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CAMBODIA: INTEGRATED FIDUCIARY ASSESSMENT AND PUBLIC EXPENDITURE REVIEW

The Agriculture, Irrigation, and Rural Roads Sectors: Public Expenditure Review

THE WORLD BANK

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Washington, D.C.

CONTENTS

ACRONYMS

ACIAR	Australian Centre for International Agricultural Research
ACR	Activity Completion Report
ADB	Asian Development Bank
ADI	Agricultural Development International
AQIP	Agriculture Quality Improvement Project
ASEAN	Association of South-East Asian Nations
ASSDP	Agriculture Sector Strategic Development Plan
AusAID	Australian Agency for International Development
BCR	Benefit-cost Ratio
bn.	Billion
BSP	Budget Strategic Plan
CAAEP	Cambodia-Australia Agricultural Extension Project
CARDI	Cambodian Agricultural Research and Development Institute
CBA	Cost-benefit Analysis
CBAPP	Community-based Agricultural Productivity Project
CDC	Council for the Development of Cambodia
CDRI	Cambodia Development Resource Institute
CEDAC	Cambodia Center for Study and Development in Agriculture
CISIS	Cambodian Irrigation Schemes Information System
CSES	Cambodia Socioeconomic Survey
CSF	Commune Sanghat Fund
CWRMSP	Cambodia Water Resources Sector Management Project
DAE	Department of Agricultural Extension
DEPFP	Department of Economic and Public Finance Policy
DIC	Department of Investment Cooperation
DoP	Department of Planning
DP	Development Partners
DRR	Department of Rural Roads
DSSAT	Decision Support System for Agro-technology Transfer
EU	European Union
FAO	Food and Agriculture Organization
FAOSTAT	FAO Statistics
FWUC	Farmer Water User Community
GB	Great Britain
GCM	Global Climate Model
GDNT	General Department of National Treasury
GDP	Gross Domestic Product
ha.	Hectare
IDE	International Development Enterprises
IFAD	International Fund for Agricultural Development
IFAPER	Integrated Fiduciary Assessment and Public Expenditure Review
IFPRI	International Food Policy Research Institute
IMF	International Monetary Fund
IPCC	Intergovernmental Panel on Climate Change
I-PRSP	Interim Poverty Reduction Strategy Paper
IRR	Internal Rate of Return
IRRI	International Rice Research Institute
kg	Kilogram
mn.	Million
MAFF	Ministry of Agriculture, Forestry, and Fisheries
MDG	Millennium Development Goals
MEF	Ministry of Economy and Finance
MOI	Ministry of Interior
MOP	Ministry of Planning
MOPS	Moving Out of Poverty Study
MOWRAM	Ministry of Water Resources and Meteorology
MRD	Ministry of Rural Development
MSBF	Ministry Strategic Budget Framework
MTEF	Medium-term Expenditure Framework
MTMF	Medium-term Macro Framework
NAPA	National Adaptation Plan of Action
NCDD	National Council for Decentralization and Deconcentration
NGO	Non-government Organization

NPFSPA	National Program for Food Security and Poverty Alleviation
NPRS	National Poverty Reduction Strategy
NPV	Net Present Value
NSDP	National Strategic Development Plan
O&M	Operation and Maintenance
PAP	Priority Action Program
PB	Program Budget
PCR	Project Completion Report
PER	Public Expenditure Review
PFM	Public Financial Management
PFMRP	PFM Reform Program
PIP	Public Investment Program
PIU	Project Implementation Unit
PMO	Project Management Office
PMU	Project Management Unit
PNH	Phnom Penh
PPCR	Pilot Program for Climate Resilience
PRECIS	Providing Regional Climates for Impact Studies
R&D	Research and Development
R50	Rainfall of more than 50mm/day
RGC	Royal Government of Cambodia
RLIP	Rural Livelihoods Improvement Project
RRSP	Rural Road Strategic Plan
SAW	Strategy for Agriculture and Water
SEACAP	South East Asia Community Access Program
Sida	Swedish International Development Cooperation Agency
SNC	Second National Communication (to IPCC)
SNEC	Supreme National Economic Council
SRI	System of Rice Intensification
SWAp	Sector-wide Approach
t.	Tonne
TOFE	Tableau des Opérations Financières de l'Etat
UNFCCC	United Nations Framework Convention on Climate Change
US	United States
US$	United States Dollar
USD	United States Dollar
V&A	Vulnerability and Adaptation
VAT	Value-added Tax
WB	World Bank

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EXECUTIVE SUMMARY

1. Overview of the Agriculture, Irrigation, and Rural Roads Sectors

Cambodia has experienced strong economic growth along with significant poverty reduction over the past decade. Average annual gross domestic product (GDP) growth was about 10 percent between 1998 and 2008, compared to a 1.8 percent population growth rate during the same period. Poverty has been reduced significantly (around 10 percentage points in a decade) and continues to fall, declining from 35 percent in 2004 to 30.1 percent in 2007. Economic growth has been broad-based, covering all key sectors, and per capita GDP has increased from $250 in 1998 to an estimated $795 in 2008. The country has achieved macroeconomic stability and put in place an open trade regime, which has led to significant inflows of foreign direct investment (FDI). FDI has been the primary contributor to the explosion of non-traditional exports (largely textiles and garments), which together with the tourism and construction sectors has been the most significant source of growth and non-farm employment. Growth, however, has proven to be vulnerable to global economic and financial crises. The slowdown in garment exports and in tourism arrivals reduced the GDP growth rate in 2008 to 6.7 percent, and the economy contracted by 2 percent in 2009, its worst performance in the post-conflict period.

Agriculture continues to be the mainstay of the economy and has recently emerged as an important source of growth. The sector expanded at an annual rate of 4.4 percent between 1998 and 2008. Although lower than the GDP growth rate, the agricultural growth rate in Cambodia has nevertheless been impressive when compared to the average rate in the East Asia and Pacific (EAP) region (3.8 percent). The sector expanded by another 4.7 percent in 2009 despite global economic and financial crises. It makes up about one-third of total GDP and provides employment to about 70 percent of the labor force. The main sources of agricultural growth are: (i) gains in crop productivity (both rice and non-rice); (ii) public and private investment in agriculture and rural infrastructure (transport, irrigation, and processing); (iii) an increase in the rural labor force, as well as substantial investment in social infrastructure such as health, education, and sanitation.

Rice is a dominant crop, consisting of about one-quarter of agriculture GDP and about half of crop value added. It is grown on 84 percent of cultivated land by about 85 percent of farmers. Despite this concentration on rice, there has been a significant amount of diversification in the sector over the last decade. Production of non-traditional food and industrial crops (maize, cassava, and soybeans) has had the most rapid growth, partly as a response to increasing demand from the livestock sector, which expanded at an annual rate of 28 percent between 1995 and 2007. Other crops in which production significantly increased in the 2000s include tobacco, peanuts, sesame, and rubber.

The agriculture sector in Cambodia has great potential to contribute to economic growth and exports. The country is endowed with a good climate and large land and surface water resource base. With appropriate technical and institutional support from the public sector, there is significant potential for making sustainable increases in overall crop yields by increasing the use of agricultural inputs such as good seed and fertilizers and by improving irrigation infrastructure.

Despite the potential of its agriculture sector, there is justifiable concern about Cambodia's ability to seize these opportunities. The concern is that there exists a set of constraints to agricultural development, and unless these are addressed by appropriate policies and interventions, they will slow down economic growth and poverty

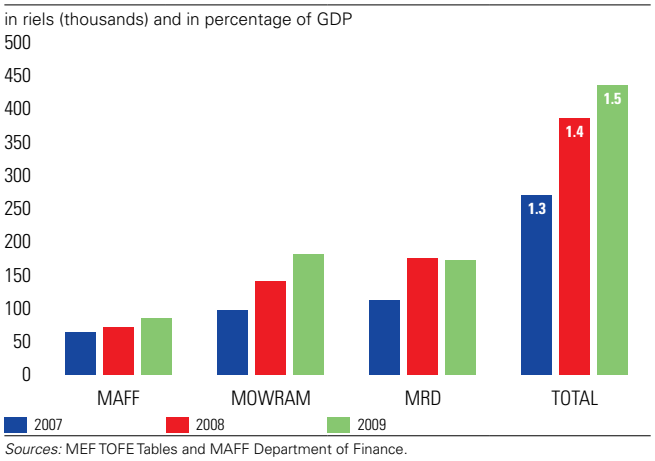
reduction. These constraints include: (i) coordination issues between agricultural research and extension that limits the effectiveness of public expenditures; (ii) weak and underdeveloped irrigation and rural roads infrastructure; and (iii) an excessive focus on rehabilitating primary irrigation infrastructure to the detriment of developing secondary and tertiary systems and of maintaining these irrigation systems.

2. The Level and Composition of Expenditures on the Agriculture, Irrigation, and Rural Roads Sectors

The agriculture and productive rural infrastructure sectors in Cambodia are serviced by three line agencies: the Ministry of Agriculture, Fisheries and Forestry (MAFF), the Ministry of Water Resources and Meteorology (MOWRAM), and the Ministry of Rural Development (MRD). MAFF is responsible for supporting dryland agriculture, upland and lowland crops, rice production, and marketing and for agricultural support services relating to research, extension and farmer education. It is also responsible for water resource functions for irrigated agriculture, for fisheries development, and for forest and catchment programs. It is organized into four thematic areas: general agriculture, rubber development, forestry, and fisheries. MOWRAM is responsible for the development and management of all water. It has two technical departments: the Engineering Department is responsible for the rehabilitation or construction of irrigation/water resources infrastructure as well as its operation and maintenance, while the Irrigated Agriculture Department deals with the institutional issues related to the development and maintenance of irrigation infrastructure. Finally, the mandate of MRD covers other rural infrastructure, including rural roads, water supply and sanitation, ethnic development, community development, and rural economic development.

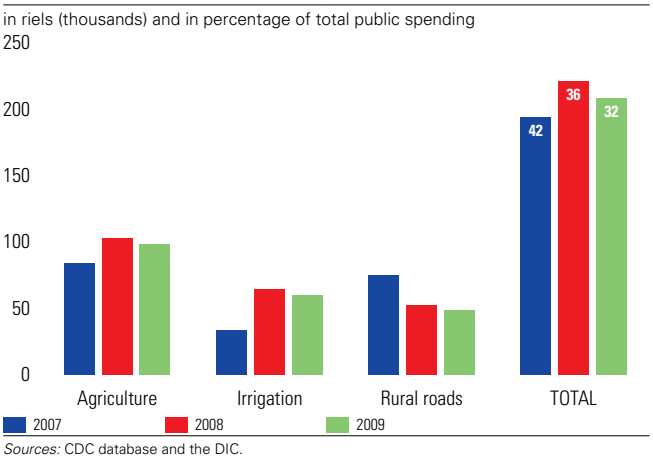
Between 2000 and 2008, total government expenditure grew faster than the economy and capital expenditure faster than recurrent. Between 2000 and 2008, Cambodia's gross development product (GDP) tripled from Riels 14,082 billion in 2000 to Riels 41,977 billion in 2008. In real terms, GDP grew by an annual average rate of 9.3 percent between 2000 and 2008. During the same period, there was steady growth in the government's recurrent budget from Riels 1,215 billion in 2000 and to Riels 4,439 billion in 2009, with real increases exceeding 14 percent annually between 2006 and 2008. On average, government recurrent expenditure, in real terms, increased by 10.1 percent between 2000 and 2008, which was higher than the trend rate of growth in GDP. The ratio of government recurrent expenditure to GDP remained broadly unchanged over the period 2000 to 2008 at between 7 to 9 percent.

Figure 1. Spending from own resources has increased...



Sources: MEF TOFE Tables and MAFF Department of Finance.

Figure 2. ...while donor support has declined



Sources: CDC database and the DIC.

Total funding for the agriculture, irrigation, and rural roads sectors from the government and donors increased from Riel 464 billion in 2007 to Riel 644 billion in 2009. This is equivalent to 1.5 percent of GDP (Figure 1). Donors continue to provide significant funding for these sectors in Cambodia. Donor spending an agriculture, irrigation, and rural roads averaged about $50 million in each of these years, increasing from Riel 194 billion in 2007 to Riel 207 billion in 2009, albeit at significantly slower rate than government spending during the same period. Most donor funding has gone to agriculture, while funding for rural roads and irrigation has been declining. The share of donor funding in total agriculture, irrigation and rural roads funding has decreased from 42 percent in 2007 to 32 percent in 2009 (Figure 2).

However, by international standards, Cambodia's public spending on agriculture compared to both GDP and to agricultural GDP is low when compared to levels in countries with similar levels of per capita GDP. Out of ten countries, only two, Indonesia and Bangladesh, have equal or lower ratios of public spending on agriculture to GDP, and only Bangladesh has a lower ratio of public spending to agriculture value added. Furthermore, public expenditure on research and development (R&D) broadly defined in Cambodia is relatively low, at only 0.1 percent of agricultural GDP compared with 0.2 to 0.6 percent elsewhere in Asia. Although, international experience shows little positive correlation between level of agriculture spending and high rates of agricultural growth. there is evidence that the quality of public spending does have positive implications on sector growth. As the analysis below shows, Government agriculture spending in Cambodia has generally gone for the provision of public goods and services which are necessary for sector growth. While public spending has in no doubt contributed to high rates of agricultural growth in Cambodia and Bangladesh, both countries also share similarities in terms of conducive and relatively distortions free policy environment, which have encouraged private sector contribution to sector performance.

Government recurrent expenditures have been growing faster than GDP in Cambodia. There have been large increases in recurrent government spending at MAFF, MOWRAM, and the MRD on agriculture, irrigation, and rural roads respectively. However, this does not reflect any increased priority in recurrent spending for the sectors. MAFF, which, as a service provider, is most dependent on its recurrent budget, has the largest recurrent budget (expenditure Riel 78.2 billion in 2009), followed by the MRD (expenditure Riel 54.6 billion) and MOWRAM (expenditure Riel 31.4 billion). The annual recurrent expenditure growth rates of the MRD (21.4 percent) and MOWRAM (15.1 percent) between 2000 and 2008 exceeded the total recurrent budget growth rates in real terms, while MAFF recurrent spending grew by 9.2 percent.

Irrigation and rural roads have been given priority in the small but expanding government capital budget. Capital expenditure is largest in MOWRAM, where it increased from Riels 17.9 billion in 2004 to Riels 148.7 billion in 2009. The MRD's capital expenditure has increased from Riels 64.7 billion to Riels 87.6 billion over the same period. The capital budget is significantly larger in MOWRAM and the MRD relative to recurrent budget, and exceeds funding received from donors. Together, MOWRAP and the MRD spend about 16 percent of the total government capital budget. MAFF on the other hand has essentially no capital budget, having received no funds for construction or equipment since 2004.

Our functional analysis of MAFF budget spending shows that only 3 percent of its budget goes to extension and 5 percent to agricultural research. The shortfalls in domestic operating budgets for research and extension have been covered by donors, which have allocated about 31 percent of their funding to these functional areas to fill these domestic funding gaps. These are also areas where donor dependence is highest—during 2007 to 2009, the share of government funding in total funding was only 3.5 percent for extension and 41 percent for agricultural

research. Donor dependence is significantly less in the case of rural roads and irrigation investments (72 percent each between 2007 and 2009) where donor aid has been concentrated mainly on new or rehabilitated infrastructure.

In total, the government share of total agriculture expenditures averaged 43 percent between 2007 and 2009 period. This heavy dependence on donor support in agriculture in general has created a number of issues, one of which is whether this funding is fiscally sustainable and another is the proliferation of project implementation units, which have attracted key skills and personnel away from the government to donor projects. Meanwhile, ministries are focused on projects rather than on policy and budget strategy, while the priorities of the donors may not always be aligned with national development goals.

3. Budget Processes and Performance

The budget processes within MAFF, MOWRAM, and the MRD are governed by systems put in place by the Ministry of Economics and Finance (MEF). The three-year rolling Medium Term Expenditure Framework (MTEF) forecasts and allocates the overall resource flows to priority sectors within the government. However, the priorities in high-level five-year planning documents such as the National Strategic Development Plan (NSDP), which guides the MTEF, are very broadly defined and may become outdated as development proceeds and circumstances change.

Budget Strategic Plans (BSPs), introduced under the Public Financial Management Reform Program (PFMRP) in 2007, are a key policy and budget planning tool for the ministries. The BSP a tool to align the sectoral planning with budgeting process. It is used by line ministries to prepare their medium-term and annual budgets and their program budgets. Despite some progress, the links between the NSDP, the MTEF/BSP, and the annual budget remain weak. Donor practices in a number of areas continue to challenge the government's ability to capture externally financed spending in its chart of accounts. The main weakness is continued poor integration of capital and recurrent expenditures, which is exacerbated by the creating of separate unit (DIC) in MEF and PMUs within line ministries that manage all aspects of donor-funded projects. To be fully effective, BSPs need to reflect all public sector resource flows to a sector (recurrent and capital), whether from the government or donors. At the moment, the BSPs only capture government resources, and this is a major weakness, given the high volume of donor aid.

The BSPs should become the central planning tool for the implementation of the Strategy for Agriculture and Water (SAW) and should cover both domestic budget allocations and donor allocations. At the moment, their effectiveness is constrained by capacity limitations, and by the difficulty of including donor aid, which currently flows through project implementation units (PMUs). The desirability of moving away from projects towards a more integrated and programmatic approach is understood by the donor/development partner community.

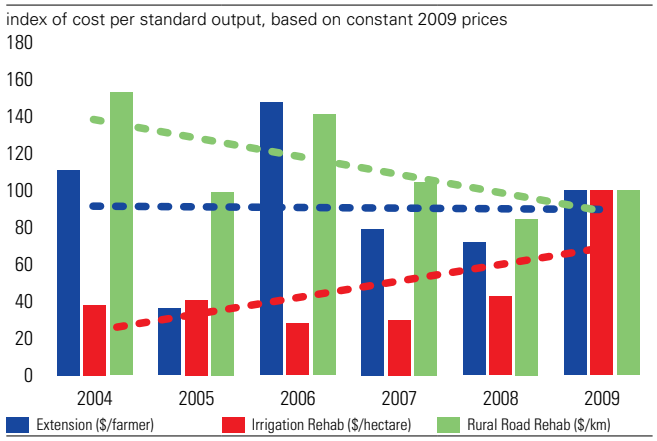
The constraints on improving budgeting are systemic and thus are to some extent beyond the control of the line ministries. The MEF is responsible for public finance management, and the Public Financial Management Reform Program (PFMRP) is working on improving the system, though the ten-year PFMRP timetable recognizes that these reforms will take some time to deliver.

4. Efficiency and Effectiveness of Expenditures on the Agriculture, Irrigation, and Rural Roads Sectors

For the purposes of this PER, the performance of the government in achieving its objectives is measured in terms of production, of increased incomes for the immediate beneficiaries of public expenditure, and of reduced expenditure. Most of the objectives of SAW for research, extension, and irrigation are aimed at increasing the incomes and livelihoods of farmer beneficiaries. In the case of rural roads, the immediate objectives of SAW are to increase the incomes of farmers and to reduce the prices and costs of transport. Also included are the wider objectives of promoting growth and reducing poverty.

The levels of output from public expenditure have been sustained since 2002, whereas the costs per unit of output have been variable (Figure 3). According to government annual reports, there has been an upward trend in outputs for both irrigation and rural roads, with the share of rehabilitations of irrigation schemes and rural roads rising to over 5 percent of the total. There are large variations in annual unit cost figures, but the trend in unit costs in real terms is that extension costs have remained static, irrigation costs have increased, and rural roads costs have decreased. The factors influencing the unit cost variables are; (i) poor reporting; (ii) a possible mis-classification of rural roads between maintenance and rehabilitation works; (iii) increased prices and crop margins; (iv) data analysis complications due to the wide range of irrigation work being done. The limited available international evidence suggests that unit costs in Cambodia are high for extension and rural roads and low for irrigation compared with other countries but do not show any tendency to increase.

Figure 3. Cost-effectiveness Indices: Actual and Trend Lines, 2004–09



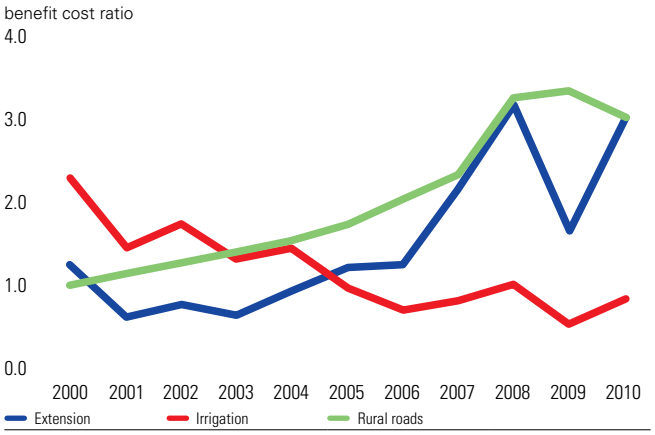
Source: Study Team calculations.
Note: Indices are calculated backwards assuming 2009 = 100. The bar chart presents actual indices for each year and the lines present trends.

The analysis of economic returns to public expenditures is based on benefit-cost ratios (BCRs). The BCR is the ratio of the net present value (NPV) of benefits to the NPV of costs that would have been calculated if economic appraisals had been done over the past decade. The BCRs were low (close to 1) in 2007 but rose to more than 2 after the commodity price increases since 2007 and despite irregular donor funding and poor coordination with research (Figure 4).

Since 2007, public expenditures on extension have yielded high returns reflecting in part raising benefits along with higher agriculture commodity prices. In the case of irrigation, returns to public expenditure have been low, even after an increase in prices since 2007. This is due largely to the disproportionate expenditure allocated to rehabilitating irrigation schemes that have limited or no maintenance operations. With better targeting of public funds, it should be possible to double the returns from public expenditure on irrigation. Public expenditure on rural roads has yielded steadily growing returns throughout the decade. If output targets remain stable and are achieved, extension will yield one of the highest returns among all government expenditure categories, whereas returns to expenditures on rural roads could be much higher.

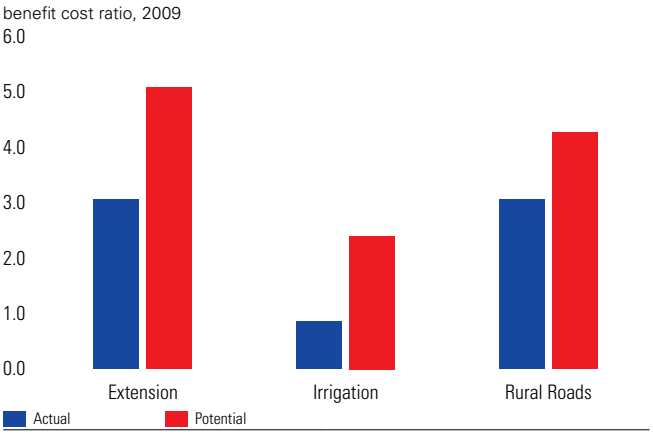
In agriculture, an analysis of economic returns to public expenditure on extension must consider the benefit-cost ratios (BCRs) in other words, the ratio of the net present value (NPV) of benefits to the NPV of costs

Figure 4. While BCRs for agriculture and rural roads investments have been rising…



Source: Study Team calculations.

Figure 5. …they are still well below their potential



Source: Study Team calculations.

that would have been calculated if economic appraisals had been done over the past decade. The BCRs were marginal (in other words, close to 1.0) in 2007 but jumped to over 2.0 after recent food commodity price rises.

In agriculture, BCRs for extension have increased since 2007, peaking at BCR of 3 in 2008. Since 2002 rice production has increased by 28 percent, which is attributable largely to an increase in adoption rates of improved sees and farming practices and irrigation on yields as a result of farmers' contact with extension agents. Public spending on agricultural extension in Cambodia has potential to continue to generate high rates of return but there is a need to increase diffusion rates and adoption rate per extension worker. There is still a considerable scope to increase farm productivity levels, especially for wet season rice, which indicates that extension activities could continue to provide significant benefits over medium to longer term. Increasing long-term performance of public extension activities requires improvements in its institutional functionalities. Achieving better balance between operating costs and recurrent costs, coupled with broader institutional changes which devolve more MAFF budget resources and staff to provincial and district levels would go long way to deliver extension messages to larger number of farmers. Better integration of agricultural research and extension delivery functions will ensure that public spending on development of new crop varieties, and information on research trials on fertilizer and soil management techniques for specific agro-ecological conditions will reach farmers quickly and in easily accessible format.

In the irrigation sector, the BCRs remained close to 1 throughout the 2000s, suggesting that irrigation is performing well below its potential. The BCRs for irrigation have not improved in recent years, despite better farm incentives, and vary widely depending on the design of the schemes. This is largely due to a sharp increase in the unit costs. The analysis in this review suggests that only about 70 percent of the command area could be actually irrigated in Cambodia, largely because of incomplete rehabilitation. This in turn is the result of public funds being spent on primary canals at the expense of secondary and tertiary canals. Meager funding for maintenance is another key reason for the limited effectiveness of irrigation investments. There is also the possibility of using new technologies in irrigation investments, which would reduce the need for costly maintenance works in the future. The government has been encouraging the creation of Farmer Water User Communities (FWUCs) to undertake local maintenance works. While this is valid in principle, it may take many decades to achieve. It is therefore unrealistic to place full responsibility for maintenance on the FWUCs, meaning that the optimum share of public funding to be devoted to maintenance is about one-third.

Expenditures on rural roads have yielded very large benefits in recent years, with BCRs of higher than 2 since 2005 and reaching 3 in 2008 and 2009. Between 100 and 600km of rural roads have been rehabilitated and 300 to 1,000km have benefited from periodic or routine maintenance. The recent increase in expenditures on maintenance will further increase the effectiveness of these investments, although the share of the budget assigned to maintenance is still far below the optimum level of about 45 percent of total roads spending. The costs of building and maintain rural roads are increasing with the growing shortage of laterite. New materials and techniques will need to be found and piloted, such as bamboo concrete and engineered earth methods if the progress in increasing rural access is to be sustained, but this will require higher upfront capital outlays and more capacity building.

The analysis shows that there is room for increasing the effectiveness and efficiency of public expenditures in agriculture given the potential indicated by the BCRs (see Figure 5). There are number of ways to increase the effectiveness of public investments at current spending levels. For example, expenditures on research, extension, irrigation, and rural roads should be seen as mutually dependent and can be more effective when concentrated in the same locations and when the best locations are selected. Furthermore, geographical targeting of productive infrastructure investments first in areas of high agricultural potential (as defined by higher population densities and closeness to main domestic and international markets) could increase returns to scarce public resources.

