on consideration of the impact on production of the various components of the proposed technology and the order in which they are adopted. In the following paragraphs a method is suggested which could help to make the subjective assessment more quantitative, although it is not intended as a mechanistic substitute for common sense.

Improved agronomic recommendations generally consist of a number of components: varieties/seeds, cultural practices, fertilizer, pest control, and post harvest treatment. The impact of each of these components on production will vary and can carefully be assessed separately. For the sake of this discussion, the proportions of predicted increase in yield attributed to the various components of the package are as follows:

Components	Percentage of Predicted Yield Increment Attributed to Component
Varieties/seeds	30
Cultural practices	10
Fertilizer	40
Pest control	10
Post harvest	10

For projects with a high ODR, that is where the whole package is adopted in three years or less, the order in which the various aspects of the package are adopted is not very significant. Where the ODR is moderate or low, that is where it may take three of more years for farmers to adopt the whole package, the order in which the various components are adopted becomes significant. Assuming no supply constraints, it is suggested, again for the sake of illustration, that for an ODR of five years, uptake of the various components will be as follows:

Component	Percentage of Component Adopted in Year				
	1	2	3	4	5
Varieties/seeds	50	50	-	-	-
Cultural practices	20	20	20	20	20
Fertilizer	40	30	20	10	10
Pest Control	30	30	20	10	10
Post harvest	10	20	40	20	10

This example is of course optimistic, as it assumes the farmer adopts 100% of the all components of the package: in fact, he is likely to be selective and choose only parts of the package.

The above figures can be used to calculate the percentage of the total predicted yield likely to be achieved in each year of a five-year period. For example, 40% of yield increase is attributed to fertilizers. Thus if the farmer uses 40% of the recommended fertilizer dosage in Year 1 and an additional 30% in Year 2, it can be estimated that the use of fertilizers results in 16% of predicted yield increase in Year 1 and a further 12% in Year 2. Similar percentages are shown below for five years. In reality, there is considerable complementarity between the proposed inputs and the various components of the package must be considered together, particularly seeds, cultural practices and fertilizer use: and it is the total cumulative percentages shown below that are most meaningful thus:

Component	Percentage Predicted Yield Increment Achieved in Year				
	1	2	3	4	5
Varieties/seeds	15	15	-	-	-
Cultural practices	2	2	2	2	2
Fertilizer	16	12	4	4	4
Pest control	3	3	2	1	1
Post harvest	1	2	4	2	1
Total	37	34	12	9	8
Cumulative Total	37	71	83	92	100

As previously mentioned, these figures are not to be regarded as standard in any way, and must be adapted to the needs of particular situations.

Production will also depend on the PAR, that is the number of farmers adopting the technology each year. The effect on production of the various parameters affecting adoption rates can be clearly seen from the following example:

No. of farmers	100
Holding size	1 ha
Yield without project	1,000 kg/ha
Predicted yield with project	2,000 kg/ha
ODR	5 years
PAR:	

Year	1	2	3	4	5	6	7	8	9	10
No. of farmers	3	4	9	15	20	19	15	9	4	2

Using the above assumptions, yield and productions will increase as shown below for Years 1, 2 and 3.

Year	No. of Farmers/ Area (ha)			Incremental Yield for Farmers			Incremental Project Production
	---------- Starting in Year ----------						
	1	2	3	1	2	3	
				(kg/ha)			(kg)
1	3			370			1110
2	3	4		710	370		3610
3	3	4	9	830	710	370	8660

etc.

By using a standard spreadsheet program, the aggregate incremental output can easily be calculated. In this case incremental and output of the 100 farms would rise over a 14-year period, after which it would stabilise, as follows:

Table

Year	Incremental Output (kg)
1	1110
2	3610
3	8660
4	18020
5	32200
6	48960
7	65440
8	79150
9	88800
10	94850
11	98020
12	99340
13	99840
14 onwards	100000

The example given above implicitly refers to a single crop, but the same methodology can be applied to a farm model with several crops. Clearly the exercise must be repeated for each farm model, but this must be done whatever methods are used to calculate adoption rates and production. The example also assumes that all farmers join the project, but there will of course be cases where some farmers never participate.

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