5. Climate Change and Public Expenditure

Much work has recently been done in Cambodia to assess the impact of climate change on agriculture. Predictions of climate change in Cambodia are difficult as the country is situated between two weather systems. However, analysis to date suggests that most areas of the country will be subject to shorter rainy seasons and longer and drier dry seasons. The social effect of this will be an increase in food insecurity among vulnerable households.

The net impact of climate change on agricultural production in Cambodia will be complex and is likely to vary considerably from one region to another. The most strongly felt impact will probably be the reduced and more variable growing seasons, which will require farmers to invest in water storage and will require the development of new crop varieties and farming techniques that are more resilient to unpredictable growing seasons. This is expected to increase significantly the returns to public expenditure in research and extension and in water storage and management.

In a country like Cambodia, where the pattern of climate change is both more mixed and more uncertain than in other countries, it is prudent to argue that public expenditure priorities should focus on "low regret" investments that combine standard national planning goals with climate adaptation. These would be public investments that could result in "low regrets" or opportunity costs (such as increased use of better seeds and improving farming techniques, including water and soil management) if the more negative climate effects as currently projected do not materialize. Investments in increasing agricultural productivity would qualify as one such "low regret" option.

6. Conclusions and Policy Recommendations

The effectiveness of public spending on agriculture could be substantially increased in Cambodia. The recent increases in agriculture prices have boosted BCRs to levels that some have interpreted as a signal to the government

to increase its spending on agriculture. In this public expenditure review, we suggest that there is little room to do this within the existing budget envelope unless offsetting reductions are made in other areas. Should such room be found, the prime candidates for increased allocations should be extension, irrigation, and rural roads. On the basis of PER analysis, the following recommendations are offered for improving the performance of public expenditures on agriculture, irrigation, and rural roads:

Reallocate more budget resources on agricultural extension. Government funding for extension is low as a share of its agriculture budget and, as a result, these services are dependent on donor support. Public extension has potential to deliver high returns in Cambodia. There is an opportunity to significantly increase government by reallocating it from functional areas of lesser value for money. However, any spending increases, both from government and donors, should be accompanied by improvements of institutional functionality of MAFF extension systems and establishment of monitoring systems to measure the effectiveness of expenditures on these functions. Better harmonization of service delivery standards between various extension providers (government, NGOs and private sector) and elimination of conflicting messages would also improve the efficiency of extension spending for all.

Don't ignore funding for agricultural research. Analysis of efficiency of agricultural research spending in Cambodia was constrained by data limitations, but international evidence shows that agricultural research can have very high rates of return.While increased public spending for agricultural research is justified, it should come with institutional changes which clarify the specific functions of the country's various research institutions and by consolidating laboratory capacities in various government units in order to reduce overlap and waste of resources. This can be done by establishing joint planning and evaluation systems by the government, donors and private sector to identify research needs and resource requirements. Technical expertise of donors could play an important role in building more effective research capacity in Cambodia. Better integration of national agricultural research institutions with extension services could further increase public spending efficiency on research, as well as extension.

Prepare for climate change. Related to two above recommendations, long-term efficiency of public spending on extension and research could be further improved by focussing more research efforts on development of new crop varietals and dissemination of knowledge on improved water storage and soil moisture preservation at farm-level—i.e. "low regret" investments that combine increased agricultural productivity with climate adaptation and mitigation against negative effects from reduced and more variable growing seasons.

Increase the effectiveness of irrigation investments. Public funding for new and rehabilitated irrigation schemes needs to be extended to secondary canals and associated infrastructure. The rehabilitation of tertiary canals using public funds is also justified provided that it includes arrangements the costs of operation and maintenance to be recovered from the end users. There also a need for more selectivity in funding irrigation schemes.

Increase the share of the budget designated for maintenance of irrigation and rural roads. In the case of irrigation, the optimal level of maintenance expenditure should be about 33 percent of total investment, and in the rural roads sector, an average of 45 percent is required for periodic and routine maintenance combined. This level of maintenance should ensure that the next major rehabilitation is not required for at least 10 years.

Investigate the economic viability of using new technologies for rehabilitating and maintaining rural roads. New technologies to consider include the use of bamboo reinforced concrete (for busy roads) and engineered

earth. The government could usefully invest in or create incentives for others to invest in promoting skills in these technologies.

Public Expenditure Planning and Management. We propose the following priorities to increase the effectiveness of public expenditure for consideration.

(a) Use the Budget Strategic Plans (BSPs) within each ministry as the key policy and budget planning tool for allocating and managing all resources to the sectors. The BSPs should become the central planning tool for the implementation of the Strategy for Agriculture and Water (SAW) and should include both domestically financed budget allocations and donor allocations.

(b) Reinforce the annual budget process by requiring MAFF, MOWRAM, and the MRD to assign "hard" and enforceable budgets to each department through the BSPs. The current system of partial program budgets should be absorbed into this comprehensive approach.

(c) Use the MEF Treasury system to record expenditure on a departmental basis. This would require an expanded version of the Tableau des Opérations Financières de l'Etat (TOFE) and greater devolution of responsibility for expenditure to departments.

(d) Introduce an annual review and planning process for the annual and medium-term budget process that includes both the government and all of its development partners, that puts BSPs at the heart of the process, and that integrates the SAW into government planning. The donors, in consultation with the government, are preparing to map the way forward, and this should be done as a joint government/ donor activity. The SAW initiatives are an opportunity to establish systems for regular and informative appraisal, monitoring, and evaluation of expenditures and for these to be fed back into future budget decisions.

1. INTRODUCTION

Agriculture is a high priority for the Cambodian government as it is one of the core sources of the country's economic growth and export earnings. Starting from a low base, government spending on agriculture rose to 1.3 percent of GDP in 2007 and to 1.5 percent in 2009, mainly through significant increases in outlays on irrigation and rural roads. This period of rising public spending on agriculture overlapped with robust annual growth in agriculture output. Al-though insufficient time has elapsed to assess with confidence whether there is a causal relationship between the level of public spending and agriculture growth in Cambodia, the evidence provided in this chapter shows that public expenditures may indeed have had a significant impact in increasing and sustaining agricultural growth, along with conducive policy environment. The analysis confirms that Government budget spending has been generally going for the provision of public goods and services, which have high returns on investments. However, the analysis also shows that there is a good potential for further efficiency gains on resources spent.

This report focuses on areas with highest potential efficiency gains to increase the value for money from investments in core public goods and services such as extension, irrigation and rural roads. This is a first attempt to carry out such an analysis in Cambodia, and even in the Greater Mekong sub-region. Based on extensive data gathering and sur-veys, this chapter analyzes the efficiency and effectiveness of agricultural sector expenditures in Cambodia and assesses various options for increasing the impact of government expenditures on agricultural growth. Other chal-lenges include an excessive focus on rehabilitating primary irrigation infrastructure and a neglect of secondary and tertiary systems, a lack of maintenance of irrigation and rural roads, and the slow pace of developing or adopting new technologies to reduce future maintenance costs. There is also a need to better prioritize agricultural and related infrastructure expenditures, both by type and by geographic location, to maximize their impact on growth.

The rest of the report is organized as follows. Chapter 2 presents recent developments in the agriculture sector of Cambodia. Chapter 3 gives an overview of sectoral expenditure trends over the last decade. The budget process and its relationship to sectoral development strategies is discussed in Chapter 3. Chapter 4 discusses the novel contribution of the AgPER in analyzing the efficiency and effectiveness of government spending using benefit-cost analysis to examine select public investments. Chapter 5 discusses how likely climate change trends may affect future agriculture expenditures and suggests some priority areas for public spending. The conclusion section summarizes the major findings and policy recommendations of the report.

2. OVERVIEW OF THE AGRICULTURE, IRRIGATION, AND RURAL ROADS SECTORS

Cambodia has experienced strong economic growth along with significant poverty reduction over the past decade. The average annual gross domestic product (GDP) growth was about 10 percent between 1998 and 2008 compared to a 1.8 percent population growth rate during the same period. Poverty has been reduced significantly (around 10 percentage points over last a decade) and continues to fall, declining from 35 percent in 2004 to 30.1 percent in 2007. Economic growth has been broad-based, covering all key sectors, and per capita income has increased from $250 in 1998 to an estimated $795 in 2008.

The country has achieved macroeconomic stability and put in place an open trade regime, which has led to significant inflow of foreign direct investments (FDI). This FDI has been the main cause of the explosion of non-traditional exports (largely textiles and garments), which together with the tourism and construction sectors, have been the most significant source of growth and non-farm employment. Growth, however, has proven to be vulnerable to global economic and financial crises. The slowdown in garment exports and in tourist arrivals reduced the GDP growth rate in 2008 to 6.7 percent, and the economy contracted by 2 percent in 2009, its worst performance in the post-conflict period.

Agriculture in Cambodia continues to be the mainstay of the economy and has recently emerged as an important source of growth. The sector expanded at an average annual rate of 4.4 percent between 1998 and 2008, which was primarily driven by growth in crop production. Although lower than the GDP growth rate, it was nevertheless impressive when compared to the average agricultural GDP growth rate of the East Asia and Pacific (EAP) region (3.8 percent). The sector expanded by another 5.4 percent in 2009 despite global economic and financial crises. Table 2.1 presents the sectoral growth trends between 2000 and 2008.

Table 2.1. Agricultural Sector Growth in GDP Context

in percent, at constant prices

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009[1]
Agriculture	-0.4	3.6	-2.5	10.5	-0.9	15.7	5.5	5.0	5.7	4.7
Crops	2.4	0.6	-4.8	21.9	-2.3	27.6	5.3	8.2	6.6	5.0
Livestock & Poultry	-8.8	10.8	-1.1	5.7	3.9	5.6	8.2	3.7	3.8	..
Fisheries	5.0	5.9	0.6	1.7	-1.7	5.6	3.8	0.8	6.5	..
Forestry & Logging	-12.4	-1.5	-4.3	-3.0	0.8	5.1	7.0	1.1	0.9	..
Industry	31.2	11.2	17.1	12.0	16.6	12.7	18.3	8.4	4.0	-10.2
Services	8.9	10.8	7.6	5.9	13.2	13.1	10.1	10.1	9.0	-1.2
GDP	**8.8**	**8.0**	**6.5**	**8.5**	**10.3**	**13.3**	**10.8**	**10.2**	**6.7**	**-2.0**

Source: National Institute of Cambodia.
Note: [1] World Bank estimates.

The sector occupies a more dominant role in the Cambodian economy than in its neighboring countries. The share of agricultural value added in GDP declined from 45 percent in 1996 to around 30 percent in 2008–09. Despite its falling share of GDP over time as the economy continues to mature, agricultural output has continued to expand due to productivity gains, which reflected an increase in the area under irrigation, the use of improved inputs, and a generally greater degree of commercialization as more private investors, both domestic and foreign, have invested in agriculture. However, the sector has still a high share of its workforce in agriculture, which, when forestry and fisheries are included, was around 70 percent in the late 2000s compared with 42 percent in Thailand and 58 percent in Vietnam.

Rice is the dominant crop in Cambodia, representing more than one-fourth of Cambodia's agriculture GDP and 40 percent of all value added of agricultural crops. It is grown on 84 percent of cultivated land by some 85 percent of farmers.[1] The country has achieved an annual rice surplus since 1995, with rice production growing at an impressive annual growth rate of 6.5 percent between 1999 and 2009, well above the population growth rates. Production over the last 10 years has increased both through area expansion (2.6 percent per annum) and increased yields (3.9 percent per annum). In absolute terms, rice productivity rose from an average 1.5 tons per ha in 1994 to 2.8 tons per ha in 2008/09, which makes it one of the highest growth rate of yields in South East Asia, albeit from a low base (Table 2.2). In fact, while yields in Cambodia have increased dramatically, they are still lower than yield levels in neighboring countries with similar agro-ecological conditions such as Vietnam (4.9 Mt/ha).

Table 2.2. Cambodia's Paddy Yield Compared with Others in the Region

tons per ha, selected years 1994–2009

	Cambodia	Indonesia	Laos	Malaysia	Myanmar	Philippines	Thailand	Vietnam
1994	1.49	4.35	2.58	3.06	3.17	2.89	2.35	3.57
1996	1.81	4.42	2.55	3.25	3.06	2.86	2.41	3.77
1998	1.79	4.2	2.71	2.88	3.13	2.7	2.47	3.96
2000	2.12	4.4	3.06	3.06	3.38	3.07	2.61	4.24
2002	1.92	4.47	3.27	3.24	3.42	3.28	2.61	4.59
2004	1.98	4.54	3.28	3.33	3.79	3.51	2.86	4.86
2006	2.49	4.62	3.35	3.39	3.8	3.68	2.92	4.89
2008	2.75	4.89	3.47	3.57	3.72	3.7	2.97	5.22
2009	2.83	..	..	..	..	..	..	..
Average Yield 1994–2008	2.07	4.47	3.05	3.23	3.42	3.23	2.64	4.37
Annual Growth 1994–2008	4.8%	0.9%	2.2%	1.2%	1.2%	2.0%	1.7%	2.8%

Sources: FAO and MAFF.

Table 2.3. Intensity of Agricultural Input Application—Cambodia and Selected Countries

	Cambodia	Vietnam	Thailand	Malaysia	China
Fertilizer consumption (kg per ha of arable land, 2004)	5	350	141	881	332
Agricultural machinery (tractors per 100 sq. km of arable land, 2005)	11	247	261	241	71
Irrigated land (% of cropland, 2003)	7	34	28	..	36
Roads, paved (% of total roads, 2004)	6	25	98	79	71
Researchers in R&D (per million people, 2002)	7	115	292	295	629

Source: World Development Indicators, World Bank.

However, despite improvements over last decade, the productivity of agriculture sector remains low when compared to neighboring countries in the region. This is largely due to low levels of input use and of mechanization and irrigation, which suggests that there remains considerable scope for increasing output and productivity. For example, Cambodian farmers applied the least amount of fertilizer compared with farmers in neighboring South East Asian countries (Table 2.3). Investment in rural infrastructure has been particularly low, and this has resulted in lower rates of rural development than the rest of the region. The country has the least developed road network in the region with the smallest percentage of paved roads. More than 70 percent of the unpaved rural road network is barely accessible or is impassable in the rainy season, which keeps some parts of the country isolated and impedes their trade in agricultural products, thus causing them chronic economic difficulties. Despite undisputable evidence that access to water increases agricultural productivity, effective irrigation coverage is still limited. Currently there are

1 The main source of data in this section is the Cambodian Statistical Yearbook of 2008 published by the National Institute of Statistics of the Ministry of Planning.

around 2,400 irrigation schemes in Cambodia, covering a total of 1.046 million season hectares (582,085 hectares of wet season irrigation and 245,288 hectares of dry season irrigation). According to MOWRAM's inventory statistics, the total irrigated capacity figures for both the dry and wet season show actual effective coverage ranging from 27 to 40 percent of rice fields. However, as discussed in Chapter 4, public expenditure on irrigation both by the government and by donors has been insufficient to provide complete and well maintained irrigation systems. The absence of such systems means that small farmers are dependent on volatile rainfall patterns and are not willing to invest in farm inputs, such as improved seeds and fertilizers.

Yet the agriculture sector in Cambodia has the potential to contribute to economic growth and exports as demonstrated by increasing private sector investments over the last few years. The country is endowed with a good climate and a large land and surface water resource base. With appropriate technical and institutional support from the public sector, there is significant potential for sustainable increases in overall crop yields through the increased use of agricultural inputs such as good seed and fertilizers and improvements in irrigation infrastructure. This is demonstrated by the growing domestic surpluses of paddy rice since 1995, which have led to robust growth in rice exports, both formal and informal. Cambodia currently exports around 2.25 million tons of paddy rice, which is exported informally mainly to Vietnam and Thailand. Formal exports of milled rice (at around US$700 million) account for around 15 percent of the country's total export earnings, which are currently dominated by garments (around 70 percent of total exports). If Cambodia were able to sustain its current growth rates of paddy production, it might be able to export some 3 to 4 million tons of milled rice by 2020, which would make it one of the leading rice exporters in the world.

Because of the abundance of fertile and sometimes under-used land in Cambodia, there is also significant potential for agricultural diversification by increasing production of non-rice crops. Among non-rice crops, production of maize, cassava and soya beans has seen the most rapid growth recently (above 20 percent annual growth rate in value added since 2002), partly due to increasing demand from the livestock sector. Other crops in which production has surged dramatically during the last decade include tobacco, peanuts, and sesame, mostly through the expansion of cultivated land. In addition, rubber and fish, despite their more modest growth over the last decade, still represent more than US$250 million of Cambodian exports annually.

Furthermore, the Royal Government of Cambodia (RGC) has made improvements in agriculture and rural development high priorities in its broader national economic development strategies. The Rectangular Strategy II 2008, which is a key strategic development document, highlights the government's resolve to make agriculture a leading sector of the national economy and a key source of sustainable economic growth, as well as its desire to expand food security and reduce poverty.[2] The National Strategic Development Plan (NSDP), which is the implementing document for the Rectangular Strategy,[3] recognizes that the traditional engines of growth (tourism, garment exports, and construction) need to be complemented by other sources that are more broad-based in order to attain its priority objective of improving the lives of the rural poor and achieving the Cambodian Millennium Development Goals by 2015. The Agricultural Sector Strategic Development Plan 2006 10 (ASSDP) stresses the importance of agricultural commercialization and private sector development, which are being addressed through its seven sectoral goals. The Strategy for Agriculture and Water 2010 13 (SAW), which replaced the ASSDP, provides a strategic framework for the implementation of the NSDP. The strategy emphasizes the development of the

2 Royal Government of Cambodia, 25 September 2008. Political Platform of the Royal Government of Cambodia of the Fourth Legislature of the National Assembly, Phnom Penh.

3 The current NSDP covers the period 2006-2010, and the new one is being finalized to cover the period up to 2013.

agribusiness sector as one of its priority areas and recognizes the potential income loss to the country, and related vulnerabilities, from the export of unprocessed agricultural commodities. It contains a commitment to increasing the competitiveness of processed agricultural exports, particularly rice, through a wide range of strategic interventions to increase Cambodia's competitive advantages. Finally, in August 2010, the government approved a policy on the Promotion of Paddy Production and Rice Export. The policy recognizes the strategic importance of rice production to Cambodia's economy and lists a number of policy measures and related investment priorities, as well as responsible institutions to implement them, to promote rice production and exports.

Despite well-defined strategic development goals and few policy-induced distortions, there is a concern about Cambodia's ability to convert its potential into development outcomes. There exists a complex set of constraints to agricultural development that, unless addressed by appropriate policies and public investments, will result in a loss of opportunities. Many of these constraints lie beyond the narrow domain of the agriculture sector and require multi-sectoral interventions (for example, the development of port, rail, and trunk road infrastructure, trade facilitation, and access to finance). These constraints may be limiting the effectiveness of some sector-specific interventions. Therefore, there is a need for a comprehensive set of fiscal and policy incentives plus substantive public investments for the sector to make productive and sustainable use of the country's natural resources. These issues will be discussed in more depth in the chapters that follow.

3. THE LEVEL AND COMPOSITION OF EXPENDITURES ON THE AGRICULTURE, IRRIGATION, AND RURAL ROAD SECTORS

A. Trends in Expenditures on and Support for the Agricultural, Irrigation, and Rural Roads Sectors.

The agriculture and productive rural infrastructure sectors in Cambodia are serviced by three line agencies: the Ministry of Agriculture, Fisheries, and Forestry (MAFF), the Ministry of Water Resources and Meteorology (MOWRAM), and the Ministry of Rural Development (MRD). MAFF is responsible for supporting dryland agriculture, upland and lowland crops, and rice production and marketing and for agricultural support services relating to research, extension, and farmer education. It is also responsible for water resource functions for irrigated agriculture, for fisheries development, and for forest and catchment programs. It is organized into four thematic areas: general agriculture, rubber development, forestry, and fisheries. Agricultural research is the responsibility of the semi-autonomous Cambodia Agricultural Research and Development Institute (CARDI). MOWRAM is responsible for the development and management of all water resources according to the Law on Water Management of 2007. It has two technical departments: the Engineering Department is responsible for the rehabilitation or construction of irrigation/water resources infrastructure as well as its operation and maintenance, while the Irrigated Agriculture Department deals with the institutional issues related to the development and maintenance of irrigation infrastructure, including the establishment of Farmer Water Users Committees (FWUCs). Finally, the mandate of the MRD covers other rural infrastructure, including rural roads, water supply, and sanitation, ethnic development, community development, and rural economic development.

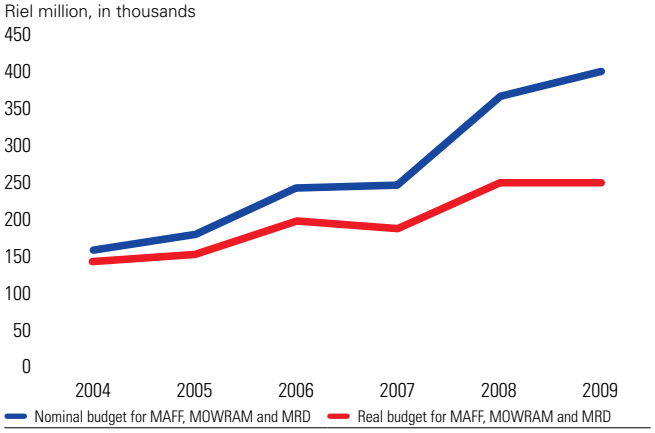
Between 2000 and 2008, the total government budget increased at faster rate than GDP. Cambodia's GDP increased from Riels 14,082 billion in 2000 to Riels 41,977 billion in 2008. In real terms, GDP achieved an annual average growth rate of 9.3 percent between 2000 and 2008. During the same period, total government spending more than tripled from Riels 1,512 billion to Riels 5,458 billion, which translates into an annual average growth rate of 11.9 percent in real terms. As a result, total government expenditure increased from 7.6 percent of GDP in 2000 to 9.8 percent in 2009.

Total government spending for MAFF, MOWRAM, and the MRD grew three times over between 2004 and 2009, driven by a five-fold raise in spending on irrigation. In 2009, total government spending on these ministries was Riel 398 billion. In real terms, spending for agriculture, irrigation, and rural infrastructure increased at average annual rate of 11.7 percent (Figure 3.1).[4] In relative terms, total government spending on MAFF, MOWRAM, and the MRD increased from 0.7 percent of GDP in 2004 to 0.9 percent in 2009, while the total budget for these three ministries increased from 2.5 percent of agricultural GDP in 2004 to 2.7 percent in 2008. It should be noted that these figures are low compared with countries at the same income level, as discussed below, although there has been a strong upward trend. When compared to total government budget, spending on MAFF, MOWRAM, and the MRD remained stagnant at around 8 percent during 2004 to 2008 period, indicating that agriculture did not receive more funding than other sectors.

MOWRAM had the largest increase in the government budget over the 2004 to 2009 period, while the MRD received the largest cumulative share of government spending. The government budget for MOWRAM

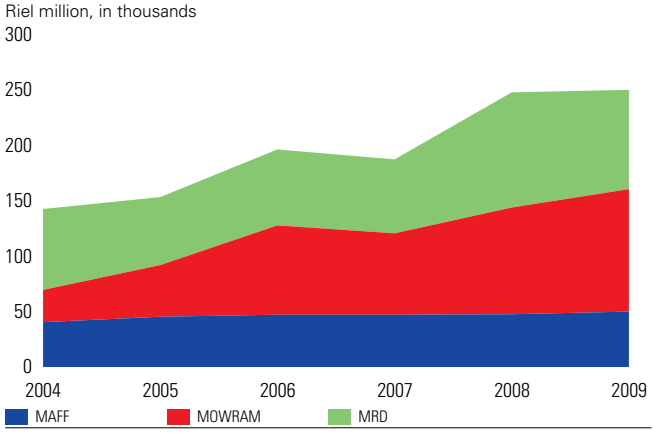
4 It is estimated that about 80 percent of the total MRD budget is spent on rural roads or related expenditures.

Figure 3.1. Trends in Nominal and Real Budgets for Agriculture, Irrigation, and Rural Roads, 2004–09



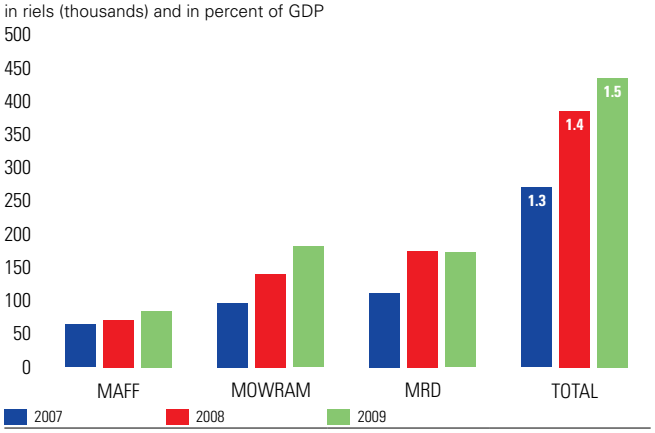
Sources: TOFE Tables and MEF.

Figure 3.2. Structure of the Approved Budget for MAFF, MOWRAM, and the MRD, 2004–09



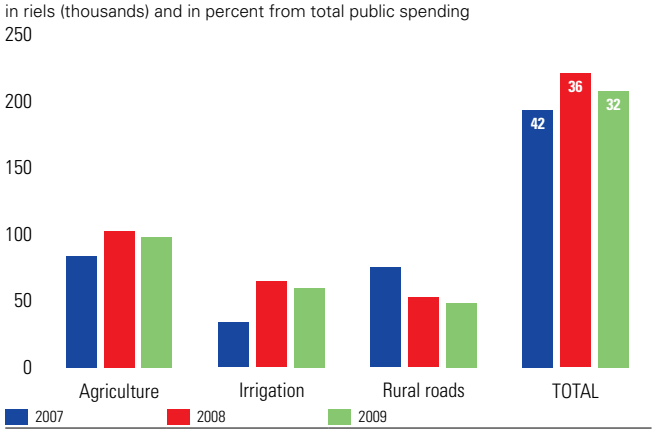
Sources: TOFE Tables and MEF.

Figure 3.3. Spending from own resources has increased…



Sources: MEF TOFE Tables and MAFF Department of Finance.

Figure 3.4. …while donor support has declined



Sources: CDC database and the DIC.

increased from Real 32.2 billion in 2004 to 174.7 billion in 2009 (an average annual rate of 30 percent in real terms), while its share of the total budget for three ministries increased from 20 percent in 2004 to 44 percent in 2009 (Figure 3.2). The budgets of MAFF and the MRD also increased though much more modestly over the same period at annual rate of 4.7 and 3.9 percent respectively in real terms. In fact, the budget share for MRD declined from 51 percent in 2004 to 36 percent in 2009.

Total funding for the agriculture, irrigation, and rural roads sectors from both government and donor sources increased from Riel 464 billion in 2007 to Riel 644 billion in 2009. This is equivalent to 1.5 percent of GDP[5] (Table 3.1 and Figure 3.3). Donor spending on agriculture, irrigation and rural roads averaged about $50 million per year between 2007 and 2009, increasing from Riel 194 billion to Riel 207 billion, albeit at significantly slower rate than government spending over the same period. The share of donor funding in total funding decreased from 42 percent in 2007 to 32 percent in 2009.

5 The data on total funding for agriculture, irrigation, and rural roads from the government and donors are available only for 2007-2009 period.

Table 3.1. Total Spending on Agriculture, Irrigation, and Rural Roads, 2007–09

Riels million

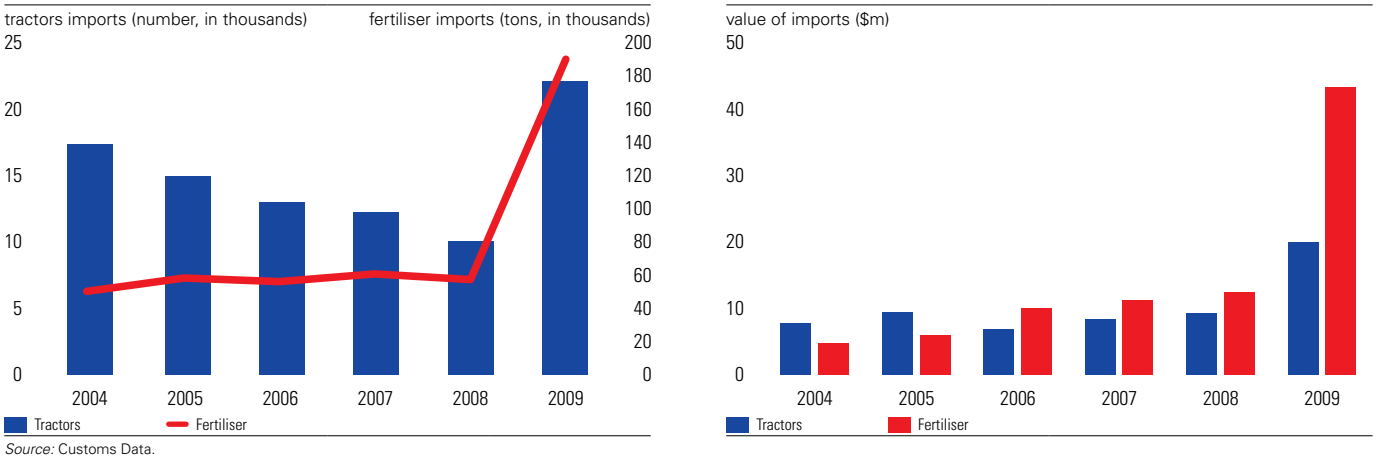
	2007		2008		2009	
	Riels	%	Riels	%	Riels	%
MAFF (Agriculture)						
Recurrent	57,655	39.1	65,821	37.7	80,172	43.9
Capital	5,462	3.7	5,699	3.3	3,638	2.0
Donor	84,369	57.2	102,968	59.0	98,687	54.1
Total	**147,486**	**100.0**	**174,489**	**100.0**	**182,497**	**100.0**
MOWRAM (Irrigation)						
Recurrent	20,427	15.9	25,861	12.6	31,352	13.1
Capital	74,508	58.0	114,593	55.8	148,691	62.0
Donors	33,570	26.1	64,975	31.6	59,768	24.9
Total	**128,505**	**100.0**	**205,429**	**100.0**	**239,811**	**100.0**
MRD (Rural Roads)						
Recurrent	13,902	7.4	18,097	8.0	25,503	11.5
Capital	53,253	28.4	108,111	47.8	87,559	39.6
Commune/Sangat Fund	44,810	23.9	47,726	21.1	59,345	26.8
Donors	75,720	40.3	52,282	23.1	48,843	22.1
Total	**187,685**	**100.0**	**226,215**	**100.0**	**221,250**	**100.0**
GRAND TOTAL	**463,676**		**606,133**		**643,558**	
GRAND TOTAL (USD mn.)	**115.8**		**148.5**		**154.5**	
Share of GDP (%)	**1.3**		**1.4**		**1.5**	

Source: MEF TOFE Tables for government capital and recurrent, except for MAFF recurrent which is based on MAFF Department of Finance figures. Commune Fund figures from the NCDD. Donor figures are from the CDC database and from the DIC. GDP figures from the national accounts.

Almost half of this donor funding was spent on agriculture, with the rest being split between irrigation and roads. Donor spending on rural roads declined over the 2007 and 2009 period, which in turn contributed to the declining share of donor spending in total spending, while funding levels for agriculture and irrigation have been more stable (Figure 3.4).

Agricultural producers in Cambodia enjoy a number of tax exemptions, which could be considered as additional indirect support to the sector. The main source of indirect support to the sector is the exemption from import duty for fertilizers and tractors. Figure 3.5 presents official customs figures, which may understate the volumes and values involved as there is a large degree of informal trade in fertilizer markets. According to the official

Figure 3.5. Quantities and Values of Imports of Fertilizer and Tractors (2004–09)



Source: Customs Data.

customs figures, imports of fertilizer have grown substantially since 2004, both in value and quantity, with a sudden jump in 2009. By 2009, nearly 200,000t of fertilizer and over 20,000 tractor units were imported, reflecting the renewed interest of the private sector in agricultural production after increased returns in 2007 and 2008. The value of imports has increased to over $40million for fertilizer and about $20 million for tractors. Assuming a 20 percent tax rate on fertilizer imports (in other words, the same as fuel imports) and a 15 percent tax rate for tractors (in other words, the same as for other equipment and machinery), the indirect support given to agricultural producers through tax exceptions was about $11 million in 2009, which makes up about 7 percent of total spending and 14 percent of government spending on agriculture, irrigation, and rural roads.

How does Cambodia's spending on agriculture, irrigation and rural roads compare to spending by other countries? International comparisons show that Cambodia spends less on agriculture than other countries when spending is measured as a share of agricultural budget in GDP (Table 3.2). Out of ten countries, only two—Indonesia and Bangladesh—have equal or lower ratios of public spending on agriculture to GDP, and only Bangladesh has a lower ratio of public spending on agriculture to agriculture value added. Public expenditure on R&D, using a broad definition, for Cambodia is relatively low, at only 0.1 percent of agricultural GDP compared with 0.2 to 0.6 percent elsewhere in Asia.

Table 3.2. Public Spending on Agriculture: International Comparisons

	2004	2004	2000	1990–2005	2003–05 av
	Govt. Spending on Agriculture % of GDP	Govt. Spending on Agriculture % of agric GDP	Public R&D % of agric. GDP	Average Annual Growth in agriculture GDP%	Agriculture value added as share of GDP %
Bangladesh	1	1.7	0.44	3.2	20
China	6	11.3	0.43	3.7	12.8
India	1	11.7	0.34	2.5	17.6
Indonesia	1	3.1	0.21	2.3	15
Philippines	3	5	0.41	2.4	14.9
Sri Lanka	3	5.3	0.64	1.4	15.9
Thailand	3	11.7	n.a.	1.8	10
Kenya	2	4.1	2.68	2.6	25.9
Uganda	5	4.1	0.5	3.9	25.6
Bolivia	2	6.8	n.a.	2.9	12.9
Cambodia (2008)	1.5	2.9	0.1	5.3*	32.4

Sourcea: World Development Report 2008 for government spending on agriculture, on public research and development, agriculture value added, and agriculture growth rates; World Bank GDP WDR data base for GDP figures: and for Cambodia, consultants' estimates.

International experience suggests that higher public spending does not always translate into higher agricultural growth.[6] Comparing year-on-year changes, public sector spending on agriculture, irrigation, and rural roads seems to have little correlation with agricultural GDP growth in Cambodia. While public investment ranged between 2.3 and 2.7 percent of agricultural GDP between 2004 and 2008, agricultural GDP growth ranged from -0.9 percent up to 15.7 percent over the same period. This indicates that changes in agricultural GDP in Cambodia have less to do with the relative levels of public spending than other factors such as climate.

On the other hand, international experience shows that expenditures on public goods, such as agricultural research, extension, and farmer education and training and rural infrastructure do help to increase agricultural growth and competitiveness. In fact, quality of expenditures is equally if not more important than the relative levels

6 See also World Bank (2007) and World Bank (2010).

of public resources spent. Clearly, spending in some areas and activities will generate higher economic and social returns than in others. For example, in allocating public funds for agriculture, many governments have chosen to spend their agricultural budgets on subsidies for private farm inputs, such as seeds and fertilizer, while spending far less on rural infrastructure and technology development. Yet international evidence suggests that returns to private input subsidies are typically lower than returns to investments in public goods. This is in part because private input subsidies are prone to encourage rent-seeking and in part because public input subsidies substitute for private financing of these private inputs. For example, Lopes et al (2006) empirically document that the government's decision to subsidize either private or public goods has negative consequences for economic development. Furthermore, analytical evidence shows that expenditures on private goods in many cases have negative returns due to high levels of corruption, the crowding out of private input purchases, resource misallocation, and consequent inefficiencies in input use. For example, estimates from 15 Latin American studies indicate that a 1 percent increase in the budget share for agricultural input subsidies reduces per capita agricultural income by 0.3 percent to 0.5 percent (Lopez, 2005).

Changes in macroeconomic conditions or agriculture policies also have an important impact on sectoral growth rates. Cambodia has maintained conducive and relatively distortions free policy environment, which have encouraged significant growth of private sector investments. This could indicate that: (a) the agriculture sector in Cambodia has the potential to yield high returns on investments and (b) Cambodia's investments in the agriculture sector, both government and donor, may have been relatively efficient.

In Cambodia, public spending on agriculture has been allocated to public goods and services, and the government should be commended for this. While Cambodia was able to achieve high agricultural GDP growth rates with low levels of public spending, maintaining these growth rates would require eventually more and better public spending to maintain current growth rates and to reduce the variability of growth due to weather-related shocks.

However, there is a need to achieve a clearer understanding of the impact of the levels and composition of public expenditures on agricultural growth. Recognizing that the tight fiscal space makes it difficult to implement a dramatic increase in public spending levels any time soon makes it even more important to ensure that public expenditures for agricultural development are efficient. Chapter 5 of this report discusses the specific expenditures that have had the greatest impact on agricultural growth in Cambodia.

B. Economic Composition of Sector Budgets

Analyzing the economic composition of the budget is the first step in determining the allocative efficiency of public expenditures. In determining the economic composition of public spending on agriculture, irrigation, and rural roads in Cambodia, expenditures must first be classified into recurrent and capital expenditures. Recurrent expenditures are then further divided into salaries and operating costs. The recurrent expenditure data used in this analysis are budgets for entire ministries. This is not a problem with respect to MAFF and MOWRAM since their ministry budgets are aligned with agriculture and irrigation activities respectively. However, for the MRD, this is less satisfactory since the ministry also deals with rural water supply, rural sanitation, and community development. We therefore estimated that about 40 percent of the MRD's total recurrent budget is allocated to rural roads.

The analysis of total government recurrent and capital budgets provides a basis for evaluating spending on agriculture. The total government recurrent budget increased from Riels 1,215 billion in 2000 to Riels 4,439 billion in 2009, an average annual increase of 10.1 percent. The total government capital budget became increasingly important over the same period, growing from Riels 297 billion in 2004 to Riels 1,019 billion in 2009. Appropriations to the government's capital budget have increased each year, growing at an annual average rate of 17 percent in real terms between 2004 and 2008.

Recurrent funding makes up about one-third of total government spending on agriculture, irrigation, and rural roads. MAFF has consistently had the largest recurrent budget among the three ministries, with its expenditure rising from Riels 23,415 million in 2000 to Riels 78,192 million in 2009, an average annual increase of 14.7 percent. The large share of recurrent budget in the total budget reflects the service provider functions of MAFF compared whereas the other two ministries are mainly responsible for rural infrastructure development. MOWRAM had the smallest share of recurrent budget, rising from Riels 6,199 million in 2000 to Riels 31,352 million in 2009, an annual average growth of 20.6 percent. The MRD experienced the highest recurrent budget growth, rising from Riels 7,550 million in 2000 to Riels 54,596 million in 2009, an average of 29.8 percent annually (about 40 percent of the MRD's total recurrent budget is allocated to rural roads)

Operating costs make up the largest share of the government recurrent budget, while the share of wages has remained modest. During the 2000 to 2006 period, the share of operating costs in total budget was 41 percent for MAFF, 74 percent for MOWRAM, and 58 percent for the MRD. The higher figures for MOWRAM and the MRD reflect the infrastructure rehabilitation and maintenance responsibilities of those ministries. The share of wages and salaries during the same period was 26 percent for MAFF, 18 percent for MOWRAM, and 16 percent for the MRD, which highlights the general problem of low salary levels in public service.

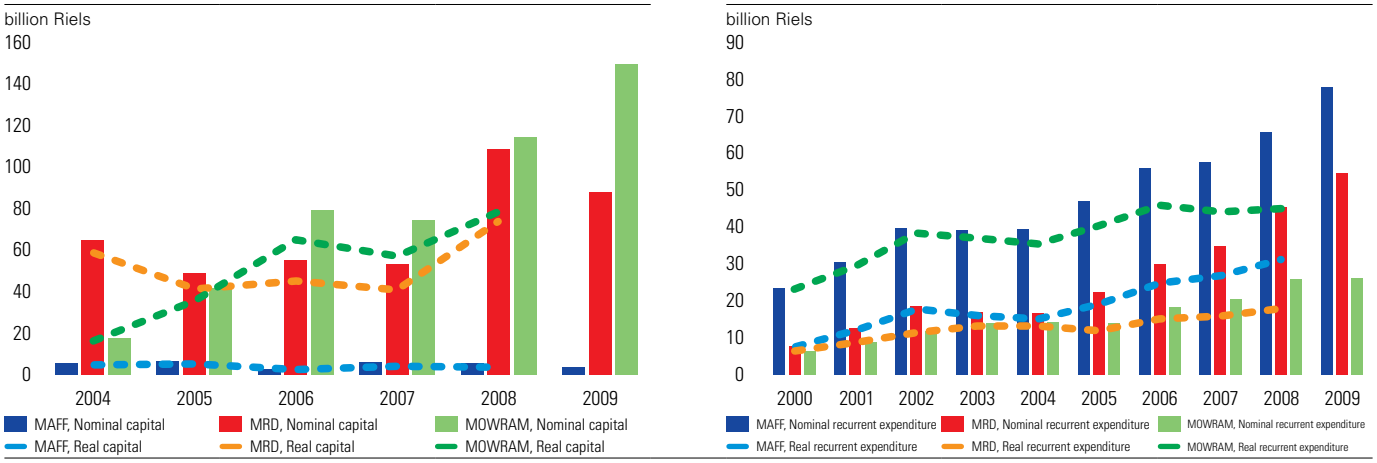
The low level of wage provision in recurrent budgets is a concern for the sustainability of public service provision functions. One of the functions of the recurrent budget is to balance the wage and operating components. The wage component should consist of sufficient resources to employ and retain adequate numbers of qualified staff, while the non-wage component should provide resources so that a trained and motivated workforce can deliver public services effectively and efficiently. Typically, the distribution of financial resources between salaries and operating costs in more advanced economies is around 60 or 70 percent to around 40 or 30 percent. If these proportions become out of balance, there is a risk that the agency in question will become unstable and ineffective. It might become difficult to recruit, retain, and motivate staff if salaries are too low, while inadequate operating budgets make it impossible to deliver planned work programs. This would apply particularly to extension services in those provinces where there is no donor support.

It is common in developing countries for staff to have little operating budget despite their very low salaries. The low salary/low operating budget scenario is also common across ministries in Cambodia. The solution is not simply to recommend that salaries be increased in isolation. Macro fiscal analysis is needed to establish whether there is any fiscal space for this and, indeed, whether it should really be the top priority for the use of scarce fiscal resources. These issues are also bound up in public administration reform, which is being handled by the Council for Administrative Reform, and are outside the mandates of the line ministries.

There have been large increases in government capital spending during the 2000s. In 2009, capital spending made up about 64 percent of total government spending for the three line ministries, up from 55 percent in 2007. The MRD and MOWRAM have been priority recipients of the increased appropriations to the government financed

capital budget over the past five years. MOWRAM's capital expenditure increased from Riels 17.9 billion in 2004 to Riels 148.7 billion in 2009 (Figure 3.6). The MRD's capital expenditure increased from Riels 53.3 billion in 2007 to Riels 87,559 billion in 2009. In the case of both ministries, the government capital budget has grown to be larger than their recurrent budgets, making up about 80 percent of their total government provided budget. Capital budget expenditures for MAFF are very low, which reflects its role as a service provider rather than an infrastructure provider. In 2009, its capital budget was only 4 percent of the total budget.

Figure 3.6. The Capital and Recurrent Budgets of MAFF, MOWRAM, and the MRD in Nominal and Real Terms, 2004–09



Sources: TOFE tables and MEF.

The capital budgets of the three ministries combined have accounted for around 30 percent of total capital expenditure in Cambodia in some years. MOWRAM's share peaked at 21 percent in 2006, and despite a large absolute increase in 2009, it had declined to 15 percent of the total. The MRD's share of the total also declined from a peak of 22 percent in 2004 to 19 percent in 2009. It should be noted that the combined ratio of capital expenditure to recurrent expenditure for MAFF, MOWRAM, and the MRD was 151 percent in 2009, compared to 23 percent in the case of total government capital and recurrent expenditures, which further illustrates the high share of capital expenditures in the budgets of MOWRAM and the MRD.

Are the current balances between recurrent and capital expenditures optimal? As we will see from the analysis of Chapter 5, the answer is probably no. In the irrigation sector, operating and maintenance budgets (O&M) cover only a fraction of the sector's total maintenance needs. In 2009, O&M accounted only 14 percent of the total recurrent budget, up from 10 percent in 2007, which is equivalent to $1 million for the whole country. Even these limited funds are used mainly for pumping rather than for maintenance. The situation is similar in the roads sector where government provision for O&M was only 31 percent of the recurrent budget in 2009 (some $4 million), which is about 20 to 30 percent of what is needed to maintain rural road network to adequate standards.[7]

The government has been trying to address the issue of underfunding for rural infrastructure maintenance in a variety of ways. In irrigation, government policy makes Farmer Water User Committees (FWUCs) responsible for O&M expenditures over a five-year transition period, during which time the FWUCs receive training and technical

7 Based on the estimates provided by the Department of Rural Roads of the MRD.

support. However, much international experience as well as experience from Cambodia suggests that this approach has not generated the expected degree of maintenance by end users. As for roads, the funds for maintenance are used mainly for gasoline and gravel. Routine and periodic maintenance is carried out by staff of the provincial departments of the MRD. The MRD has a stock of medium and small-sized vehicles from various projects that are used to carry out maintenance, and no vehicles have been bought for O&M from the MRD's capital budget (see Annex D for details of the central and provincial recurrent budgets).

C. The Functional Composition of Sector Budgets

Analyzing sectoral expenditures by functional areas gave us a clearer sense of how government and donor spending is related to sectoral development goals and constraints. We assembled data on functional areas by disaggregating departmental-level budget data at the central MAFF level for 2007 to 2009. No disaggregated data are available at the provincial level. During the period of 2007 to 2009, the central MAFF budget constituted 65 percent of the total MAFF recurrent budget, the rest going to the provinces. We assumed for the analysis that the structure of the central and the provincial budget is likely to be similar. We aggregated data from 23 budget units within MAFF into 11 primary functional spending areas.

The majority of government agriculture expenditures between 2007 and 2009 were concentrated on policy and planning, forestry, and agricultural education/training (57 percent). Only 5 percent of the budget was spent on agricultural extension and research (Table 3.3). The largest budget allocation increases during this period were for livestock/ veterinary services and for policy and planning.

At the same time, donors have concentrated on providing assistance to agricultural extension, which made up some 31 percent of total donor funding, followed by agro-industry (15 percent), and fisheries (14 percent).[8] Agricultural research was one of the functional areas that received the smallest share of donor funds (3 percent), along with agricultural machinery and rubber production.

Table 3.3. Government and Donor Expenditures by Functional Areas, 2007–09

Riel, mill

	2007			2008			2009		
	Government	Donors	Total	Government	Donors	Total	Government	Donors	Total
Agronomy/land improvement	5,104	7,956	13,060	5,159	6,575	11,734	3,262	5,151	8,413
Agricultural machinery	949	-	949	1,018	-	1,018	393	-	393
Agricultural extension	1,492	33,166	34,658	1,850	24,389	26,239	1,424	29,702	31,126
Livestock and veterinary	3,901	4,469	8,370	5,335	10,959	16,294	9,420	14,286	23,706
Rubber production	2,871	4,740	7,611	1,964	3,065	5,029	1,640	-	1,640
Agro-industry	494	3,760	4,254	784	31,355	32,139	372	6,843	7,215
Agricultural research	2,727	3,375	6,102	2,567	2,852	5,419	3,166	3,905	7,071
Agricultural education/training	8,167	2,586	10,753	7,822	3,705	11,527	9,636	6,839	16,475
Forestry	13,240	5,293	18,533	13,538	3,550	17,088	9,533	5,685	15,218
Fisheries	7,083	15,219	22,302	10,643	9,005	19,648	4,601	16,638	21,239
Policy planning/management	11,626	3,805	15,431	14,256	7,514	21,770	35,788	9,639	45,427
Capital budget	5,462	-	5,462	5,699	-	5,699	3,638	-	3,638
TOTAL	**63,116**	**84,369**	**147,485**	**70,635**	**102,969**	**173,604**	**82,873**	**98,688**	**181,561**

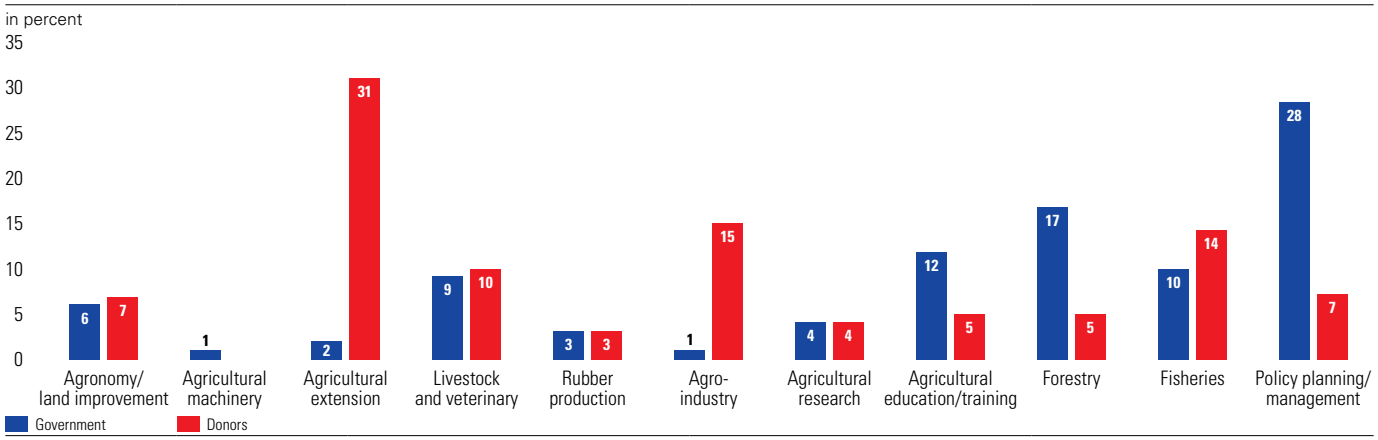
Sources: TOEFE tables and MAFF. Consultant estimates based on CDC database and DIC records.

8 A comprehensive list of donor projects providing resources to the agriculture sector is presented in Annex C.

Taking government and donor spending together, agricultural extension and policy and planning are the two functional areas that received the largest shares of total funding (18 and 16 percent respectively). In total, agricultural extension and research received 22 percent of total expenditure. This shows that government extension services would find it difficult to operate without donor support. Services would have to be scaled back from the current five extension agents per district to two. Fisheries (13 percent) and forestry (10 percent), both of which have donor-supported sector plans in place, continue to be major beneficiaries under, though forestry receives a lower share of donor support than of the government budget. Agricultural machinery, research, and rubber production received the lowest share (7 percent total). During the 2007 to 2009 period, agro-industry had the largest increase in budget allocations, while rubber production, agricultural machinery and agronomy, and land improvements had the largest declines. Figure 3.7 presents the spending shares for government and donor funds by functional areas.

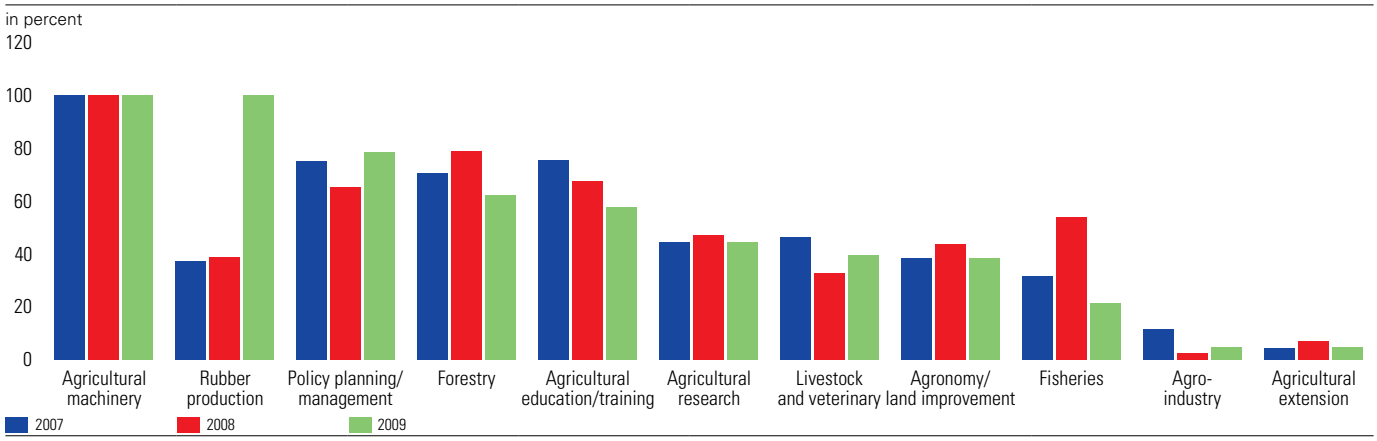
As see from the above, the agriculture sector in Cambodia relies heavily on donor funds, although there are some functional areas where the government provides the majority of funding. Overall, the ratio of government to total consolidated funding for the agriculture sector stood at 41 percent in 2007, 43 percent in 2008, and 46 percent in 2009 (Figure 3.8). This ratio has been improving but the government is still dependent on donors for the majority of sector funding. As noted above, areas such as agricultural extension and agro-industry receive very little funding

Figure 3.7. Shares of Government and Donor Expenditures by Functional Areas, average between 2007 and 2009



Sources: TOEFE tables and MAFF. Consultant estimates based on CDC database and DIC records.

Figure 3.8. Government Share of Total Consolidated Public Spending Allocations to Agriculture, 2007 to 2009



Sources: TOEFE tables and MAFF.

from the government, and are therefore dependent on donor resources for the majority of their resource flows. The government's contributions to agricultural extension, agricultural research, agronomy and land improvement, livestock and veterinary, agro-industry, and fisheries are all less than 50 percent.

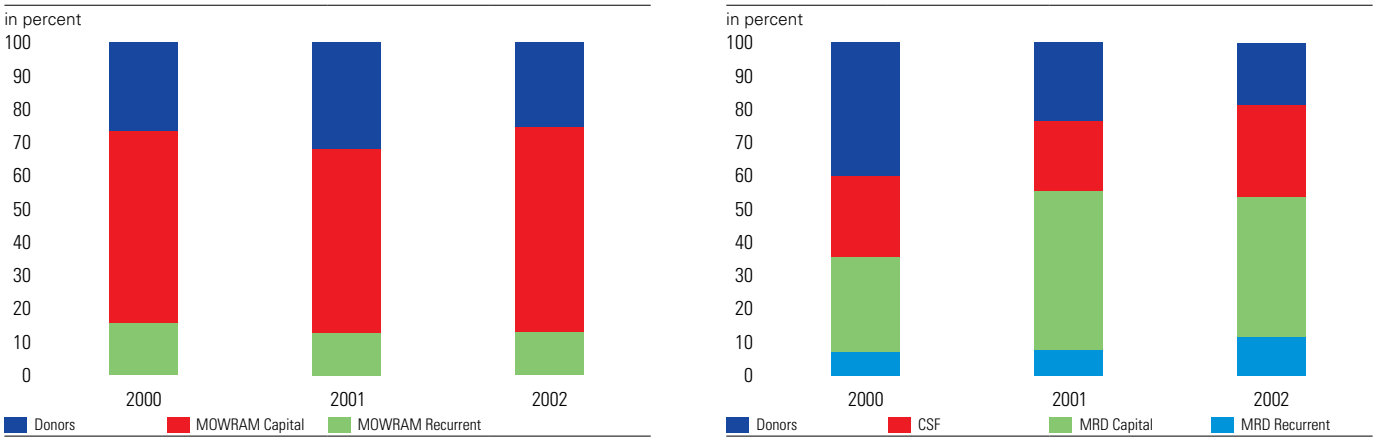
Why has government funding been so low for some functional areas and so high for others? A number of factors may be at play. Government funding may be low because it does not see these areas as priorities, perhaps because of a perception that returns to public investments in those areas will be low. Alternatively, it could be a rational response to the fact that donors are allocating more resources to these functional areas based on their agency priorities, thus allowing the government to reallocate its scarce funds to other functional areas that would otherwise have been underfunded. The indications are that both elements may be in play. Until recently, the MEF had been skeptical about the effectiveness of and returns to agricultural research and extension expenditures. On the other hand, donors have not just been filling gaps but have deliberately emphasized research and extension because they anticipated favorable returns, a view which is supported by some international as well as local evidence. However, the government's perceptions may be changing as indicated by the increase in spending on agricultural extension in the 2011 budget.

Over-dependence on donor funding has a number of implications. The first is related to the lack of fiscal sustainability as there is uncertainty about the duration of donors' funding commitments to various functional areas or to the sector in general. Donors have increasingly been taking a longer-term view of their support, but there are still time limits on any donor's funding commitments. Secondly, unless a sector is supported by the government budget, donor support means establishing parallel project-based financing and management systems. Donor accountability requirements mean a proliferation of PMUs, which often operate outside government structures and which have incentives to attract skilled staff away from the public sector. The PMUs distract both resources and attention away from the core business of government. And there are no procedures requiring all donors to provide the government with the necessary information to capture their financing in line agency budgets, which would remain a key challenge for achieving government's budget comprehensiveness and transparency. Third, the timing of donor funding is less predictable than government funding, and this can lead to funding gaps, which can add to uncertainty.

Unlike the situation in the agriculture sector, the government provides the majority of funding for irrigation and rural roads. During the three years from 2007 to 2009, the government provided 72 percent of the resource flows to the irrigation sector, which signifies the high priority given to this sector on the national development agenda. Similarly, the government provided some 74 percent of funding for rural roads during the same time period (78 percent in 2009) (Figure 3.9).

Both MOWRAM and the MRD command a sizable share of the government's capital budget, specifically 29 percent during the 2004 to 2009 period. Detailed departmental data are not available for MOWRAM or the MRD, which makes it difficult to analyze the ministries' budget provisions by functional areas. The Department of Engineering within MOWRAM is well equipped to carry out construction and rehabilitation work in the irrigation sector. However, the limited funding available for capital expenditures has meant that civil works have had to be carried out in phases, with the highest priority given to the construction or rehabilitation of primary channels, leaving the work on secondary and tertiary structures for later when and if funds become available. This piecemeal approach has limited the effectiveness of public funds as discussed in Chapter 4. In roads, capital spending has focused on rehabilitating national and rural roads under the Department of Rural Roads. While most government-funded capital work on rural roads is carried out by state sub-contractors, donor-funded rehabilitation work tends to be done by private sector contractors.

Figure 3.9. Consolidated Resource Allocations for Irrigation and Rural Roads, 2007–09



Sources: TOFE, MAFF, and MRD Department of Finance.

An additional source of capital funds for rehabilitation of rural roads comes from Commune Sangkat Fund (CSF). Some 90 percent of CSF funds are used for infrastructure, of which historically about 80 percent has been spent on rural roads. The CSF is financed by a sub-decree that provides for a fixed annual allocation of government domestic revenues. This fixed amount was 2.8 percent of domestic revenues in 2009. The CSF funds are complemented by various donor funds. In 2009, funds channeled through the CSF for use by communes reached $27.0 million.

Summary. **In agriculture, shortfalls in domestic operating budgets for research and extension have been covered by donors.** Donor funding for agriculture in Cambodia has given priority to agricultural services and has helped to fill domestic funding gaps particularly for agricultural extension. However, there may be disadvantages to this very extensive dependence on donor funding related to the sustainability and predictability of fund flows and the diversion of skilled workers from the government to donor projects. There may be a need for some rebalancing of the government/donor relationship in this area.

One solution might be to adopt a programmatic or sector-wide approach that would require donor projects to operate through government channels. Some other improvements might include: (a) bringing donor aid more closely into the government's planning and budgeting processes; (b) recording donor spending more explicitly in government accounts (or at least alongside the government accounts); and (c) requiring donors to report and be accountable to the relevant national ministry. There is also a need to consider whether the approaches, levels of input, and cost structures in the donor-funded sectors are compatible with the government eventually taking over financing responsibility for thse areas.

The government has provided high levels of domestic capital spending to rehabilitate physical infrastructure in the irrigation and rural roads sectors over last decade. However, there is a room to increase the effectiveness of this capital spending on irrigation since it has mainly been used to build or rehabilitate primary infrastructure such as water storage facilities. Since many farmers are still unable to use such infrastructure, this has negatively affected the returns to these investments.

Furthermore, while impressive amounts of infrastructure assets have built in both sectors, the emphasis on rehabilitation and new construction has limited the amount of resources available to maintain and preserve

the quality of those assets. Therefore, a rebalancing of domestic capital and maintenance budgets is required in order to increase the efficiency of this spending.

The policy of exempting fertilizer and farm machinery from import duties provides additional support to the sector in the amount of $11 million, which makes up about 14 percent of government spending on agriculture, irrigation, and rural roads. The government should be commended for providing this additional support to agriculture.

4. BUDGET PROCESS AND PERFORMANCE

The budget processes for MAFF, MOWRAM, and the MRD are governed by the systems put in place by the Ministry of Economy and Finance (MEF). Since 2005, the government has engaged in a comprehensive program of Public Finance Management (PFM) reform through its long-term (2005 15) Public Finance Management Reform Program (PFMRP). The PFMRP provides the direction for the development of PFM systems.

The Medium-term Macro Framework (MTMF) and the Medium-term Expenditure Framework (MTEF) provide the planning framework for macroeconomic and inter-sectoral resource allocations within which line ministries have to operate. The MTEF allocates the global resource envelope between sectors or administrative units (in other words, line ministries) and between the wage and non-wage elements of the ministry budgets. The MEF first introduced guidelines on the preparation of the ministry Budget Strategic Plans (BSPs)[9] by line ministries in 2007. Within MAFF, MOWRAM, and the MRD, the BSP process is managed jointly by the Department of Planning and Finance of each ministry. The BSP is essentially the bottom-up component of the MTEF system for allocating resources between sectors and ministries and is used by MAFF, MOWRAM, and the MRD to prepare their medium-term and annual expenditure plans. The BSPs have a programmatic structure based on the identification of organizational objectives, budget activities, output targets, and indicators for ministry spending.

Despite some progress, the links between the NSDP, the MTEF/BSPs, and the annual budget remain weak. The recurrent, capital, and donor budgets are not yet fully integrated into the BSPs. For example, externally financed spending is only partially captured in the government budget and is not classified according to the government chart of accounts. Also, the current BSPs have some weaknesses relating to the low levels of application of program expenditures and the inadequate specification of objectives, targets, and indicators. This is due to a combination of weak guidelines and supervision from the center and to capacity constraints in the line departments. To be fully effective, the BSPs need to reflect all public sector resource flows to a sector, whether from the government or donors. At the moment, the BSPs only capture government resources, and this is a major weakness given the high volume of donor aid. One of the difficulties in incorporating donor funds into the BSPs is the fact that donor projects are run by project management units (PMU) that are separate from and independent of the institutional mainstream of the ministries. As a result, the Departments of Planning and Finance have no authority over them. Only MOWRAM has made some progress in this area by consolidating the PMUs within its functional remit [check] into two or three central Project Management Offices (PMOs).

Both MAFF and the MRD are involved in the piloted introduction of Program Budgets (PBs) that began in 2007. The PB system, which is intended to provide more budget detail and more transparency, replaced the previous system of Priority Action Programs (PAPs) in 2007, but the system is still in the early stage of development. In the case of MAFF, the PB still applies to only 18 percent of the recurrent budget even after three years of piloting (see Annex C). This can be attributed to a combination of weak capacity and a lack of guidelines in the line departments in this area. In the MRD, PBs account for nearly 50 percent of the total recurrent budget, with 70 percent of PB allocations being allocated to rural roads maintenance. MOWRAM is not yet involved in the PB pilot.

PBs that are prepared as part of the BSP are intended to increase the relevance and improve the performance of public expenditure in a number of ways. The traditional kind of budgeting process is not explicitly based on the

9 These were originally known as Ministry Strategic Budget Frameworks (MSBF).

government's policy objectives and priorities. In contrast, the PBs align the resource allocation process more closely with policy priorities. While Sector-wide Approaches (SWAps) are intended ambitiously to be "sector wide," PBs are focused on a single area of policy activity, which makes them easier to manage.

However, the problems that stand in the way of improved budgeting are systemic and are to some extent beyond the control of the line ministries. There are distorted incentives inherent in the PB system. This is because under the current system, non-program PBs are less structured and less demanding in terms of the specification of activities, outputs, targets, and indicators and are therefore allow ministries more flexibility in dealing with short-term, unanticipated needs. The MEF, which is responsible for the PFM, is working to improve the budgeting systems through the PFMRP. The ten-year PFMRP timetable recognizes quite realistically that it will take time to deliver these reforms.

A major deficiency in the current budgeting process is the lack of a coherent departmental budgeting and financial reporting system. The departments of MAFF are provided with annual budgets, but all transactions have to be approved centrally. The system for monitoring and reporting expenditures and results by technical departments on an ongoing basis is, therefore, very opaque. A transparent system that would allow individual departments to be held to account is vital as the basis for the functional planning and monitoring of resource use.

Another element in any future solution to improve resource planning lies with donors. The donor community understands the desirability of moving away from projects towards a more programmatic approach. This is clear from the support that donors have given to the preparation of the Strategy for Agriculture and Water (SAW) and its five programs. However, the transition to programs should be coordinated with the current development by the government of budget planning and management instruments, including and especially the BSPs. The donors and the government should prepare to map the way forward for this transition.

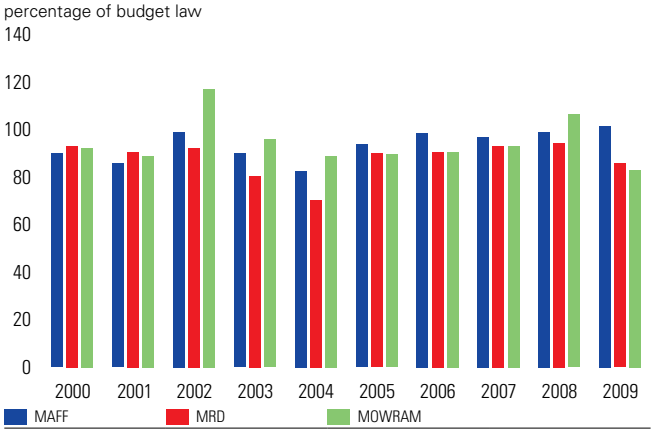
Since 2000, donors have led initiatives to introduce SWAPs as a way to improve the budgeting process in the health and education sectors in Cambodia. They were motivated by the realization that new and more comprehensive approaches were needed both to provide more holistic sector planning and to bring all donor resource flows under one coherent sector policy and strategy framework. The health and education sector SWAPs have been reasonably successful in terms of providing sound policy and strategy frameworks. They have also been successful in positioning the government as the lead partner and in persuading donors to locate their resources within a common sector planning framework. Having donors adopt common financial and implementation arrangements has been more difficult, although a degree of joint planning and monitoring activity has been achieved. However, channeling donor resources through government systems to save on transaction costs and to stem the loss of skilled personnel from the government to PMUs has not yet been generally accepted by most donors because of fiduciary risks.

What has been the budget execution performance of MAFF, MOWRAM, and the MRD? It was only possible for us to analyze the execution of the government recurrent budget. This is because domestically funded capital expenditures are not allocated to specific ministries. Instead, in accordance with the Budget Law, they appear as a single line item, to be apportioned by the Prime Minister to line ministries during the year.

Overall, between 2000 and 2009, MAFF and MOWRAM were within 5 percent of budget in only four years out of nine and the MRD in only one year out of nine. The budget execution rate for MAFF, MOWRAM, and the MRD reflects some under-spending during earlier years when the government's unpredictable revenue position led to difficulties with cash flow budgeting (Figure 4.1). Deviations from the original budget allocations were greatest during

the 2001 to 2005 period, when the under-spent budget was often more than 10 percent of total budget due to cash flow difficulties. However, since 2007, there has been a marked improvement in the budget execution rate in all three ministries since resource availability has become more predictable as a result of measures to improve resource forecasting and strengthen financial management introduced by the PFMRP. The average execution rate for the three years between 2007and 2009 was 99 percent for MAFF, 94 percent for MOWRAM, and 91 percent for the MRD, though these figures mask some deterioration in performance by MOWRAM and the MRD in 2009.

Figure 4.1. Recurrent Budget Execution Rates, 2000–09



Sources: TOFE Tables, MEF.

Table 4.1. Comparison of Actual Spending with Costings in the ASSDP and SAW

Riel, mill

	Strategy Investment Costing		Govt. Capital and Donor Outturn	
	5 Years	3 Years[a]	2007-09	% of 3 yr Strategy Costing
ASSDP Sectoral Goals 2006–10				
Research services	388,112	232,867	57,200	24.6
Extension services	40,359	24,215	10,131	41.8
Market access for agricultural products	26,650	15,990	87,257	545.7
Institutional and legislative framework	56,061	33,637	41,958	124.7
Fisheries reform - sustainable access	57,453	34,472	34,089	98.9
Forestry reform	16,428	9,857	40,862	414.6
Total MAFF	**25,874**	**15,524**	**14,528**	**93.6**
SAW Programs 2006–10				
Institutional capacity building & management	205,350	123,210	20,959	17.0
Agricultural and agri-business support	205,350	123,210	49,395	40.1
A&W research, education & extension	410,700	246,420	49,763	20.2
Water resource, irrigation & land management	410,700	246,420	496,177	201.4
Total MAFF/MOWRAM	**205,350**	**123,210**	**110,518**	**89.7**

Sources: ASSDP 2006-10, p. 31-32; SAW 2006-10, p.31; NSDP 2006-10, p.87 and 110; and consultant estimates.
Note: _a/ 60% of 5 year total.

How consistent are government and donor spending priorities with programmatic spending budgets? Actual government spending on agriculture and irrigation deviates from the projected costings set out in its strategies (Table 4.1). Comparing the ASSDP and SAW costings with government and donor spending reveals that research and extension were under-funded, while forestry, market access for agricultural products, and irrigation were over-funded. The amounts actually provided for the institutional and legislative framework and for forestry reform were close to the amounts projected in the ASSDP. Compared with SAW costings, actual spending on investments in irrigation appears to have been substantially above what was projected in 2005. It should be noted that most of the projections in these strategies refer to investment costs only, which have been matched by government capital and donor project funding over a common three-year time frame. The analysis is complicated by the fact that the ASSDP and SAW include substantial allocations for food security, for which there is no single operational responsibility within the government.[10]

10 Some of the activities in the food security programs can be assigned to research, extension, and/or crop production. However, a large part of the ASSDP is assigned to scaling up the National Program for Food Security and Poverty Alleviation (NPFSPA), which supports community-based development with no pre-assigned sub-sectoral allocations.

Summary

The ministries' Budget Strategic Plans (BSPs) have the potential to be the key policy and budget planning tool for allocating and managing all resources among and within sectors. The BSPs should become a central planning tool for the implementation of SAW and should cover both domestically financed budget allocations and donor allocations. The annual budget process would also be strengthened by requiring MAFF, MOWRAM, and the MRD to assign "hard" and enforceable budgets to each department through the BSPs. The current system of partial program budgets should be absorbed into a departmentally based approach covering all resources allocated to a department.

There is a need to introduce transparent reporting of expenditures for monitoring the performance of activities financed by the budget. At the moment, the MEF Treasury system records expenditures only by economic classification but not on a departmental or functional basis.

We suggest that a joint government/development partner annual review and planning process should be introduced for the annual and medium-term budget process that puts BSPs at the heart of the process. The government and donors have already succeeded in putting in place an agreed sector plan—SAW and its program design document for 2010-2013. At the same time, progress has been made in developing budget planning processes within the government. The three-year rolling Medium-term Expenditure Framework (MTEF) is actively predicting and guiding resource flows to priority sectors within the government. The BSPs, introduced in 2007, should become the central planning tool for the implementation of SAW. To encourage devolution of expenditure responsibility to departments, we recommend expanding TOFE under the MEF Treasury system. Absorbing SAW into the sector budgets will require it to be coordinated with and integrated into the budget planning and management instruments that have been put in place under the PFMRP. The donors, in consultation with the government, are preparing to map the way forward, and this should be done as a joint government/donor activity. The SAW initiatives present an opportunity to establish systems to ensure more regular and informative appraisal, monitoring, and evaluations and for these to be linked into budgeting decisions. Annex J presents one possible approach to improving the linkages between budgets and the strategic programs in the SAW under joint government/donor supervision.

5. THE EFFICIENCY AND EFFECTIVENESS OF EXPENDITURES IN THE AGRICULTURE, IRRIGATION, AND RURAL ROAD SECTORS

The analysis of how public resources are spent and of the impact of those resources is particularly important for low-income country, such as Cambodia, with limited budget resources and high dependence on donor aid. For the purposes of this PER, the performance of the government in achieving its objectives is measured in terms of crop production, of increased incomes of the immediate beneficiaries of public expenditure, and of reductions in expenditure. Most of the SAW objectives for research, extension, and irrigation involve increasing the incomes and livelihoods of farmer beneficiaries. In the case of rural roads, the immediate objectives are to increase the incomes of farmers and to reduce prices and costs of transport as well as the wider objectives of promoting growth and reducing poverty. Based on the results of this analysis, we make some recommendations for increasing the effectiveness and efficiency of public expenditures on the agriculture, irrigation, and rural roads sectors in the future.

The chapter presents a sequence of analytical steps that form the building blocks of a comprehensive analysis of public expenditures. We begin with a discussion of *outputs* and *outcomes* achieved as a result of public expenditures, both by the government and donors. We then assess the unit costs of these outputs and their trends over the past decade, which yields information about the *efficiency* of resource use. We then estimate the *effectiveness* of public spending using the techniques of cost-benefit analysis (CBA), identifying areas where performance could be improved and additional benefits achieved for the lowest possible cost. In order to complement data that were obtained from secondary sources, the study team carried out a rapid field survey to confirm the analytical results. The survey provided us with detailed information about farmers' perceptions about the benefits and constraints of public service provision in the extension, irrigation, and rural road sub-sectors. (Annex F provides summary of the field survey and Annex G a summary of case studies in Cambodia.) The chapter then concludes with the results of an illustrative simulation analysis that estimates the impact of various expenditure scenarios on GDP growth. However, it is important to recognize that the analysis of effectiveness and efficiency of public expenditures is a complex task that is complicated by the limited information basis in Cambodia. As such, the results should be treated as indicative.

A. Outputs and Outcomes achieved in the Agriculture, Irrigation, and Rural Roads Sectors

Outputs are defined as the immediate results from government-executed activities, which would be under its control. The outputs achieved are estimated using the available management records for MAFF, MOWRAM, and the MRD, most of which are compiled in the annual reports for each ministry. No independent verification of these data is available at national scale. The outputs reflect the indicators chosen by departments of the three ministries, which track results of their main activities. These indicators are appropriate, and reporting in most cases has been well organized. The analysis of agricultural research is constrained by lack of systematic and reliable information on outputs and costs, and will be therefore excluded from the analysis of efficiency and effectiveness. The discussion below summarizes the main outputs and outcomes achieved in agriculture, irrigation and rural roads sectors (see Tables 5.1 and 5.2).

Table 5.1. Output Indicators for the Agriculture, Irrigation, and Rural Roads Sectors, 2002–09

	units	2002	2003	2004	2005	2006	2007	2008	2009
Extension									
Farmers at training courses	'000	15.4	17.1	17.4	56.4	11.0	21.3	20.7	-
Farmers at meetings	'000	2.5	1.5	6.0	24.1	6.5	8.1	4.4	-
Farmers on field visits	'000	0.1	0.6	1.5	1.3	1.8	0.0	0.4	-
Farmers at field school	'000	2.4	2.9	3.1	5.3	-	4.3	0.4	-
Farmers at demonstrations	'000	1.1	1.0	1.1	0.9	4.7	0.5	0.6	-
Farmers at demon. Days	'000	2.4	4.7	3.0	8.4	0.8	3.2	2.2	-
Total farmers contacted		23.9	27.8	32.1	96.4	24.7	37.5	28.7	20.0
- as % of all farmers		0.9	1.1	1.2	3.6	0.9	1.4	1.0	
Irrigation									
New area irrigated (DoP)	'000ha	24.2	51.1	28.0	43.8	89.2	52.1	54.1	25.1
- as % of total irrigated area		3.8	7.5	4.1	5.9	10.6	5.9	5.8	2.7
Rural Roads									
Rehabilitation	km	107	349	256	277	204	262	585	432
- as % of total rural road		0.4	1.2	0.9	0.9	0.7	0.8	1.8	1.3
- No. of Rehab Roads	no.	11	17	11	8	13	23	34	34
Periodic Maintenance	km	-	297	999	609	0	353	510	503
- as % of total rural road		0.0	1.0	3.4	2.0	0.0	1.1	1.6	1.6
Routine Maintenance	km	82	159	124	241	334	384	535	594
- as % of total rural road		0.3	0.6	0.4	0.8	1.1	1.2	1.7	1.8

Sources: DAE Annual Reports, MOWRAM DoP records and CISIS, MRD DRR records.

Table 5.2. Outcomes Generated by Public Expenditure, 2002–09

Outcomes	units	2002	2003	2004	2005	2006	2007	2008	2009	Avg
Extension:										
New farmer adopters	'000	25	29	34	101	26	39	30	21	38
New improved cultivation	'000ha	24	29	34	105	28	43	33	23	40
Increased margins	$/ha	13	11	18	24	26	47	74	43	32
Total annual benefits	$m	311	337	607	2,558	730	2,021	2,438	979	1,248
Increased yields	t/ha	0.7	0.7	0.8	0.7	0.9	0.9	1.0	0.9	0.8
Increased production	'000t	18	20	26	76	25	39	31	22	32
Irrigation:										
Wet Season										
New area irrigated	'000ha	7	20	11	26	53	26	18	15	22
Increased yield from rainfed	t/ha	1.1	1.0	1.2	1.0	1.4	1.4	1.4	1.4	1.2
Increased rice production	'000t	8	20	13	27	71	35	26	21	28
Increased margins	$m	336	871	647	1,833	3,953	2,907	3,000	1,748	1,912
Dry Season										
New area irrigated	ha	28	-10	18	27	7	17	16	23	16
Yield on new area	t/ha	3.2	3.2	3.5	3.9	3.9	4.0	4.0	4.0	3.7
Increased rice production	'000t	89	-32	65	107	27	66	66	94	60
Increased margins	$m	3,123	-1,005	2,805	5,795	1,571	6,453	9,678	8,415	4,604
Rural Roads:										
Length rehabilitated	Km	107	349	256	277	204	262	585	431	309
Population affected	'000	23	71	49	50	35	43	93	66	54
Lower crop marketing costs	$'000	2	6	4	4	4	5	21	17	8
Reduced travel time	$'000	582	1,906	1,406	1,530	1,137	1,475	4,548	3,449	2,004

Source: Study team calculations.
Note: The number of farmer adopters is calculated from the number of farm contacts per extension worker, multiplied by the diffusion rate (3:1).

Agricultural Extension

Extension outcomes are closely associated with the adoption of improved farm management practices. The model used in Cambodia is for extension officers to train lead farmers who are then expected to contact other farmers. The key output variable associated with extension performance is thus the adoption rate per extension worker and subsequent diffusion rate among farmers. The MAFF/DEA extension service typically contacts between 25,000 and 40,000 farmers a year, which amounts to between 1 and 2 percent of all farmers in Cambodia. Over 2002 to 2009 period, the total number of farmers contacted amounted to nearly 10 percent of all farmers, although it is likely that many contacts were repeat contacts. Extension outputs are well defined and relatively continuous, although with some large spikes and gaps in outputs, reflecting the lumpiness of project activities. However, there is no clear trend in the outputs.

The evidence from field survey confirms that most farmers obtained extension messages from other farmers, suggesting that diffusion is indeed active. Furthermore, the evidence from Cambodia shows that about half farmers who have been contacted by extension officers adopt some form of improved farm practices, although about half of these adoptions are partial. The field survey found that over 90 percent of farmers were aware of DAE extension services, including farmers living in "non-extension" villages that were not covered by DAE extension activities. The adoption rate of extension messages, including partial adoption, was found to be 71 percent in villages visited by DAE extension officers and about 45 percent in non-extension villages (i.e. between 67 and 87 percent of all adopters adopt extension messages at least in part). The survey provides evidence of the importance of indirect contact—i.e. 61 percent of farmers reported obtaining extension advice from other farmers in their villages, while 37 percent obtained advice directly from DAE extension officers, and 36 percent obtained advice from NGOs. The field survey confirmed also a relatively high satisfaction rate among farmers with DEA extension services. Farmers reported an average yield increase of 31 percent as a result of adopting extension messages.

According to the field survey, most common messages received by farmers were for: rice farming (71 percent of households), fertilizer use (68 percent), pest management (65 percent) and compost making (59 percent). Over 40 percent of farmers also benefited from assistance with vegetables, sustainable rice intensification (SRI), and livestock and water management, while about 20 percent of farmers benefited from assistance with post harvest, cash crop and organic farming techniques. However, the majority (66 percent) of farmers reported that extension messages were difficult to understand, while 51 percent said that there was too little training, and 39 percent said that there was a lack of experiments and demonstration work. This suggests that the level of extension activity in villages is too thinly spread. Yet, only 11 to 13 percent of farmers reported problems associated with the lack of experience and skills of extension workers, supporting the view that good field capacity exists in DAE extension services.

Irrigation

The main output indicator used by MOWRAM is the area of new land irrigated as a result of its activities. Figures are reported separately for dry and wet season areas, which are very different in terms of water use and impact on yields. The incremental area rehabilitated each year has averaged about 5 percent of the total irrigated area, which means that over last eight years MOWRAM has probably rehabilitated about 40 percent of the total irrigated area in Cambodia. The proportion of area rehabilitated is slightly higher for dry season irrigation than for wet season. However, total irrigated area is variable on year-to-year basis. The data presented by MOWRAM does not

specify the proportion of the area that is actually cultivated. The results of the field survey suggest that there are many schemes in which actual irrigated area is smaller than total command area. For example, MAFF figures indicate that the average annual increase in dry season irrigation was about 4.6 percent from 2002 to 2009, compared to 7.5 percent of MOWRAM figures. This suggests that only about 60 percent of the new area reported by MOWRAM may be actually under cultivation.[11] The Cambodian Irrigation Schemes Information System (CISIS) contains data for command areas and cultivated areas for about 70 of the 710 schemes entered in the database. These data suggest that almost all wet season irrigated area and about 87 percent of dry season area is actually cultivated.

The field survey results also indicate that by far the main issue associated with irrigation is lack of water (reported by 85 percent of farmers). Lack of distribution canals and water diversion were also important (48 percent and 39 percent) emphasizing the problems associated with partial rehabilitation of schemes. Poor management of water allocation was mentioned by 36 percent of farmers and lack of maintenance by 25 percent. Lack of funding and cooperation were less significant problems and lack of labor was reported as a problem by only 4 percent of farmers.

Rural Roads

The MRD's 2007 Rural Road Strategic Plan (RRSP) suggests that 84 percent of rural roads are in poor or bad condition, based on a road condition survey in 2002. The RRSP estimated that it would require an investment of $314 million to bring all rural roads to good condition and that the annual costs of maintenance would be $17.2 million, including both periodic and routine maintenance. However, much has been achieved since 2002. The MRD data show an increasing trend in the number of kilometers of road rehabilitation, with large increases in 2008 and 2009. On average about 1 percent of all rural roads were rehabilitated each year, with about 1.3 percent benefiting from periodic maintenance and 1 percent receiving routine maintenance. The Commune Database provides additional indication of the extent of the achievements in rehabilitation of rural roads. Although the database is based on subjective assessments, there are some encouraging indications of improvements that suggest that only 37 percent of rural roads may have been in poor condition in 2008, which translates into required rehabilitation cost of $133 million. The Commune Database also reports plans to build an additional 7,668km of new rural roads at a total cost of over $100 million.

The field survey shows that farmers perceive highest benefits from improved roads coming from improved roads (in 1 to 4 scale) to improved access to hospitals and schools (3.4), followed by time savings (3.0). Increased volume of traders and general economic activities were also rated highly (2.9 3.0). Reduced transportation cost was rated less highly perhaps because (fuel) transport costs have risen sharply in recent years, which have partially offset gains from improved roads. The survey also asked farmers to estimate the scale of benefits and concluded that travel times were reduced by over 50 percent, costs of motorbike travel by 15 percent, and cost of travel by cars and lorries by 41 percent. On the other hand, the field survey states the poor quality of roads, due to lack of maintenance, as a main issue related to rural roads (80 percent of respondents), and less than half the respondents expected the benefits of the road rehabilitation works to be sustained.

11 The MAFF figures for dry season irrigation are higher than the MOWRAM figures, suggesting that the MAFF data cover areas that are not recorded by MOWRAM. MAFF does not report wet season irrigation, which is complicated by the variety of practices used for agricultural water management in the wet season.

Table 5.3. Cost Effectiveness, 2004–09

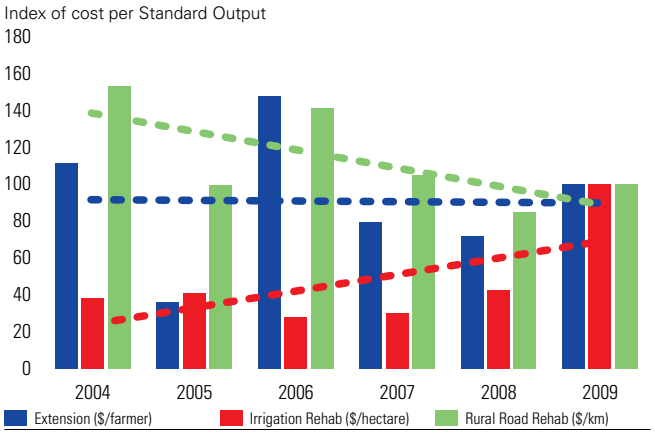
	unit	2004	2005	2006	2007	2008	2009	Tot/avg
Extension								
Outputs: Farmers contacted	'000	32.1	96.4	24.7	37.5	28.7	20	239
Costs: Government	$m	1.1	1.1	1.2	1	1	0.8	6.0
Costs: Donors	$m	10.2	10.6	12	10.2	7.7	8.4	59.0
Cost per farmer	$	354	122	534	298	302	457	273
as index (2009=100)		*111.3*	*36.3*	*147.8*	*79.5*	*72.3*	*100*	
Irrigation								
Outputs: New area irrigated	ha	28	43.8	89.2	52.1	54.1	25.1	292
Costs: Government	$m	8	13.4	24	23.5	34.7	48.8	153.0
Costs: Donors	$m	10.9	19.3	26.3	8.9	18.6	14.4	98.0
Cost per hectare	$	674	746	564	623	987	2516	858
as index (2009=100)		*38.5*	*40.5*	*28.4*	*30.3*	*42.9*	*100*	
Rural Roads								
Outputs: Length rehabilitated	Km	256	277	204	262	585	431	2,015
Costs: Government	$m	16.1	11.9	13.4	13.2	26.7	25.4	107.0
Cost per km	$	62,688	42,863	65,701	50,411	45,749	58,906	52,947
as index (2009=100)		*153*	*99.5*	*141.3*	*104.6*	*85*	*100*	
Outputs: Routine maintenance		999	609	0	353	510	503	2,974
Outputs: Periodic maintenance		124	241	334	384	535	594	2,213
Maintenance costs: Government		2.0	1.7	2.9	3.6	5.4	6.3	22.0

Sources: Table 5.1 and the cost data collected by study team.
Notes: Averages are presented as period averages, dividing total costs for the period by total outputs. They are therefore different from the straight arithmetic average of the annual unit costs. The indices show the unit costs adjusted so that the year 2009 has an index value of 100.

B. Efficiency and Unit Costs

Efficiency measures the extent to which outputs could be achieved with fewer inputs and can be measured by cost effectiveness, which considers costs per unit of output. Unit costs of various agriculture, irrigation and rural roads outputs are presented in Figure 5.1 and Table 5.3. The calculation of unit costs in this analysis required a considerable simplification due to difficulties of accounting for all costs of a single output variable, including overhead costs. As such, the results presented in this analysis should be treated with a caution. The discussion below summarizes the main findings and trend lines from the analysis of unit costs for agriculture, irrigation and rural roads expenditures.

Figure 5.1. Cost-effectiveness Indices: Actual and Trend Lines, 2004–09 (based on constant 2009 prices)



Source: Table 5.2.
Note. Indices are calculated backwards assuming 2009 = 100. The bar chart presents actual indices for each year and the lines present trends.

Agricultural Extension

The typical model of government extension activities in Cambodia is where extension workers generally work intensively with a small number of lead farmers (typically about 50 per extension officer) and aim to achieve high adoption rates (i.e. Farmer Field Schools). In general, the cost of government extension workers is similar to NGOs. The direct annual costs per government and NGO extension officer are less than $1,000 per year.

However, it can rise up to $20,000 per year for NGO extension officers when all local and international overhead costs are included. The average total cost per farmer contacted by the government extension officers was $273, including all overhead costs of the Departments of Extension and Crop Production and other project related costs.

International comparisons are difficult because they tend to report a narrower range of costs and because different extension systems define farmer contacts in different ways. For example, Fleischer et al (2002) reported costs of only $15 per farmer visited for the national extension project T&V approach in Kenya (2000); $80 $100 for a monthly visit system of private extension in Nicaragua (2001); $65 for the Indonesian Farmer Field School (FFS) system (1993 99) and $48 for the Philippines IPM farm field school program (1992 97). The Cambodian statistics show considerable variations in costs per farmer from year-to-year basis, caused mainly by large changes in outputs. However, the trend line for real costs per farmer is flat and shows that, on average throughout the 2004 to 2009 period, there has been no increase in extension costs per farmer in real terms. However, it is difficult to draw clear conclusions on the optimal unit costs and level of farmer extension contact as it involves better understanding of issues related to changing extension messages and curriculum, institutional development goals, farmer perceptions and household dynamics, which goes beyond the scope of this analysis.

Irrigation

The average cost of bringing an additional hectare under irrigation over 2004 to 2009 period was $858, when government and donor expenditures are divided by the incremental increase in irrigated area. However, cost has increased substantially over this period, and was particularly high in 2009, when it increased nearly threefold to over $2,500/ha, partly as a result of the high level of spending by the government. The recent rise in unit costs may be partly because the higher MOWRAM expenditures in recent years may not be reflected yet in the increase of additional new irrigated areas, which was rather low for 2009. The lower unit costs in early years may be because some of the earlier works done by MOWRAM were relatively modest in size but enabled large areas of land to return to irrigation, demonstrating increasing marginal cost of irrigation investments as easier schemes are rehabilitated first, with subsequent schemes requiring more expensive investments into water storage and transmission systems. However, these unit costs compared favorably with the unit cost of $1,500 to $2,000/ha used for budgeting in MOWRAM.

It should be noted that the unit costs of irrigation works in Cambodia still compare favorably with international norms. A review of World Bank support for Agricultural Water Management worldwide from 1991 to 2004 (World Bank, 2006) reported that the shift from new construction to rehabilitation over the period resulted in a reduction in unit costs from $6,600/ha to $2,900/ha. There are also wide variations internationally. A major review of 208 World Bank projects (Jones, 1995) estimated an average unit cost of $4,800/ha, with a range from $1,400/ha (South Asia) to $18,000/ha for Sub-Saharan Africa. Inocencio et al (2007) update this analysis with a review of 314 irrigation projects, estimating average unit costs of about $5,000/ha worldwide, with $8,200/ha for construction and $2,900/ha for rehabilitation. The average cost for Southeast Asia was $4,400/ha with $9,700/ha for new construction and $1,800/ha for rehabilitation in 2000 prices. Thus these data provide some comforting evidence that irrigation expenditures in Cambodia are efficient by international standards.

The analysis of effectiveness assumes annual maintenance costs of irrigation schemes as $115 per ha, which is about 50 percent of total rehabilitation cost on discounted basis. The national guidelines recommend contributions from FWUC members of 140 kg/ha for paddy, or about $35 equivalent for dry season irrigation for O&M

costs. There are also costs of water pumping and the private sector typically charges an additional 360 kg of paddy per hectare for this, which is equivalent to $80.

Rural Roads

The total cost of government-funded rehabilitation of rural roads was estimated as $53,000/km, including cost of technical support and management. This compares with the current contracting unit costs used by the MRD of between $30,000 and $45,000 depending on size, location and topography. Surprisingly, the trend line for the actual costs per km for rural roads has declined in real terms over the period, despite the fact that the unit costs reported by the MRD have increased by some 50 percent over recent years, notably as a result of increases in the costs of laterite and fuel. This may be because many road works carried out in early years involved major rehabilitation and improvement, including for example frequent tree removal (i.e. opposite to irrigation schemes where more complex works were carried out in later years). Management may also have become more efficient as the MRD has adopted improved contracting systems and overhead costs have been spread over a larger volume of activity.

Comparisons rural roads unit costs with other countries are complicated due to differences in circumstances, including topography, construction techniques and road sizes. However, these data suggest that unit costs of road rehabilitation in Cambodia are high by international standards. For example, the World Bank Vietnam Rural Transport Project included a condition that roads must cost less than $15,000/km. According to a recent Bank funded Rural Roads Project Report in India, a $34 billion rural roads spending program succeeded in building 375,000km on new rural roads and rehabilitating a further 372,000km. Assuming that the ratio of construction to rehabilitation unit costs was 4:1, the unit rehabilitation cost would be about $18,000 $/km. In Africa, unit costs show a wide variation from less than $3,000/km in Mozambique to $8,000/km in Uganda and $19,000/km in Ghana. There are a number of possible reasons for the high costs in Cambodia, including the need for demining in some areas, and the fact that a large proportion of the roads are in areas that are flooded every year and therefore require large amounts of construction material.

C. The Effectiveness of Expenditures on the Agriculture, Irrigation, and Rural Roads Sectors

The analysis of effectiveness measures how the government spends its resources to achieve its sectoral development objectives, and the value for money it gets for spending those resources. The performance of the government in achieving its objectives is measured in terms of production volumes, increased farm incomes, and reduced costs in providing services to intended beneficiaries. This is consistent with the NSDP monitoring indicators, which include a mix of output and outcome indicators, including cultivated area, rice yield, rice production, irrigated area and rehabilitated rural roads (RGC, 2008).

The analysis considers the impact of public expenditure on rice production, which is the main crop in Cambodia and serves as a good proxy for the whole agriculture sector. The choice of rice is justified on the following grounds: (a) it accounts for about 40 percent of crop value added in Cambodia: (b) it is a crop for which returns and farmer decisions are reasonably clear and well understood in Cambodia; and (c) it is a crop that has been a key focus of public spending on research, extension, and irrigation.

In this analysis, the quantification of the benefits from public spending are measured as changes in production volumes and in crop gross margins. The effects of public spending on production and crop margins are calculated using crop budgets. The effect of rainfall on production is estimated by assuming a best-fit linear relationship between rainfall and production. It is assumed that irrigation investments generate higher production and crop margins than extension in rainfed conditions. The benefits and production arising from dry season irrigation are higher than for wet season irrigation, reflecting the fact that wet season irrigation only involves a marginal increase in yields, whereas dry season irrigation makes a crop possible in areas where it would not otherwise be possible to grow a crop. The table also shows that the benefits associated with marketing of crops are relatively low compared with the benefits from reduced travel time.

The national data shows that the average annual growth in rice production has been 436,000 tons per year from 2002 to 2009. Out of this about 166,000 tons can be attributed to the increase in cultivated area and conversion to irrigation, and 74,000 tons to the improvements in rainfall through the period. The remaining 196,000 tons was a result of increased yields not associated with irrigation, of which 68,000t can be attributed to increased fertilizer use. The remaining annual increase in yields of 128,000 tons was caused by adaptation of improved farming practices (Table 5.4). The contribution of extension to increased production is estimated at an average 32,000 tons per year. Public expenditure can be credited for the production from the increase in dry season irrigation (60,000 tons per year) and for the production from conversion from rainfed to wet season irrigation (28,000 tons per year). Public expenditures can be thus attributed to an average annual increase of 120,000 tons of production, which is about 28 percent of the total production increase.

Table 5.4. Public Expenditure Contribution to Production Increase 2002–09

	2002	2003	2004	2005	2006	2007	2008	2009	Average
Total increase in production	-277	889	-541	1,816	279	463	448	410	436
Dry season irrigation area	89	-32	65	107	27	66	66	94	60
Wet season irrigation area	8	20	13	27	71	35	26	21	28
Rainfed area	-37	373	-293	397	88	16	27	53	78
Rainfall	-367	467	-121	252	360	0	0	0	74
Improved practices:									
More fertilizer use	18	18	18	27	-8	18	-14	467	68
Other improved practices	11	44	-223	1,005	-260	327	344	-225	128
Total	29	61	-206	1,033	-268	345	330	242	196
Of which government									
Dry season irrigation area	89	-32	65	107	27	66	66	94	60
Wet season irrigation area	8	20	13	27	71	35	26	21	28
Extension	18	20	26	76	25	39	31	22	32
Total	**115**	**8**	**105**	**210**	**123**	**140**	**123**	**137**	**120**
as a % of total									28%

Source: Study team calculations.
Note: Increased production due to expansion of dry season irrigation and conversion of rainfed wet season to irrigation, is estimated from MOWRAM figures, assuming MAFF average yields for the period. Expansion of wet season rainfed area is taken from MAFF figures, assuming average yields for the period. The impact of improved weather since 2005 is calculated by linear correlation of total production with total rainfed. Because the correlation is not linear, this creates unrealistic annual results, but the average response is more reliable. Fertilizer impact is based on import figures and crop budgets for yield impact.

The cost-benefit analysis (CBA) was carried out to estimate the net benefits generated by public expenditures. The key assumptions of the CBA are presented in Table 5.5. The CBA calculates benefit-cost ratios (BCRs), which present the discounted net benefits generated for every unit of expenditure incurred (i.e. present value of future steam of benefits and costs) based on prevailing market prices at a given year. The advantage of BCRs approach is that it can be applied to both capital and to recurrent expenditures, making it possible to compare infrastructure sectors with service delivery sectors. The BCRs are calculated using a discount rate of 6 percent. BCR of 1 indicates

Table 5.5. Key Assumptions in Cost-benefit Analysis

	Basis for Actual	Basis for Potential
General:		
Prices	Market prices for the year apply to whole benefit stream	Same
Duration	20 years	Same
Discount rate	6%	Same
Extension:		
Farmer contacts	3 farmers per extension officer	5 farmers per extension officer
Adoption rate	35%	Same
Yields and margins	Wet season rice yields increase by 60%. For dry season, irrigation allows to produce additional crop.	Same
Cost per extension officer	Actual costs, assuming $1,200 per extension officer	Same
Irrigation:		
Irrigated area as % of command area	70% of MOWRAM figure for new irrigated area	100% of MOWRAM figure
Yields and margins	Crop budgets verified against national figures	Same
Costs per hectare of command area	Actual costs and MOWRAM area figures	Same
Operation and maintenance activity	Annual maintenance cost $115 per ha. No maintenance, resulting in 10% loss of benefits per year	Full maintenance, no decline in benefit stream
Rural Roads:		
Km rehabilitated and maintained	MRD figures	Same
Transport costs saved	30% savings on $0.75 /ton/km	Same
Time savings on travel	30% savings on 4 hours/day for 220 days	Same
Value of time saved	55% of market wage rate	Same
Costs per km rehab and maintenance	Actual costs and MRD figures for km rehabilitated/ maintained	Same
Maintenance activity	Actual maintenance activity, with decline in benefits linked to maintenance gap	MRD recommendations, no decline in benefit stream

Source: Study Team assumptions.

that there is no net benefit from the expenditures (i.e. equivalent to NPV of zero). The BCR greater than 1 indicates positive net impact of public expenditures. The BCR above 2 is considered broadly as a good benchmark for the acceptable returns to public investments.

Figure 5.2. While BCRs for agriculture and rural roads investments have been rising…

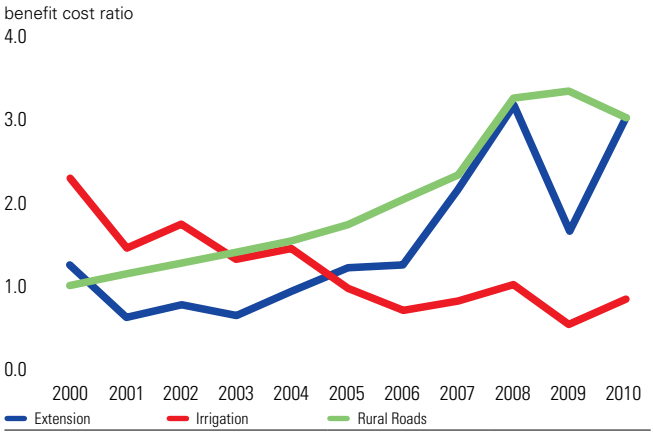
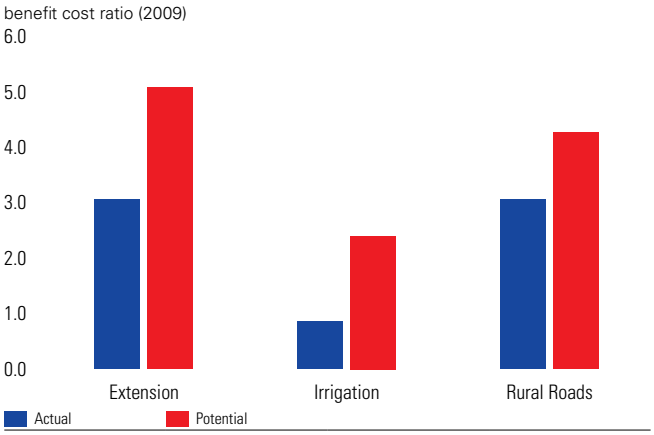


Figure 5.3. …they are still well below their potential



Source: Study team calculations.
Note: BCRs were calculated as discounted net benefits generated for every unit of expenditure incurred, which includes both capital and recurrent expenditure. This makes it possible to compare infrastructure sectors, such as rural roads, with those delivering public services, such as extension. The BCRs were calculated for each year, based on actual trend of unit costs of a year and expected benefit stream valued at market prices. The bar chart compares the BCRs for each year to potential BCRs that would have been theoretically achieved if the performance of public expenditure had met its stated targets or if there would have been a balance between rehabilitation and maintenance expenditures. For example, BCR for extension is calculated by assuming the average actual diffusion rate of 3 farmers per extension worker per visit, while potential BCR was calculated by assuming average diffusion rate of 5 farmers per extension worker per visit, which is a target set by Department of Extension of MAFF.

Since 2007, public expenditures on agricultural extension have resulted in attractive returns, while returns to irrigation investments have remained low (Figure 5.2). Performance of public expenditures in extension and irrigation was close to 1 from 2000 to 2006, suggesting that public spending generated little or no net benefit to Cambodia in that period. The poor performance of public spending on irrigation, even after the increase in prices since 2007, is puzzling. It may indicate disproportionate expenditure spending on rehabilitating irrigation schemes with poor or little maintenance operations. With a better targeting of public funds on better schemes it should be possible to significantly increase the returns from public expenditure in irrigation. Public expenditure on rural roads has given acceptable and steadily growing returns throughout the decade.

The results would suggest that, if high current outputs and prices for agricultural products (i.e. rice) are sustained, public expenditure on extension and rural roads will continue to significant returns. However, there is room to increase the efficiency of public expenditures as returns on investments are still significantly below their potential (Figure 5.3). This is particularly relevant when maintaining high returns on public investments during periods of price declines of agricultural products.

Agricultural Extension

The Agriculture PER analysis shows that, until 2006, BCRs for extension were mostly around 1, which indicates the limited effectiveness of public spending. However, since 2007, the increase in international rice prices had a strong effect on crop margins. This has had a dramatic effect on the effectiveness of public expenditures, which makes returns to extension investments equally attractive to roads, peaking at a BCR of 3 in 2008. While the average total cost per farmer contacted by public extension officers in Cambodia has comparable to international norms, there has been rather significant gap between actual and potential BCRs over 2000–09 period—in other words 3 and 5 respectively. The quality of extension staff at district and provincial levels is generally good, but the effectiveness of extension spending has been limited by sub-optimal length and frequency of farmer visits to maintain/achieve desired knowledge diffusion and adoption rates, which may result from insufficient operating budgets.

The results of the CBA are consistent with the evidence from various country specific studies, which show that public spending on extension can be a cost-effective means of generating greater economic returns to farmers (see Birkhaeuser et al, 1991). For example, in a meta-analysis of 292 research studies, median rates of return of 58 percent for extension advisory services investments have been found, which translates into BCR ration of about 6.5 using a 6 percent discount rate (Alston et al, 2000 and Dercon et al, 2008).

Public spending on agricultural extension in Cambodia has potential to continue to generate high rates of return. While savings in costs, especially those associated with overheads, would have a positive effect on BCRs, the key variable that affects the performance of extension expenditures is the adoption rate per worker and the resulting increase in diffusion rates. As a benchmark for effectiveness, an extension worker in Cambodia would need to generate adoption of new practices worth about $1,500 per year in increased farm margins, assuming that this increase in farm margins is sustained. This can be achieved by a combination of extension measures, such as: (a) improving extensive messages (such as advice on planting times), which when assuming an increase in margins of about 10 percent (or about $15 per adopter), would require 100 new adopters per extension worker per year; and (b) intensive messages (such as the adoption of a comprehensive package of seeds and inputs), which when assuming an increase in margins of about 50 percent (or about $75 per adopter), would require only 20 new adopters per year. The number of adopters could be roughly similar to the number of farmers contacted with a diffusion rate of 3 and an

adoption rate of 35 percent. In areas of higher population densities and good agricultural potential, such as Tonle Sap region and Southeastern provinces, extension workers can expect even higher diffusion and adoption rates.

For extension there are strong initial gains from adopting improved rice seeds and efficient fertilizer and pesticide use practices. Once these basic improvements have been adopted, there remains limited scope for further improvement. Most dry season irrigated cultivation in Cambodia already uses improved seeds and modern farm inputs. Further improvements in dry season yields are still possible, but they will be more modest than those achieved during the last decade. However, there is still a great scope to increase rice productivity in the wet season by improving seed varieties and expanding their use and associated techniques, and by improving water storage and management. There is also scope in both wet and dry season farming for advances in crop diversification. Therefore, in the foreseeable future, there seems little reason to expect the benefits from extension to diminish, provided that institutional efficiency will be gradually increased.

Increasing long-term performance of public extension activities requires improvements in its institutional functionalities. The main issue related to current performance of DAE extension services is insufficient operating budgets which results shorter and less frequent than optimal visits to farmers to help increase knowledge and spur the adoption of more new technologies, but also broader institutional issues. Achieving better balance between operating costs and recurrent costs, coupled with broader institutional changes which devolve more MAFF budget resources and staff to provincial and district levels would go long way to deliver extension messages along extensive margins by reaching larger number of farmers. Harmonization of extension messages and delivery approaches between various service providers (government, NGOs, private sector), and elimination of conflicting messages, would also improve value of money for extension spending by all. Finally, better integration of agricultural research and extension delivery functions will ensure that public spending on development of new crop varieties, and information on research trials on fertilizer and soil management techniques for specific agro-ecological conditions will reach farmers quickly and in easily accessible format, providing a principal basis for intensification of extension messages.

Irrigation

The BCRs for irrigation have been close to 1 throughout 2000s, suggesting that irrigation remains a challenging sector for public expenditures. High priority given to irrigation may be based on expectations of impact that has not been achieved. The BCRs did not respond to increasing rice price trends since 2007 which effect was more than offset by increasing irrigation unit costs, although the latter still compare favorably with international norms. This is a major concern and MOWRAM needs to devote more attention to prioritizing its investment activities. The wide variability of BCRs by schemes shows that irrigation investments can be competitive even with current high level of unit costs if schemes were well selected and designed, fully implemented and properly maintained.

The actual BCRs of irrigation investment are less than half of potential returns. The main reasons are incomplete rehabilitation and inadequate maintenance. It has been estimated that only about 70 percent of command area could be actually irrigated in Cambodia, and this has lot to do with lack rehabilitation of the whole irrigation areas as public spending has been mainly limited to headworks and primary canals to the neglect of secondary and tertiary canals, which contributed to low returns as many farmers are still not able to irrigate.

The second reason for low effectiveness of irrigation is almost complete lack of funding for maintenance. The lack of maintenance work means that actual BCRs are about 2/3 of their potential levels (i.e. lack of proper maintenance

Box 5.1. Example of Alternative Approach to Irrigation Infrastructure Investments

Earth canals dominate canal distribution systems in Cambodia, which cause high losses of water, vulnerability to erosion and siltation and substantial land take. It is worth considering alternatives such as simple box-section concrete canals for the secondary distribution network illustrated in left photo above. While the construction of a concrete canal is much more expensive than construction of an earth canal (on the right), the size of canal needed is much smaller, causes less siltation and may not require large regulator and off-take structures, such as are commonly constructed on earth canals, so total capital costs may not be so much higher than for the earth canal option. Furthermore, water is used more efficiently by avoiding transmission losses while keeping maintenance costs low.

have reduced benefits by up to 10 percent each year). In order to sustain the benefits of irrigation rehabilitation works, it is recommended that about 5 percent of the rehabilitation costs are devoted to maintenance in each subsequent year. This means that about one-third of total expenditure on irrigation should be devoted to maintenance. There is an opportunity to use new technologies and approached for irrigation investments, which reduce the need for costly maintenance works in future years (Box 5.1). While the government's objective of engaging Farmer Water User Communities (FWUCs) in maintenance is valid in principle, this may take many decades to achieve. It is thus unrealistic to place full responsibility for maintenance on FWUCs, meaning that the optimum share of public funding to be devoted to maintenance is about one third.

The comparison of BCRs with international experiences should be treated with caution, given the wide range of economic, social, and physical conditions and given Cambodia's unusual circumstances in the wet season. Multilateral funding for irrigation projects generally requires internal rates of return (IRRs) of at least 15 percent, equivalent to a BCR of about 1.8 using a 6 percent discount rate. This provides a yardstick for international comparison which suggests that Cambodian irrigation investment has been roughly in line with international norms. Morales and Mongcopa (2008) reviewed experience with ADB funding for irrigation, based on 105 projects in 18 Asian countries. Proportion of these projects that were rated as successful at ex-post evaluation was only 55 percent. The study focused on 21 projects rated as successful, giving an average IRR of 32 percent at appraisal

and 18 percent at evaluation. The figures for partly successful or unsuccessful projects were 18 and 7 percent, respectively. The evaluation stressed the importance of good project design, extensive stakeholder consultation, flexible implementation and effective O&M. Project size had no impact on success, and the effect of cost over-runs was modest. The review of 192 World Bank irrigation projects around the world found that two-thirds of the projects were considered satisfactory, with an average IRR of 15 percent at the time of evaluation. Barker and Molle (2004) also demonstrated the sensitivity of irrigation to food prices, showing that, in Sri Lanka, the BCR of irrigation fell from around 3 in the 1970s to less than 1 from the mid-1980s. Jones found that cropping intensity, which is a proxy for the technical performance of the scheme, was also important and that larger irrigation projects were significantly more successful than smaller ones in all regions.

The scope for introducing major new irrigation schemes in Cambodia is limited and MOWRAM expects to concentrate its resources on rehabilitating and improving existing schemes and expanding the coverage within these schemes. The analysis of benchmarks shows that rehabilitation of irrigation can be probably justified on economic and financial grounds if the cost per hectare of the additional land that is actually brought under irrigation will be less than $2,000 and if the irrigation schemes are maintained so that the irrigated area continues to be cultivated for at least 10 years. As the more efficient schemes have been probably already rehabilitated and improved maintenance on these schemes reduces the need for repeat rehabilitation, the costs per hectare of future investment are expected to continue to increase in the future. The wide range of BCRs indicated by the CISIS information suggests that this could have a substantial impact on the effectiveness of public expenditure on irrigation. It is therefore important that MOWRAM's prioritization practices are technically sound from engineering, agricultural and economic perspectives.

Rural Roads

Expenditures on rural roads have resulted in the largest benefits in recent years, with BCRs higher than 2 since 2005 and reaching 3 in 2008 and 2009.[12] This explains the high priority given to rural roads by communes, households, and politicians. The increase in rice productivity seems to be closely associated with a marked increase in the value of rural labor, and this has led to a large increase in the returns to rural roads, as people value time savings more highly. About 100-600km of rural roads have been rehabilitated (an average of about 1 percent each year) and 300-1,000km have benefited from periodic or routine maintenance (an average of about 2.3 percent each year).

The BCRs of rural roads depend heavily on the level of maintenance efforts. In order to secure a full benefit stream for 20 years, the MRD estimate that the combined costs of routine and periodic maintenance should average about 9.5 percent of rehabilitation costs each year. This means that about 45 percent of total rural roads spending should go to maintenance. These conclusions are similar to those reached by Abrams (2004) and MRD (2004). If benefits were to fall by 10 percent a year without maintenance, then the BCR would be reduced to 60 percent of the potential level. The benchmark analysis shows that the rehabilitation or construction of rural roads is generally justified on economic grounds if the cost per beneficiary is less than about $250 and if the road is maintained so that the population has the benefit of the road for at least 10 years. This justification is based primarily on savings in travel time for those people using the road on a daily basis.

12 The CBA for rural roads does not include donor-funded projects due toa lack of information about outputs and unit costs.

With the gradual completion of the road reconstruction program and the increasing distances involved in sourcing laterite, the unit costs of rehabilitation and maintenance are expected to increase markedly. Switching to new technologies, such as moving from laterite surface to Double Bituminous Surface Treatment for road pavement, is also likely to increase the unit costs of rural roads, although it will also change the nature and frequency of maintenance requirements and may reduce total maintenance costs.

There is little synthesis of international experience. Individual project evaluations provide a useful range of evidence. The ADB evaluation of the Laos Rural Access Roads Project reported an IRR of 11.8 percent (BCR of 1.5), while in Tajikistan the IRR for rural roads was 21.5 percent. In India, the National Planning Commission evaluated 21 projects in Rajasthan in 2006 and estimated the average IRR as 15.6 percent.

Results of Sensitivity Analysis

The sensitivity analysis shows that all BCRs are sensitive to the choice of discount rate. Increasing the discount rate from 6 percent to 10 percent will reduce all BCRs by 25 percent. However, increasing the discount rate will affect fewer investments that generate short-term benefits, such as extension, while it will reduce the attractiveness of infrastructure investments, especially expenditures for maintenance which are needed to sustain longer-term benefits.

For extension expenditures, the BCRs are highly sensitive to number of farmers contacted, adoption rate and estimates of yield changes. For example, if extension services would achieve diffusion rate of 5 instead of 3 as assumed in the analysis, the BCRs would have been 67 percent higher. Similarly, if the adoption rates are 50 percent rather than 35 percent, the BCRs would have been 43 percent higher. The BCRs are inversely proportional to the unit costs of the extension service, such that 10 percent savings in unit costs result in a 10 per cent increase in BCR.

For irrigation, the BCRs are directly proportional to the estimates of the proportion of irrigated areas from total command area. The data from individual BCRs shows high variability in this parameter, which could be as high as 50 percent from average estimates. The BCRs are also strongly affected by incremental yield assumptions. As expected, the BCRs are inversely proportional to costs per hectare and these are relatively unreliable, given the uncertainty about the portion of actual irrigated land.

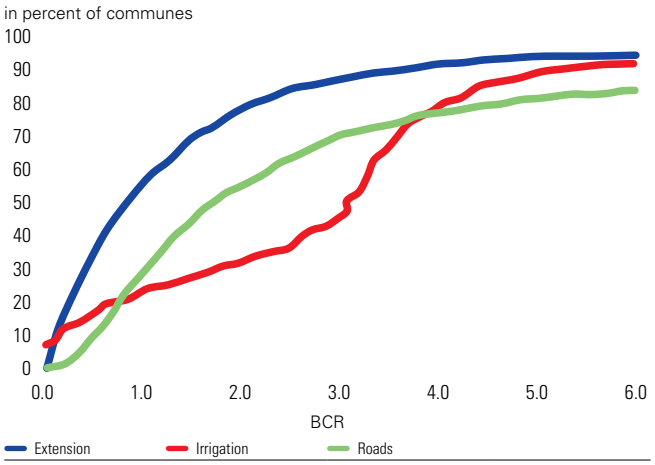
For rural roads, the BCRs are directly proportional to the estimates of the frequency of use of the roads and the reduction in time taken and in the costs of travel. These estimates are based on case study evidence and cannot be validated against national level data. The BCRs are also strongly influenced by the assumptions on ongoing maintenance activity. A lack of maintenance has a tendency to reduce benefits rapidly which means that BCR for rehabilitation without maintenance may not be able to reach acceptable levels.

To validate the findings of CBBA a review of 14 case studies from Cambodia was undertaken, mainly comprising ex-post project evaluations. The review showed that the results of this analysis are well within the boundaries of BCRs reported in case studies in their magnitude. The range of BCRs for extension was 1.4 to 12; for irrigation 2 to 8; and 1 to 11 for rural roads. Some very high figures have been calculated, notably for extension activity, especially at a local scale. In some cases, this may have been because project overhead costs have not been included. Details of the case studies are provided in Annex G.

Spatial Distribution of Benefits

Spatial factors such as access to markets and road infrastructure, agro-ecological zones, rural population densities, and proximity to population centers strongly influence the performance of public spending. These spatial factors are important to understand, as they point towards the profound differences in rural areas with respect to economic returns on public investments. Partly in response to this diversity, different approaches are used for government expenditures in different locations, making it difficult to generalize about the optimal location of public expenditures. However, there are some general patterns that could be expected to apply.

Figure 5.4. Range of BCRs for Communes, 2008



Source: Study team calculations.
Notes: BCRs are calculated using the same methodology as elsewhere in the PER and the data in the commune database. For extension, the benefits are estimated from commune database figures for actual yields compared with district averages, on the assumption that the improvement in yields achieved by the extension service has been proportional to the gap between actual and potential. For irrigation, BCRs are based on the commune database figures on the cost of rehabilitation of irrigation schemes and the area irrigated. The extent to which irrigated area is dependent on rehabilitation is not clear and the relative figures are therefore of more interest than the absolute figures. For rural roads, the benefits are estimated from figures for population, and the costs are estimated by applying national average unit costs per km to the length of road requiring rehabilitation and the status of rural roads. The data in the commune database are collected largely through the subjective response of key officials in the commune and the response rate from communes is patchy. While the data illustrate the range of circumstances, a dedicated research project would be required to use the database for more detailed analysis.

Figure 5.4 presents the range of BCRs by their geographical location using data from the commune database. One should exercise caution when interpreting these results as data from commune database is prone to significant noise due to self reporting. As such, the analysis would focus on broader spatial trends rather than relative performance of communes. The analysis shows that the proportion of communes for which BCRs are less than 1 is about 50 percent for extension, and 25 percent for irrigation and rural roads. Between 85 and 95 percent of communes have BCRs of less than 6.0, for all agricultural interventions. The fact that majority of communes for which data is available seem concentrate in area of BCR for irrigation between 3.0 and 4.0 which may mask a large diversity of BCRs between geographical sites. This indicates that geographical targeting of public spending may be most important for irrigation investments.

The aggregate spatial trends illustrate that there is a general tendency for returns to be highest in the so called "rice belt" which runs from North East provinces around Tonle Sap area to South Eastern provinces of Cambodia (see Annex H). However, the pattern is patchy due to missing, with large variations between neighboring communes, which could indicate data errors. The quality of data is not sufficient to allow any reliable spatial prioritization. However, it does show the importance of space in influencing returns to public spending.

There are strong advantages from concentrating public expenditure on areas with highest agricultural potential. Irrigation is widely spread around the country, but its effectiveness is strongly influenced by its geographical location and level of funding. Annual expenditure on irrigation is generally concentrated in 20 to 40 schemes, which may benefit perhaps 100 communes. The number of roads rehabilitated by the MRD has risen to 34 per year in 2008–2009, from about 15 roads per year in previous years, suggesting that between 50 and 70 communes are affected annually. Thus, public expenditure in irrigation and roads now reaches perhaps 5 percent of communes in any one year and has reached about 30 percent of communes over the last decade. The spending per commune on irrigation is normally between $200,000 and $500,000 while the spending per commune on rural roads is somewhat higher, including an allocation of all overhead costs. In addition, the CSF provides much smaller funds to each commune.

Based on current patterns of spending, it will take 20 years before government expenditure on irrigation and rural roads reaches all irrigation schemes and rural roads in Cambodia, assuming that the schemes and roads that have been rehabilitated are not revisited during that time. Yet, there are strong arguments for accepting the concentration of expenditure. Firstly, wide variation in BCRs, if true, indicates the need to close geographical targeting of public expenditures. MAFF, MOWRAM, and the MRD all have experience in the geographical prioritization of public expenditure, often involving technical and economic analysis undertaken jointly with donors. These processes can be developed and improved further. Secondly, extension, irrigation and rural roads are strongly complementary and the total benefits generated are at least 20 percent higher if they are implemented in the same geographical location. For example, the field survey found that farmers in irrigation villages rate extension as significantly more useful than other farmers.

D. The Impact of Public Expenditures on Economic Growth

The impact of public expenditure on economic growth is estimated using the BCRs, which are based on crop margins, and adjusted for additional labor income. This is because economic growth is defined as value added, including profits and labor income. For extension, additional labor income is assumed as 30 to 40 percent of crop margins and for irrigation it is assumed about 25 percent of margins. For transport, the BCRs are based on reduced travel times and transport costs. It is thus reasonable to expect that the time released by quicker travel will be used to generate additional growth through other farm and non-farm activities. It is also assumed that market wage provides a reasonable estimate of the value that the time released will generate in the economy.

Improved crop productivity and reduced transport costs will lead to a combination of increased farm-gate prices and reduced consumer prices. The increased farm prices directly contribute to agricultural GDP and the reduced consumer prices will benefit the rest of GDP by allowing consumers to increase consumption on other goods. The contribution of public expenditure to the growth of total GDP and for agricultural GDP was calculated based on BCRs for 2006 to 2009 (Table 5.7). Total public expenditure in extension, irrigation and rural roads, including both government and donor funding, was $118.5 million in 2008. Most of it was in the form of investment, which generated an increase in total value added of $30.2 million. It was estimated that about two thirds of total benefits are generated by rural roads, but these benefits are dominated by time savings only part of which lead to more agricultural growth. When adjusting to this, the total increase in agricultural value added was estimated at about $12 million.

Table 5.7. Simulation Results for Growth due to Government and Donor Expenditures, 2008

	Expenditure ($ mn)	Average BCR (2006–09)	Increase in total value added ($ mn)	Increase in agricultural value added ($ mn)
Extension	8.7	3.8	3.3	3.3
Irrigation	53.3	0.8	4.3	4.3
Rural roads	56.5	4	22.6	4.4
Total	**118.5**		**30.2**	**12**

Source: Study Team calculations using data on agricultural growth from the National Institute of Statistics.

Simulations were carried out to explore the impact of allocation of public expenditure to agriculture versus other sectors on GDP growth. The analysis presents results of allocating $1million of public spending to either investments in non-agriculture sectors or investments in agriculture sector (Table 5.8). Three sets of scenarios were developed on various allocations of public expenditures to agriculture and non-agriculture investments, which are

based on relative performance of public expenditures in generating growth in agriculture and non-agriculture sectors, and on contribution of agriculture and non-agriculture sectors to government revenues. For each scenario, the analysis presents the NPV of incremental GDP growth. The base-case scenario assumptions aim to depict the situation in Cambodia in 2010. In this set of assumptions, BCRs for agriculture are higher than they were before 2007, but not as high as they could be potentially be if the efficiency and effectiveness of public expenditures were to improve (i.e. high-case scenario). For non-agriculture sectors, the differences in relative BCRs are based on differences in sectoral growth rates, although this does not necessarily reflect returns to public expenditures. It is assumed that the public revenue from agricultural growth is small (at 5 percent) and that it is obtained largely from VAT and from taxes on trade and related economic activities, rather than from agricultural production itself. It is assumed that the incremental revenue generated by the growth in agriculture and non-agriculture sectors is allocated to the same purposes as the original $1 million. It should be noted that the assumptions used in the analysis and the resulting changes in indicators are subjective estimates, which have not been validated statistically. The results should therefore be treated only as illustrative.

Table 5.8. Net Present Value of Poverty Reduction and GDP Growth in Cambodia

	Policy scenarios		
	Low	Base	High
Assumptions:			
BCR of agriculture	1.5	2.0	2.5
BCR of non-agriculture sectors	3.0	2.5	2.0
Tax revenues from agriculture	3%	5%	7%
Tax revenues from non-agriculture sectors	14%	12%	10%
Results for Policy Scenarios ($ mill)			
NVP of additional GDP from $1 mill spent on:			
100% invested in non-agriculture sectors	3.80	2.91	2.18
100% invested in agriculture	1.50	2.04	2.68

Source: Study Team calculations.

The analysis shows that under the base-case scenario $1 million of public spending generates about $2 million worth of incremental GDP growth, while investing $1 million in higher growth (in non-agriculture) sectors generates GDP of $2.9 million. However, increasing BCR for agriculture investments under high scenario to 2.5 would generate $2.7 million of additional GDP growth from $1 million public investment in agriculture, compared to $2.2 million additional GDP growth from investment in non-agriculture sectors. Under the low-case scenario, the impact of public spending on GDP in agriculture sector is less than 40 percent of that for non-agriculture sectors. Under this scenario public investment in non-agriculture sectors would be more favorable than investment in agriculture. This set of assumptions would have typified the situation in many developing countries in the years up to 2007, and may explain the lack of public investments in agriculture back then.

In the high-case scenario, agriculture generates higher BCRs than other sectors. This scenario confirms that if recent increase in world crop prices be sustained, and potential improvements in efficiency of public expenditure are achieved, then public expenditure in agriculture could become an important contributor to economic growth. This is particularly relevant in Cambodia where agriculture has demonstrated high growth potential.

Summary

Our analysis of effectiveness and efficiency explains the high priority given by the government to rural roads and the lower priority it has given to extension, at least in the past. It also validates the interest in increasing public expenditures on agriculture as a result of greater farm profitability in recent years. The high priority given to irrigation in the past seems to have been misplaced, given the problems with the performance of the sector.

The government's extension service plays a valuable role in assisting Cambodian farmers as a complement to private and NGO activity, and there are some valuable workers in the service. However, the kinds of information that it provides to farmers is sometimes not well matched to their needs, often because of a lack of resources. The effectiveness of donor spending on extension is limited by the stop-start nature of their funding. A more coordinated system of support is needed to increase continuity and build sustainable practices.

Research results have often not found their way into mainstream extension practices in Cambodia, which could increase its effectiveness. Government and donor spending on both research and extension should be better coordinated. Research into the development of new crop varieties and farm management practices needs to include applied research to ensure that it meets the needs of farmers in their specific agro-ecological conditions and the need for agriculture to adapt to the changing environment, climate, and economic circumstances.

Our analysis has shown that an incomplete pattern of rehabilitation of irrigation schemes is resulting in low returns to public investments. Limiting rehabilitation to headworks and primary canals is a very inefficient use of public resources, except in the rare circumstances when the private sector or the farming community has the capacity to complete the rehabilitation.

Returns to expenditures on the maintenance of existing irrigation infrastructure will generally be higher than those on the construction of new schemes. The returns to rehabilitation on infrastructure that has been maintained are double those of rehabilitation on infrastructure that has not been maintained. In irrigation, the optimal share of total expenditure that should be devoted to maintenance is 33 percent. Official MOWRAM policy requires Farmer Water User Communities (FWUCs) to take responsibility for all maintenance. It will take a long time for these FWUCs to build up the necessary technical, institutional, and financial capacity to take full responsibility for the maintenance of irrigation schemes. Unless the government and donors provide funding for maintenance while FWUCs build this capacity, there will be few irrigations schemes on which rehabilitation will be justified. Therefore, there is a need for the government to fund maintenance in the interim before beginning a phased withdrawal to allow FWUCs to take over responsibility.

Both the government and donors should pay more attention to the maintenance of rural roads. Current allocations for the maintenance of rural roads still fall short of the optimal share of total expenditure, which is about 45 per cent. It is expected that the costs of rehabilitation of rural roads will increase in coming years as a result of the growing shortage of laterite. There is a need to develop and pilot new techniques, such as moving from laterite surface to Double Bituminous Surface Treatment for road pavement, if recent progress in expanding rural access is to be sustained.

Expenditures on research, extension, irrigation, and rural roads should be seen as complementary and will be more effective when concentrated in the same locations, preferably the best locations. Continued strong agricultural growth will have a dramatic effect on reducing poverty. However, concentrating public expenditures in

high agriculture potential areas is unlikely to reduce nationwide inequities so the government should put in place complementary social protection programs to reduce inequities and poverty in less advantaged areas.

In order to ensure that growth can be sustained at a high level similar to that achieved by many Southeast and East Asian economies in recent decades, the Cambodia government will also need to address some broader sectoral issues. These include the need to correct market failures (such as information and coordination externalities); to improve the business enabling environment; to remove barriers to accessing finance for agricultural investments, including the high cost of finance relative to economic returns in agriculture; and finally, to upgrade the level of technology. Continuing improvements in agriculture sector policy environment and more efficient collaboration between the government and donors, NGOs, and the private sector would increase the effectiveness of public spending in the agriculture sector.

6. CLIMATE CHANGE AND PUBLIC EXPENDITURES

Cambodia is situated between two global weather systems, which makes it vulnerable to the effects of climate change. There is some scientific evidence that climate changes will make northern and western parts of the country drier, with fewer floods and more droughts, while the opposite is expected to take place in the south and east. Agricultural growing seasons (reflecting the effect of a combination of rainfall and temperature on potential evapotranspiration) are expected to become markedly shorter in the next 50 years before returning to close to their current levels by 2080 (see Annex I for further analysis). This implies the need to adapt public expenditures in the agriculture sector to increase their effectiveness and efficiency in the future. In this chapter we evaluate the potential impact of various climate change parameters on agricultural production (particularly rice) in Cambodia and then we analyze the implications of various climate change scenarios for public expenditure patterns.

A. The Impact of Climate Change on Agriculture

The Royal Government of Cambodia (RGC) is in the final stages of preparing the Second National Communication (SNC) to the UN Framework Convention on Climate Change (UNFCCC). This includes a Vulnerability and Adaptation (V&A) Assessment that analyzes likely changes in temperature and rainfall and in growing seasons. The V&A projections of annual rainfall and temperature were made using the PRECIS model and fourteen Global Climate Models (GCMs) (Masutomi, 2009). These suggest that temperatures are likely to increase by about 2˚C by the end of the century. Changes in rainfall patterns are complex, because Cambodia is on the boundary between two global weather systems. The PRECIS analysis of past trends suggest there has been a general increase in total rainfall of about 2 mm per year, with the highest increases having been in the northwest during the wet season and in the southeast during the dry season. It should be noted that the northwest and southeast are the main rice-producing regions in Cambodia. The GCM analysis presents high and low emission scenarios. In general, the dry season is projected to get drier and the wet season wetter, especially after 2025. Rainfall is expected to increase most in the southeast, while the northwest may experience some decline. The wet season is projected to start later than it does now, especially in the low emissions scenario.

According to the V&A projections, every additional 10mm of wet season total rainfall will add 6,500 tons (or about 0.1 percent) to rice production. The V&A modeling considers a range of agro-hydrological zones, and the assessment concludes that production in the south and east may increase by 1 percent over next 50 years, while the opposite may happen in the northern parts of the country. The effects of total rainfall on rice production are likely to be small. The potential impact of higher temperatures suggests that research and extension for farming practices that optimize soil and crop moisture (such as zero tillage) is expected to become more valuable in coming years.

The changing temperature and rainfall patterns are expected to affect growing seasons. The V&A assessment analyzes rainfall patterns and shows that there have been considerable changes since 1960, but its projections suggest that changes will be less marked in the future. However, the combination of rainfall patterns and temperature will increase evapotranspiration which in turn is expected to have a significant impact on growing season. Under both scenarios, the average growing season for the majority of cultivated land is expected to decrease from seven months to five months. This effect will be moderated after 2050, when increased rainfall is expected to counteract the effect of higher temperatures.

Furthermore, the PRECIS analysis for the V&A assessment suggests that there will be changes in the start and duration of the wet season, which will affect the length of the growing season. Since temperatures are sufficiently high at the end of the wet season to allow most crops to mature, there would only be a limited impact on crop production if the wet season started and finished later, especially if light-insensitive crop varieties were used. Therefore, the main effects of seasonality would be the loss of production that would occur if the wet season became shorter. The V&A analysis suggests that wet seasons could shorten by at least a month in many regions, although this effect might be reversed after 2050 in the low emissions scenario.

However, the wet season will still be sufficiently long in most major crop growing regions to allow for one rice crop to be grown, especially if short maturing varieties are used. Thus, the main loss of production could come from the inability to grow a second crop. Currently, the late season crop typically accounts for about 25 percent of rice production in Cambodia and is also important for vegetable production. Much of this would be under threat from a shortened growing season, except where irrigation is available. Irrigation that is designed for an early end to the wet season gives returns up to twice as high as supplementary wet season irrigation and will become increasingly relevant as climate change progresses. Therefore, responding to changing seasonality must be the most important priority when adjusting public expenditures in agriculture to climate change.

An analysis suggests that, as the climate changes, the south and east Cambodia will have more floods and fewer droughts, while the opposite will happen in the north and west (Endo et al, 2009). This is consistent with the V&A analysis on total rainfall. The frequency of drought days is likely to decrease by 25 percent in the northwest and increase by a similar amount in the southeast. Losses from drought and floods are variable and can be traumatic when they occur. However, only about 5.5 percent of total production has been lost to flood and drought in Cambodia in the last decade. If the frequency of extreme events and associated losses were to increase by 25 percent, then losses in production would be about 1.4 percent of total crop production, which could be worth about $20 million per year.

The V&A analysis of past rainfall patterns that examined the duration of droughts showed that adopting crop varieties and farming practices that will enable crops to survive one additional day of drought would reduce average annual losses from drought from about 5.5 percent to about 5.0 percent of total production. This would be worth about $8 million for the economy, suggesting that public investments in research and extension for drought resilience is justified. The increasing frequency of droughts in the northwest, including the Tonle Sap region, suggests that investments in drought-bridging water storage should favor this region.

B. Implications of Climate Change for Public Expenditures

In theory, expected increases in rice production in south and southeast Cambodia and decreases in northern parts of the country should result in a shift in public expenditure in favor of the more productive areas. In particular, the importance of extension activities associated with water management and the scope for irrigation point to the need to increase public expenditures in these areas that would not reduce their effectiveness. However, as shown above, the changes involved in production are likely to be marginal. Instead, issues associated with flood and drought risk and changing seasonality are likely to have a more important effect on the optimal allocation of public expenditure in agriculture. In this section, we discuss these changes in turn.

Research and Extension

There are substantial benefits to be gained from the development of new crop varieties that are adapted to new climate conditions. The order of magnitude of these benefits can be illustrated by what would happen if public expenditures were support the development of varieties that would be able to survive one additional day of drought or flood. This would reduce average losses from drought from about 5.5 percent to about 5 percent of total crop production, which would be worth about $8 million if all farmers were able to benefit from these seeds. Given the current unit cost of developing crop varietals is about $1 million per varietal, the returns to developing more drought- and flood-resistant crop varieties could be high, provided they are widely adopted by farmers. However, in practice, it is likely that these varietals will only be adopted gradually. Increasing the efficiency of extension services can accelerate this process. Extension agents can also help farmers to adapt to climate change, particularly by changing their cultivation practices and cropping choices.

Irrigation

Returns to irrigation are expected to increase substantially as a result of the increased need to store water to protect against increased drought and flood frequency and a shorter wet season and growing period. The shortened rainy season is likely to be the feature of climate change that has the most significant impact on agriculture and on the performance of public expenditures on agriculture. If irrigation were used to ensure the survival of a crop during a shortened rainy season, the benefits of this would be about double the benefits of standard wet season supplementary irrigation.

Rural Roads

The marginal likely increase in the frequency of flood events will increase the need for major repairs and to designing rural roads to survive floods, which may add additional costs to rural road rehabilitation. However, it is expected that the effects of climate change factors on rural roads will be smaller than its effects on research, extension, and irrigation.

Current priorities for climate change activities are defined in the National Adaptation Plan of Action (NAPA) and will soon be further elaborated for the Pilot Program for Climate Resilience (PPCR). The NAPA contains 16 non-health priorities, of which seven are associated with investments in agricultural water management. This is consistent with the analysis in this chapter, which stresses the importance of irrigation in preparing for climate change. The NAPA includes a priority on supporting integrated farming systems. However, it does not put a sufficiently high priority on funding research and extension on adapting crop varieties and practices.

In a country like Cambodia where the pattern of climate change is both more mixed and more uncertain than in other countries, it is prudent that public expenditure priorities should focus on "low regret" investments that combine standard national planning goals with climate adaptation. These would be public investments that would result in "low regrets" or opportunity costs (such as the increased use of improved seeds and better farming techniques, including water and soil management) if the more negative climate change effects as currently projected do not materialize. Investing in increasing agricultural productivity would qualify as one such "low regret" option.

Summary

The net impact of climate change on agricultural production in Cambodia will be complex and is expected to vary considerably from one region to another. The strongest will probably be the reduced and more variable growing seasons, which will require farmers to invest in water storage and the development of new crop varieties and farming techniques that are more resilient to unpredictable growing seasons. This is expected to result in significant increases in returns to public expenditures on research and extension and in water storage and management.

7. CONCLUSIONS AND POLICY RECOMMENDATIONS

A. Agricultural Sector Growth and Public Spending

Cambodia's success in improving livelihoods and reducing poverty has been driven by strong economic growth. Agricultural sector growth has been lower than in other sectors, but it has been relatively robust and a key factor in the impressive reduction of poverty. Growth has been high despite of low levels of public spending as a percentage of GDP.

Our analysis of the effectiveness of public spending has shown that more and especially better spending on agriculture or related infrastructure could lead to higher growth. The potential for high returns from agriculture sector is demonstrated by the increasing interest shown by private sector investors in agriculture in recent years. However, significantly more public investments in productive rural infrastructure and more public services will be needed to leverage more private sector investments in the sector and to reduce the risk and volatility facing farmers and commercial producers. Returns to investments in the agricultural sector are still limited by the under-provision of non-infrastructure types of public goods by the government, especially in two key areas—agricultural technology (generation, adaptation, and dissemination) and public regulatory capacity.

Furthermore, sustaining high agricultural growth levels continues to depend on non-investment factors such as climate change. While weather and climate-related shocks have had a large impact on changes in agricultural GDP in Cambodia, targeted public investments in irrigation and drainage could have a significant impact in reducing such climate-induced volatility in agricultural yields and hence returns. The key is to ensure that investments are meaningful and efficient and tackle genuine constraints to agricultural production in a given location.

When we looked at expenditure trends over last decade, a clear pattern of funding emerged, with donors concentrating mainly on MAFF and MOWRAM recurrent expenditure financing, while the government has funded MOWRAM capital investments and much of the MRD's rural roads capital investment. In recent years, there have been some signs that the government is funding more maintenance expenditures, especially for rural roads. The overall pattern of funding is pragmatic but there are problems of aid dependency in the areas of agricultural research and extension. While increasing the budget allocation for capital spending on rural roads has generated positive agricultural and non-agricultural benefits, the high priority given to irrigation investments in the past seems to have been somewhat misplaced in light of the highly variable returns to these investments.

The analysis presented in this report demonstrates that the performance of public expenditure, including both government and donor resources, in extension and irrigation was weak until 2007, after which improved economic conditions led to a period of higher returns. The performance of rural roads has tended to be stronger and more stable, although they have also been positively affected by improved rural incomes. There have been a number of problems with public expenditures that have limited their effectiveness and thus their performance. These include: (a) a lack of continuity in agricultural research; (b) poor coordination between research and extension; (c) a lack of continuity in funding the O&M costs of extension; (d) an excessive focus on rehabilitating primary irrigation infrastructure and a neglect of secondary and tertiary systems; (e) a lack of irrigation maintenance; (f) a lack of periodic and routine maintenance for rural roads; and (g) the slow pace in developing new technologies for rural roads to address the declining supplies of laterite.

B. Policy Options Available to the Government

There is a case to be made in favor of more and better public expenditures for agriculture. Through much of the last decade, the BCRs for public expenditures in extension, irrigation, and rural roads have been below 2. It has therefore been difficult to justify increasing public expenditures for those sectors. The recent increases in agriculture prices, however, have boosted BCRs to levels which could justify increased government spending on agriculture. While increasing agricultural spending on public goods and services is desirable, we believe that there is little room to do this relative to GDP within the existing budget envelope in the short-term, unless offsetting reductions are made in other areas. Should such room be found, the prime candidates for increased allocations should be extension, irrigation, and rural roads. The recommendations in this chapter would therefore focus primarily on improving the overall efficiency and effectiveness of existing agriculture spending levels.

We offer the following recommendations for improving the performance of public expenditures on agriculture, irrigation, and rural roads:

i. Reallocate more budget resources on agricultural extension. Government funding for extension is low as a share of its agriculture budget and, as a result, these services are dependent on donor support. Public extension has potential to deliver high returns in Cambodia. There is an opportunity to significantly increase government by reallocating it from functional areas of lesser value for money. However, any spending increases, both from government and donors, should be accompanied by improvements of institutional functionality of MAFF extension systems and establishment of monitoring systems to measure the effectiveness of expenditures on these functions. Better harmonization of service delivery standards between various extension providers (government, NGOs and private sector) and elimination of conflicting messages would also improve the efficiency of extension spending for all.

ii. Do not ignore funding for agricultural research. Analysis of efficiency of agricultural research spending in Cambodia was constrained by data limitations, but international evidence shows that agricultural research can have very high rates of return. While increased public spending for agricultural research is justified, it should come with institutional changes which clarify the specific functions of the country's various research institutions and by consolidating laboratory capacities in various government units in order to reduce overlap and waste of resources. This can be done by establishing joint planning and evaluation systems by the government, donors and private sector to identify research needs and resource requirements. Technical expertise of donors could play an important role in building more effective research capacity in Cambodia. Better integration of national agricultural research institutions with extension services could further increase public spending efficiency on research, as well as extension.

iii. Prepare for climate change. Related to two above recommendations, long-term efficiency of public spending on extension and research could be further improved by focussing more research efforts on development of new crop varietals and dissemination of knowledge on improved water storage and soil moisture preservation at farm-level—i.e. "low regret" investments that combine increased agricultural productivity with climate adaptation and mitigation against negative effects from reduced and more variable growing seasons.

iv. Increase the effectiveness of irrigation investments. Public funding for new and rehabilitated irrigation schemes needs to be extended to secondary canals and associated infrastructure. The rehabilitation of tertiary canals using public funds is also justified provided that it includes arrangements the costs of operation and

maintenance to be recovered from the end users. There also a need for more selectivity in funding irrigation schemes.

v. **Increase the share of the budget designated for maintenance of irrigation and rural roads.** In the case of irrigation, the optimal level of maintenance expenditure should be about 33 percent of total investment, and in the rural roads sector, an average of 45 percent is required for periodic and routine maintenance combined. This level of maintenance should ensure that the next major rehabilitation is not required for at least 10 years.

vi. **A longer-term measure to improve the efficiency of spending on rural roads would require investigation of economic viability of new road rehabilitation and maintenance technologies.** New technologies to consider include the use of bamboo reinforced concrete (for busy roads) and engineered earth. The government could usefully invest in or create incentives for others to invest in promoting skills in these technologies.

Table 7.1. Actual and Suggested Optimal Balance between Recurrent and Investment Expenditures (Million Riel)

	Irrigation		Rural Roads	
	Actual 2009	Optimal	Actual 2009	Optimal
Recurrent	31,352	79,137	25,503	99,562
Investment	208,459	158,275	195,747	121,687
Total	239,811	239,811	221,250	221,250

Source: Study Team calculations.

Public Expenditure Planning and Management

The key areas of weakness related to public spending in the three line ministries are: (i) the weak link between policies, programs, and the budget process; (ii) the duplication of programs, including unrealistic budget estimation without identified any sources of funding; and (iii) the lack of effective internal control in the procurement process. This weakness is compounded by duplication of programs and unrealistic budget estimations with no identified sources of funding.

We make the following recommendations for improving government expenditure planning and management:

i. Use the BSPs within each ministry as the key policy and budget planning tool to allocate and manage all resources to the sectors. The government should consider using the BSPs as the central planning tool for the implementation of the Strategy for Agriculture and Water (SAW) and applying them to both domestically financed budget allocations and donor allocations.

ii. Reinforce the annual budget process by requiring MAFF, MOWRAM, and the MRD to assign "hard" and enforceable budgets to each department through the BSPs. The current system of partial program budgets should be absorbed into this comprehensive approach.

iii. Use the Treasury system to record expenditure on a departmental basis. This would require a more comprehensive financial reporting (currently called an expanded version of the TOFE) and greater devolution of responsibility for expenditures to budget entities.

iv. Introduce an annual review and planning process for the annual and medium-term budgets that includes both the government and its development partners that puts BSPs at the heart of the process and that integrates the SAW into government planning. The latter will require the coordination and integration of all the budget planning and management instruments that have been put in place by the government under the PFMRP. The donors, in consultation with the government, are preparing to map the way forward, and this should be done as a joint government/donor activity. The SAW initiatives are an opportunity to establish systems for regular and informative appraisal, monitoring, and evaluation of expenditures and for these to be fed back into future budgeting decisions.

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ANNEX B: NOTE ON DATA SOURCES

Acquiring time series data for this analysis has been a challenge, and dealing with data needs for three ministries in the current state of public finance management reform is complex and demanding. Time series data for recurrent expenditure by economic classification are readily available. However, budget and expenditure data on a functional basis are hard to find. A variety of sources have been used to build the data sets used in this study for the allocation and composition expenditure analysis of agriculture, irrigation and rural roads. They are:

The TOFE (*Tableau des Opérations Financières de l'Etat*) tables of MEF for recurrent expenditure by economic classification: the TOFE tables provide a time series of budget and expenditure data by ministry broken down by economic classification. The TOFE tables are compiled and issued by the Department of Economic and Public Finance Policy (DEPFP) of the Ministry of Economy and Finance (MEF), based on the expenditure records of the General Department of National Treasury (GDNT). GDNT is the body responsible for preparing Government's consolidated expenditure accounts and financial reports. These tables were available for the analysis period 2000–09. However, a change in the budget classification introduced through a new Chart of Accounts in 2007 means that there is a discontinuity in the presentation by economic classification. Provincial expenditure, which was reported up to 2007, is not separated thereafter, when budgets are structured into a Non-Program and Program budget framework.

Line-ministries' data for recurrent expenditure by functional area: the Government Budget is structured by administrative unit (i.e. by ministry) and by economic classification (by Chapter and Article). But expenditure figures by functional area are not available from the standard budget expenditure reports. This is a particular limitation in the analysis of agriculture which has a large number of functional areas or subsectors. To enable the study to carry out a functional expenditure analysis of agricultural spending, a dedicated exercise was put in place with the assistance of the MAFF Department of Finance. The MAFF Department of Finance arranged for individual line departments to compile spending figures for two years, 2007–09. Based on these reports, a functional analysis of government expenditure (and ultimately of donor disbursement also) is then possible.

Spending reports received from 23 budget units in MAFF were rationalized into eleven functional spending areas:

- Agronomy and land improvement
- Agricultural machinery
- Agricultural extension
- Livestock and veterinary
- Rubber production
- Agro-industry
- Agricultural research
- Agricultural education and training
- Forestry
- Fisheries
- Policy planning and management

The aligning of more than 150 donor projects to the above functional areas was made by the PER team. In many cases, it was evident even from the title of the project as to which area it should be located in. Project descriptions in the CDC data base also help. However, the classification of some projects is not straightforward. For example, projects which have training or capacity building objectives have been classified under Agricultural Education and Training, though in the MAFF budget this item is limited to training at the agricultural universities.

Projects which relate to value chains, including input supply projects, have been classified under Agro-industry, whereas the responsibilities of the department of that name are much narrower. Projects which are predominantly for extension have been allotted to the extension program though their resources may overlap with other technical areas such as agronomy and land improvement, or with livestock and veterinary. Large integrated projects pose a particular problem since they are comprised of components which serve a range of functional areas. Neither the DIC nor the CDC data bases provide a breakdown of project disbursements by components. Thus, in most cases, the disbursements for these projects have been disaggregated, based on information contained in project design or other donor documents available to the PER team. However, design documents provide an ex-ante presentation of cost allocations, and there is a degree of uncertainty about the actual expenditures. The assumptions regarding the allocation of individual project disbursements to the functional areas are indicated in the working tables at Annex C. For a small number of large projects, it has been possible to obtain information from donors on actual disbursements to different functional areas.

MOWRAM's Department of Finance provided actual expenditure data on ministry wage and operation and maintenance budgets for 2007–09.

MRD's Departments of Finance and Rural Roads provided expenditure data on the rural roads department wage budget for 2009, and on the rural roads operation and maintenance budget for 2008 09.

MEF's DIC provided records of domestically financed construction and equipment expenditure for the government financed capital budget. Records both at the aggregate ministry level and by individual project are available. The domestically financed capital budget has increased in importance in recent years, nearly quadrupling between 2004 and 2009. Along with national roads, rural roads and irrigation have been priority recipients, and together accounted for 75 percent of this source of funding in 2009.

CDC and DIC provide data for donor project disbursements. The CDC data base provides a range of technical and cost and disbursement information on nearly all multilateral and bilateral, loan and grant, donor projects sponsored by the so-called traditional donors, and for one of the major new donors, the Republic of Korea. The Republic of China projects do not yet appear in the data base.

Disbursement data disaggregated by project are available on the CDC data base only from 2007. Projected disbursements are also available for many projects for 2010 12. Data input to the CDC system is the responsibility of donors. CDC holds training sessions with donor operatives to ensure that there is conformity across donor organizations, but there is no ex-post central quality assurance. As a result, there are occasional cases of inaccuracy in the data in terms of misclassification and duplications. The PER team reviewed each project on the CDC data base before including it into the PER data set for functional analysis.

For multilateral lending agency loan and grant projects, DIC maintains disbursement records. Since the DIC carries out direct checks with donors on its disbursement figures, DIC records have been the preferred source for multilateral

projects for the years 2007 09. DIC records do not show projected disbursements for 2010 12. For bilateral projects, CDC figures have been used.

The Ministry of Interior's National Committee for the Management of Decentralization and De-concentration Reform (NCDD) provided data on the Commune/Sanghat Funds (CSF), which channel significant volumes of resources to rural roads. NDCC has provided expenditure figures for 2002 09.

Data reliability: the spending reports contained in the TOFE and DIC reports are considered to be reliable, because they are based on the actual payments passed and reported by the General Department of the National Treasury. The CDC data are subject to a degree of uncertainty because of the donor-input modality. There is no procedure for CDC to check all the data once they have been provided. Indeed, it would require a lot of resources to do so. The PER team found, however, that there was a reasonable degree of conformity between the DIC and CDC data for those projects which are reported on by both organizations. Overall, it is thought that the CDC data are probably accurate to within +/ 10 percent margin of error.

ANNEX C: INTEGRATED AGRICULTURE, IRRIGATION AND RURAL ROADS PER DATA SET

(Riels million, 2007–09)

	2007	2008	2009
Exchange rate USD/Riel eop (EAP Brief Nov 09 update)	4,003	4,081	4,165
MINISTRY OF AGRICULTURE, FORESTRY AND FISHERIES (MAFF)			
AGRICULTURAL PRODUCTION SERVICES			
Agronomy and Land Improvement: Govt.	**3,275**	**3,380**	**2,136**
Agronomy and Land Improvement: Donors			
Agricultural Quality Improvement Project	4,123	1,995	1,040
Mine Action Cambodia	333	571	
TA to Control Brown Plant Hopper and Associated Virus Diseases in Rice	130	122	
Sanitary and Phyto-sanitary Action Plan Preparation			48
Development of Agriculture in Rural Cambodia	93		
Green Garden	130	142	
Poverty Reduction Among Subsistence Rice Farmers in Four Districts	717		783
Improving the Livelihoods of Poor Farmers in Southern Cambodia (alloc. 20%)	155	382	
Tonle Sap Poverty Reduction and Smallholder Development - prov (alloc.15%)		158	125
Community Based Rural Development Project (alloc. 26%)	846	159	986
Rural Livelihoods Improvement Project (alloc. 30%)		1,975	1,500
Rural Poverty Reduction in Prey Veng and Svay Rieng (alloc. 10%)	1,429	1,070	669
Agronomy Subtotal: Donors	7,956	6,575	5,151
GOVT/TOTAL RATIO	*29*	*34*	*29*
Agricultural Machinery: Govt.	**609**	**667**	**257**
Agricultural Extension: Govt.	**957**	**1,212**	**932**
Ag. Extension: Donors			
CAAEP Ph II	11,012		
Cambodia Radio Development Assistance Project	1,783	2,322	1,445
Cambodia Agricultural Value Chain Programme (alloc. 25%)	582	1,285	1,872
ADRA Harvest Project Implementation - NGO Coop. Agreements	3,837	3,544	2,259
CARE Australia IRDM Project - NGO Cooperation Agreements	5,023	5,829	5,123
Agricultural Sector Development Project (alloc. 80%)	2,293	3,444	5,431
Improving the Livelihoods of Poor Farmers in Southern Cambodia (alloc. 20%)	155	382	
Tonle Sap Lowlands Rural Development (alloc. 25%)			312
Tonle Sap Poverty Reduction and Smallholder Development (alloc. 15%)		158	125
Tonle Sap Demonstrations for Productivity Enhancement			
Agricultural Development in Mine Affected Areas (alloc. 40%)	4,558		3,502
Support Project for Agricultural Development of Cambodia (alloc. 50%)		412	1,456
Rural Livelihoods Improvement Project (alloc. 40%)		2,634	2,000
Rural Poverty Reduction in Prey Veng and Svay Rieng (alloc. 5%)	715	535	334
Community Based Rural Development Project (alloc. 8%)	282	49	304
Regional Vegetable IPM Programme			900
Battambang Nurturing and Development Project	2,653	3,193	3,369
Community Development in Ramsar Protected Areas			174
Farmers CB in Ratanak Kiri			516
Socioeconomic Development Support in Prey Thom	273	603	580
Ag. Extension Subtotal:Donors	33,166	24,389	29,702
GOVT/TOTAL RATIO	*3*	*5*	*3*

	2007	2008	2009
Exchange rate USD/Riel eop (EAP Brief Nov 09 update)	4,003	4,081	4,165
Livestock and Veterinary: Govt.	**2,503**	**3,495**	**6,168**
Livestock and Veterinary: Donors			
SE Asia FMD Eradication Campaign - Regional	138	288	
Smallholder Livestock Production Programme (SLPP)	3,022	5,522	5,106
Prevention and Control of HPAI with focus on smallholder livelihoods	1,027	407	778
Enivironmental Animal Health Management Initiative in SE Asia			408
Support to Smallholder Livestock Production			2,845
Support to Sericulture Rehabilitation			2,499
Community Based Rural Development Project (alloc. 8%)	282	49	304
Avian Flu Control and Preparedness (PHRD TF 56832)		1,265	899
Avian Flu Control and Preparedness (IDAH3610)		2,571	1,086
Avian Flu Control and Preparedness (MDTF 58146)		857	362
Livestock and Veterinary Subtotal: Donors	4,469	10,959	14,286
GOVT/TOTAL RATIO	*36*	*24*	*30*
Other Agricultural/Rural Support Services: Donors			
Community Based Agricultural Productivity Project			
MDTF for Natural Resources Management-L Programme, Cambodia			
Economic Growth			
Other Agricultural/Rural Support Services: Subtotal Donors	0	0	0
AGRICULTURAL PRODUCTION SERVICES: TOTAL GOVT	7,344	8,753	9,493
AGRICULTURAL PRODUCTION SERVICES: TOTAL DONORS	45,591	41,922	49,139
AGRICULTURAL PRODUCTION SERVICES: TOTAL GOVT AND DONORS	52,935	50,676	58,632
GOVT/TOTAL RATIO	*14*	*17*	*16*
RUBBER PRODUCTION SERVICES			
Cambodia Rubber Research Institute: Govt.	1,400	1,373	1,492
Rubber General Department: Govt.	442	492	66
Rubber Services: Donors			
Development of Smallholder Rubber Plantations: Interim Project	2,985		
Transitional Project on Smallholder Plantation and Diversification	1,755	3,065	
Support to Private Plantations to Develop Smallholder Plantations			
RUBBER SERVICES: SUBTOTAL DONORS	4,740	3,065	0
RUBBER SERVICES: SUBTOTAL GOVT.	1,842	1,865	1,558
RUBBER PRODUCTION SERVICES: TOTAL GOVT AND DONORS	6,582	4,930	1,558
GOVT/TOTAL RATIO	*28*	*38*	*100*
AGRO-INDUSTRY	**317**	**514**	**372**
Agro-Industry: Donors			
Feasibility Study on Establishing an Open Paddy Market	435		
Agricultural Product Market Access			
Cambodia Agricultural Marketing Information Project	2,859	4,202	3,628
Cambodia Agricultural Value Chain Programme (alloc. 20%)	466	1,028	1,498
Formulation Assistance for the Agro-industry Strategy Development Plan			
Input Supply to Vulnerable Populations under Soaring Food Price Init.		789	24
Telefood (Micro Projects)			194
Rural Livelihoods Improvement Project (alloc.30%)		1,979	1,500
Grant Assistance to Underpriveliged Farmers		12,847	
Grant Assistance to Underpriveliged Farmers (2KR)		10,511	
AGRO-INDUSTRY: SUBTOTAL DONORS	3,760	31,355	6,843
AGRO-INDUSTRY: SUBTOTAL GOVT.	317	514	372
AGRO-INDUSTRY: TOTAL GOVT. AND DONORS	4,077	31,869	7,215
GOVT/TOTAL RATIO	*8*	*2*	*5*

	2007	2008	2009
Exchange rate USD/Riel eop (EAP Brief Nov 09 update)	4,003	4,081	4,165
AGRICULTURAL RESEARCH			
CARDI Govt.	1,750	1,682	2,073
Ag. Research: Donors			
Tonle Sap Poverty Reduction and Smallholder Development (alloc. 5%)		53	42
CARDI Assistance Project	1,333		
Water Resources Management Research Capacity Development	2,042	2,387	2,407
Support Project for Agricultural Development of Cambodia (alloc. 50%)		412	1,456
AG. RESEARCH SUBTOTAL: DONORS	3,375	2,852	3,905
AG. RESEARCH SUBTOTAL: GOVT.	1,750	1,682	2,073
AGRICULTURAL RESEARCH: TOTAL GOVT. AND DONORS	5,125	4,533	3,905
GOVT/TOTAL RATIO	*34*	*37*	*53*
AGRICULTURAL EDUCATION AND TRAINING			
Ag. Education and Training: Govt.			
Royal University of Agriculture	2,400	2,652	2,690
Kampong Cham Agri. School	1,338	1,481	1,685
Prek Leap National Agri. School	1,501	990	1,935
Ag. Education and Training: Donors			
Agricultural Sector Development Project (alloc. 20%)	573	861	1,358
Regional Sanitary and Phyto-Sanitary CB	458		
Integrated Management of Natural Resources and Agric. Development MSc		715	698
CB for the Conservation of Plant Genetic Resources in Asia			105
Strengthening Agricultural Project Formulation and Design	293	906	614
Strengthening Sanitary and Phyto-Sanitary Services		339	696
CB for Quality Standard Control of Fertilisers and Pecticide			3,369
Technical Training in Japan 2007 and 2008 (allocation)	1,262	884	
AG. EDUCATION AND TRAINING SUBTOTAL: DONORS	2,586	3,705	6,839
AG. EDUCATION AND TRAINING SUBTOTAL: GOVT.	5,239	5,124	6,310
AG. EDUCATION AND TRAINING: TOTAL GOVT. AND DONORS	7,826	8,829	13,149
GOVT/TOTAL RATIO	*67*	*58*	*48*
FORESTRY			
Forestry: Donors			
Promoting Community Foresty in Cambodia	2,155		992
Community Forestry Development in NW Cambodia		253	
Linking Communities in SE Asia to Carbon Markets			
National Forest Programme Facility		41	417
Strengthening policy and capacities for REDD			
CB Project for the Forestry Sector Ph 2	3,138	3,244	3,369
Strengthening capacities of Forest Communities in NE Provinces		12	908
FORESTRY: SUBTOTAL DONORS	5,293	3,550	5,685
FORESTRY: SUBTOTAL GOVT.	8,495	8,868	6,242
FORESTRY TOTAL: GOVT. AND DONORS	13,788	12,418	11,927
GOVT/TOTAL RATIO	*62*	*71*	*52*

	2007	2008	2009
Exchange rate USD/Riel eop (EAP Brief Nov 09 update)	4,003	4,081	4,165
FISHERIES: Subtotal Govt.			
Fisheries General	4,288	6,772	3,013
Fisheries Research Station	257	200	0
Fisheries: Donors			
Sustainable Rice Fish Integration	348	344	297
CB for Community Fisheries Mgemnt	212		
CB for Fish Quality Control			101
Regional Fisheries Livelihoods Programme			286
Freshwater Aquaculture Research and Ext. Project	4,440	4,046	3,369
Marine Aquaculture Centre Construction			7,841
MDTF for Natural Resources Management-L Programme, Cambodia	8,811	4,399	3,873
Prom and Devel of Sustainable Aquaculture Kratie and Stung Treng	1,409		
Prom and Devel of Sustainable Aquaculture Ratanakiri and Mondulkiri		216	870
FISHERIES: SUBTOTAL DONORS	15,219	9,005	16,638
FISHERIES: SUBTOTAL GOVT.	4,544	6,972	3,013
FISHERIES TOTAL: GOVT. AND DONOR	19,764	15,977	16,638
GOVT/TOTAL RATIO	*23*	*44*	*18*
MAFF PLANNING AND MANAGEMENT			
Planning and Management: Govt.			
Central Ministry (Non PB only) - contains a residual	6,667	8,571	22,491
International Cooperation (established 07)	561	670	735
Planning and Statistics	44	97	130
Personnel and human resources (budget allocated only for 07)	107		
Economic Land Consessions (M&E)	80		
Legal Affairs			77
Planning and Management: Donors			
Policy and Institutional Reforms in the Agriculture Sector	361	583	
Strengthen National Programme Budgeting for Agriculture	207		
PFM TA for Rural Development (alloc. 33%)			2,749
Tonle Sap Poverty Reduction and Smallholder Development (alloc. 5%)		53	42
Agricultural Policy Support Under the Soaring Food Prices Initiative		167	1,086
Pro-Poor Policy Formulation, Dialogue and Implementation			169
FAO-IFAD Collaborative Assistance on Pro-poor Policy Formulation			68
New Agricultural Programme Development	1,256	810	320
Cambodia Agricultural Value Chain Programme (alloc.15%)	349	771	1,123
Rural Livelihoods Improvement Project (alloc.10%)		660	500
Support to Agriculture Sector Policies	720	1,047	2,758
TA Support to Agriculture and Water Sector Policies	602	489	411
Japn Overseas Cooperation Programme in 2007 and 2008			
Technical Cooperation by Experts 2009		2,751	
Activities to Promote Efficiency of TC in 2007, 2008 and 2009	310	184	413
Promoting Climate Resilient Water Management and Agriculture			11
PLANNING AND MANAGEMENT: SUBTOTAL DONORS	3,805	7,514	9,639
PLANNING AND MANAGEMENT: SUBTOTAL GOVT.	7,459	9,338	23,433
MAFF PLANNING AND ADMINISTRATION: TOTAL GOVT. AND DONORS	11,264	16,853	33,072
GOVT/TOTAL RATIO	66	55	71
RECURRENT CENTRAL MAFF: GOVT.	36,990	43,116	52,494
RECURRENT PROVINCE MAFF: GOVT.	20,665	22,705	27,678
TOTAL MAFF RECURRENT	57,655	65,821	80,172
CAPITAL MAFF: GOVT.	5,462	5,699	3,638
TOTAL MAFF: GOVT. RECURRENT AND CAPITAL	63,117	71,520	83,810
TOTAL DONOR AGRICULTURE	84,369	102,968	98,687
TOTAL GOVT. AND DONORS	147,486	174,489	182,497
GOVT/TOTAL RATIO AGRICULTURE %	43	41	46

	2007	2008	2009
Exchange rate USD/Riel eop (EAP Brief Nov 09 update)	4,003	4,081	4,165
Total MAFF Recurrent (R Mill.) Source: TOFE	57,606	65,823	78,192
MAFF Ministry/NonPB from 2007 (R Mill.)	48,010	56,051	64,233
MAFF Provinces/PB from 2007 (R Mill.)	9,596	9,772	13,959
Share Province/PB (from 2007) - of Total MAFF %	16,7	14,8	17,9
IRRIGATION			
RECURRENT MOWRAM GOVT. TOFE	20,427	25,861	31,352
CAPITAL MOWRAM (Domestically Financed) (Source: TOFE)	74,508	114,593	148,691
TOTAL MOWRAM: GOVT RECURRENT AND CAPITAL	94,935	140,454	180,043
Irrigation: Donors			
Integrated Development in Battambang in Support of SPFS			1,960
Stung Chinit Irrigation and Rural Infrastructure	6,309	5,762	
Northwest Irrigation Sector Project	3,047	3,440	13,573
Flood and Drought Risk Management and Mitigation			
Water Resources Management Sector Development Preparation	885	1,016	616
Water Resources Management Sector Development			
Tonle Sap Lowlands Rural Development (alloc.10%)			541
PFM TA for Rural Development (alloc. 33%)			2,749
Cambodia Agricultural Value Chain Programme (alloc.40%)	931	2,056	2,995
ECOSORN	1,069	7,063	2,750
Strengthening Participatory Irrigation Management	189	602	421
Northwest Irrigation Sector Project	2,784	3,717	4,932
Rehabilitation of Prey Nup Polder, Phase 3	2,252	995	
Stung Chinit Irrigation Scheme Rehabilitation	2,375	1,102	
Water Resources Management Sector Project			
Community Based Rural Development Project (alloc. 16%)	564	98	607
Rehabilitation of Kandal Stung Irrigation System	1,571	268	
Rehabilitation of Thnol Bot Irrigation System	567		
Prek Thnot River Basin Agricultural Development Study	3,178	2,089	
Technical Service Centre for Irrigation Ph II	753	4,577	3,369
The Basin Wide Irrigation and Drainage Master Plan Study	2,487	3,982	3,369
The Improvement of Agricultural River Basin Management			3,369
JICA/KOICA Joint Programme for Irrigation System Rehabilitation			417
Improvement of Roleang Chrey Headworks			643
Improvement of Roleang Chrey Headworks - Detailed Design			842
Rehabilitation of Boeung Veam Irrigation System			
Rehabilitation of Kbal Tonsoung Irrigation System		346	
Rehabilitation of Portasu Irrigation System		347	
Rehabilitation of Potawa Irrigation System			
Rehabilitation of Thanal Chan Reservoir		345	
Rehabilitation of Toul Kou Irrigation System	322		
Rehabilitation of Bos Leave Irrigation System	342		
Technical Training in Japan 2007 and 2008 (allocation)	1,262	884	
Technical Cooperation by Experts 2009		2,751	
Krang Ponley Water Resources Development		21,365	5,689
JICA/KOICA Joint Programme for Irrigation System Rehabilitation			833
Irrigation System Construction in Batheay District			6,248
Community Self Reliance and Flood Risk Reduction	539	460	
PFM for Rural Development (assumed allocation 33%)			2,749
Tonle Sap Poverty Reduction and Smallholder Development (alloc.10%)		105	83
Rural Poverty Reduction in Prey Veng and Svay Rieng (alloc. 15%)	2,144	1,605	1,003
Promoting Climate-Resilient Water Management and Agriculture (alloc. 25%)			11
Battambang Dam			
IRRIGATION SUBTOTAL: DONORS	33,570	64,975	59,768
IRRIGATION TOTAL: GOVT. AND DONORS	128,505	205,429	239,811
GOVT/TOTAL RATIO IRRIGATION %	*74*	*68*	*75*

	2007	2008	2009
Exchange rate USD/Riel eop (EAP Brief Nov 09 update)	4,003	4,081	4,165
RURAL ROADS			
RECURRENT MRD GOVT. TOFE	34,754	45,243	63,758
RECURRENT FOR RURAL ROADS (estimate 40% of total MRD)	13,902	18,097	25,503
CAPITAL MRD (Domestically Financed) (Source: TOFE)	53,253	108,111	87,559
TOTAL RURAL ROADS: GOVT RECURRENT AND CAPITAL (MRD)	67,155	126,208	113,062
Commune Funds C/SF (MOI) Spent on Rural Roads	44,810	47,726	59,345
TOTAL RURAL ROADS: GOVT (MRD) AND C/SF	111,965	173,934	172,407
Tonle Sap Sustainable Livelihoods (alloc. 20%)	271	1,479	5,992
Tonle Sap Lowlands Rural Development (alloc.10%)			541
Northwest Development Project	22,853	21,752	
Tonle Sap Poverty Reduction and Smallholder Development (alloc. 10%)		105	83
Provincial Rural Infrastructure Project	6,281	1,761	1,710
PFM TA for Rural Development (alloc.15%)			1,250
ECOSORN	2,027	2,545	9,929
Rural Poverty Reduction in Prey Veng and Svay Rieng (alloc. 15%)	2,144	1,605	1,003
Community Based Rural Development Project (alloc. 4%)	141	24	152
Flood Damage Repair of Rural Roads	236		
Rural Infrastructure Programme RIP II			
Rural Infrastructure Programme Siem Rip and Kampong Thom RIP I			12,762
Tertiary Road Improvement Programme TRIP II	32		
Tertiary Road Improvement Programme TRIP III	719		
Tertiary Road Improvement Programme TRIP IV	24,331	11,413	3,469
People in Crisis	16,685	11,597	11,952
RURAL ROADS SUBTOTAL: DONORS	75,720	52,282	48,843
TOTAL RURAL ROADS: GOVT (MRD) AND C/SF AND DONORS	187,685	226,215	221,250
GOVT/TOTAL RATIO RURAL ROADS %	*60*	*77*	*78*

ANNEX D: RECURRENT BUDGET BY ECONOMIC CLASSIFICATION, 2000–06

(Riels mn.)

	2000	2001	2002	2003	2004	2005	2006	Avge.
MAFF								
Ministry								%
Ch 10: Salaries	3,618	2,290	5,461	4,567	4,585	6,183	7,032	
Ch 11:Operating Costs	9,004	7,778	7,193	5,971	6,700	8,956	10,500	
Ch 12: Subsidies to Provinces				4,846	4,899	7,681	8,000	
Ch 13: Specific Programme Activities		2,105	5,844	6,064	6,259	7,430	10,000	
Ch 30: Economic Interventions	285	3,989	4,424	600	816	600	700	
Ch 31: Social Interventions	71	51	46	54	49	84	100	
Ch 32: International Organisations	368	966	312	378	332	259	450	
Subtotal	13,345	17,179	23,281	22,480	23,640	31,193	36,782	
Provinces								
Ch 10: Salaries	3,555	3,348	5,028	4,941	4,901	4,587	5,265	
Ch 11:Operating Costs	4,060	6,980	7,846	8,312	7,851	8,189	10,418	
Ch 30: Economic Interventions	2,340	2,825	3,335	3,087	2,762	2,917	4,000	
Ch 31: Social Interventions	113	136	162	203	214	224	370	
Subtotal	10,069	13,289	16,372	16,544	15,728	15,917	20,053	
Total	23,415	30,468	39,652	39,024	39,368	47,109	56,835	
Ministry and Provinces								
Ch 10: Salaries	7,173	5,638	10,489	9,508	9,487	10,771	12,297	24
Ch 11:Operating Costs	13,064	14,758	15,039	14,283	14,551	17,145	20,918	41
Ch 12: Subsidies to Provinces				4,846	4,899	7,681	8,000	6
Ch 13: Specific Programme Activities		2,105	5,844	6,064	6,259	7,430	10,000	12
Ch 30: Economic Interventions	2,625	6,814	7,760	3,687	3,578	3,517	4,700	12
Ch 31: Social Interventions	184	186	208	257	263	307	470	1
Ch 32: International Organisations	368	966	312	378	332	259	450	1
Total Ministry and Provinces	23,415	30,468	39,652	39,024	39,368	47,109	56,835	98
MOWRAM								
Ch 10: Salaries	687	777	1,126	1,334	1,324	1,612	2,016	
Ch 11:Operating Costs	4,286	5,637	7,918	8,910	9,617	8,195	9,043	
Ch 30: Economic Interventions								
Ch 31: Social Interventions	9	8	5	6	12	11	19	
Ch 32: International Organisations	119	142	407	107	81	40	40	
Subtotal	5,101	6,564	9,456	10,358	11,034	9,858	11,118	
Provinces								
Ch 10: Salaries	496	524	763	836	799	942	1,171	
Ch 11:Operating Costs	584	1,156	731	1,701	1,457	1,972	2,831	
Ch 30: Economic Interventions		496	884	913	984	929	3,625	
Ch 31: Social Interventions	18	24	26	35	32	45	44	
Subtotal	1,098	2,200	2,405	3,486	3,271	3,887	7,671	
Total	6,199	8,764	11,861	13,844	14,305	13,745	18,789	
Ministry and Provinces								
Ch 10: Salaries	1,183	1,301	1,889	2,171	2,123	2,554	3,187	17
Ch 11:Operating Costs	4,870	6,793	8,649	10,611	11,073	10,167	11,874	74
Ch 30: Economic Interventions		496	884	913	984	929	3,625	8
Ch 31: Social Interventions	27	32	32	42	44	56	63	0
Ch 32: International Organisations	119	142	407	107	81	40	40	1
Total Ministry and Provinces	6,199	8,764	11,861	13,844	14,305	13,745	18,789	100

	2000	2001	2002	2003	2004	2005	2006	Avge.
MRD								
Ch 10: Salaries	483	498	998	1,079	1,124	1,716	2,090	
Ch 11:Operating Costs	3,031	3,987	4,314	2,731	2,354	4,712	3,864	
Ch 13: Specific Programme Activities		2,191	5,500	5,256	5,517	6,347	11,747	
Ch 30: Economic Interventions								
Ch 31: Social Interventions	4	7	7	8	6	15	30	
Ch 32: International Organisations								
Subtotal	3,518	6,682	10,819	9,073	9,001	12,791	17,732	
Provinces								
Ch 10: Salaries	934	914	1,478	1,579	1,586	1,855	2,272	
Ch 11:Operating Costs	2,989	4,719	5,925	6,104	5,897	7,343	9,867	
Ch 30: Economic Interventions								
Ch 31: Social Interventions	109	127	174	145	142	156	143	
Subtotal	4,032	5,760	7,577	7,828	7,626	9,353	12,282	
Total	7,550	12,442	18,395	16,901	16,627	22,144	30,014	
Ministry and Provinces								
Ch 10: Salaries	1,418	1,412	2,476	2,658	2,710	3,571	4,362	15
Ch 11:Operating Costs	6,019	8,705	10,239	8,835	8,251	12,055	13,732	58
Ch 13: Specific Programme Activities		2,191	5,500	5,256	5,517	6,347	11,747	26
Ch 30: Economic Interventions								0
Ch 31: Social Interventions	113	134	181	153	149	171	174	1
Ch 32: International Organisations								
Total Ministry and Provinces	7,550	12,442	18,395	16,901	16,627	22,144	30,014	100

ANNEX E: RECURRENT BUDGET ANALYSIS BY ECONOMIC CLASSIFICATION, 2007–08

(Riels mn.)

	2007	% Share	2008	% Share	Ave.
MAFF					
Total Non Budget and Budget Programming					
Ch 60: Purchases	13,873	24	15,209	23	24
Ch 61: External services	6,165	11	7,289	11	11
Ch 62: Other services	8,472	15	9,396	14	14
Ch 64: Personnel charges	14,973	26	22,126	34	30
Ch 65: Subsidy and Social assistants	14,099	24	11,719	18	21
Ch 63: Tax and Excise	74	0	85	0	0
Total	**57,655**	**100**	**65,823**	**100**	**100**
MOWRAM					
Ch 60: Purchases	7,299	36	10,888	42	39
Ch 61: External services	3,759	18	3,792	15	17
Ch 62: Other services	1,571	8	1,716	7	7
Ch 64: Personnel charges	3,619	18	4,453	17	18
Ch 65: Subsidy and Social assistants	4,116	20	4,896	19	20
Ch 63: Tax and Excise	0	0	57	0	0
Total	**20,364**	**100**	**25,801**	**100**	**100**
MRD					
Non Budget and Budget Programming					
Ch 60: Purchases	6,753	19	5,915	13	16
Ch 61: External services	17,448	50	26,982	60	55
Ch 62: Other services	5,196	15	5,797	13	14
Ch 64: Personnel charges	5,323	15	6,513	14	15
Ch 65: Subsidy and Social assistants	0	0	0	0	0
Ch 63: Tax and Excise	34	0	36	0	0
Total	**34,754**	**100**	**45,243**	**100**	**100**

ANNEX F: BENEFICIARY PERCEPTION SURVEY

Introduction

The Beneficiary Perception Survey was conducted as part of the PER Review. The survey was expected to provide evidence of the impact of public spending (both Government and donors) for agricultural extension, irrigation (large and small scale) and rural roads. The field survey was undertaken between 22nd February and 2nd March 2010. The survey was intended to supplement the data from secondary sources and from case studies.

The survey focused on the effectiveness of public interventions, relying mainly on farmer perceptions. In particular, the survey intended to assess the effects that agricultural extension, irrigation and rural roads have had on agricultural production and local livelihoods. The survey does not aim to collect evidence of the coverage of Government activity, which is more effectively done in CSES and MOPS.

Nine villages across Cambodia were chosen for the survey. Three villages were selected to focus on each type of intervention (extension, irrigation, and rural roads). Each village was selected to represent a variety of characteristics of villages in Cambodia such as wet-season rice, dry season rice, cash crop, and remote ethnic villages. The selection of particular villages was done through consultation with and suggestions from the relevant functional authorities at the provincial and district levels. The sample villages were supposed to be among villages that performed best in their own characteristics: extension, irrigation, and rural roads. Table F.1. summarizes the sample villages in the survey.

Table F.1. Sample Villages

Public Intervention on Extension			
1	Vegetable	Koh Toch	Kandal
2	Dry season	Chuntul Maek	Takeo
3	Wet season	Samreth	Kampong Speu
Public Intervention on Irrigation			
4	Flood control	Voiyeav	Kampong Thom
5	Small scale	Trang	Battambang
6	Reservoir	Damnak Kanseng	Pursat
Public Intervention on Rural Roads			
7	Rice surplus	Angkal	Prey Veng
8	Cash crops	Choim Tamao Koeut	Kampong Cham
9	Remote ethnic	Puchrey Chang	Modulkiri

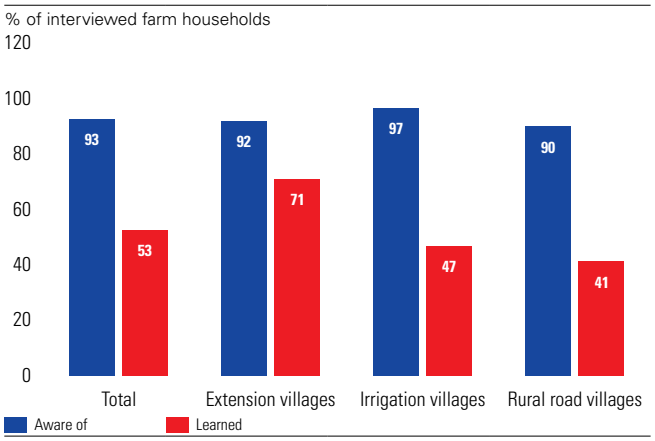
Source: PER survey.

The survey collected data from three types of respondents in each village: key informants of the village, farmers (farm households), and laborers. Different semi-structured questionnaires were used for each type of respondent. Work in each village started with one group interview/meeting with 4-6 key informants. Then, thirty farm households were interviewed and five laborers were selected among the sample farm households whose members were laborers for further interview to assess the impacts of public intervention on local demand for labor.

The selection of the thirty sample farm households from each village was done differently for extension, irrigation, and rural road villages. In rural road villages, the sample farm households were randomly selected among all village households while farm households in village irrigation were also selected randomly, but only among the village households that had access to irrigation systems. The method in the latter case was employed because the survey aimed to examine the benefits of irrigation, while the data on coverage of (or access to) irrigation among village households could be collected from the interviews with the village's key informants. In the case of extension villages, the sample selection targeted the households that were contacted by the extension service. However, because the number of contact farmers was usually 20-30 per village, some non-contact farmers were included in the sample. The main focus of the interviews was on the questions associated with the selected intervention type, but all respondents were also asked a subset of questions on other types of intervention.

Extension Services

Figure F.1. Coverage of Extension Services



Source: PER Survey of farmer perception in 9 villages (February–March, 2010)

Coverage of extension services. Although three villages were in particular selected to represent the type of public intervention in agricultural extension, all six other villages also reported having received extension services. Among all surveyed farm households, 53 percent had received agricultural extension advice. The percentage of farm households having received extension advice was highest in three villages (extension villages) that were particularly chosen to represent public intervention in extension. 71 percent of the households interviewed in these villages reported that they attended the extension training. The figure should in any case be unsurprising since the selection of the households in these three villages was deliberately targeted on those receiving the extension courses provided to the village. While the survey aimed to interview 30 households per village, it tried as much as possible to cover those farm households receiving extension services.

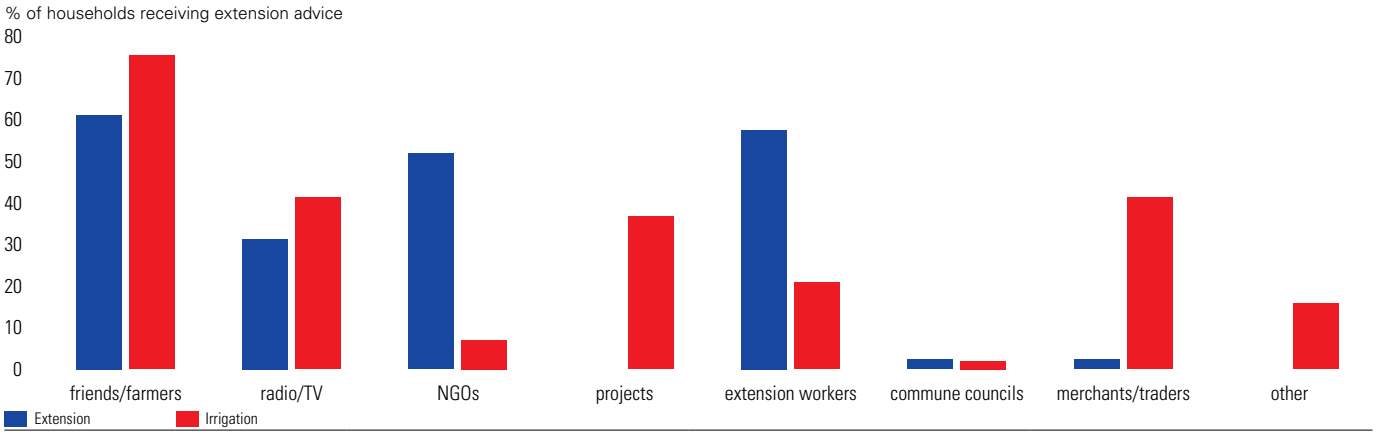
However, while the method of selecting farm households in other villages for interview was different to that in the extension villages, the percentage of farm households having received extension advice still appears high: 41 percent in rural road villages and 47 percent in irrigation villages. While the figure in irrigation villages could be influenced by the selection of households that in particular benefited from the irrigation scheme, the statistic in rural road villages should be more representative given the random selection of farm households in those villages. However, the coverage of extension services at 41 percent of the households in rural road villages could be the result of extension programs provided by many different actors (i.e. the government, donor projects, and NGOs), rather than a single service provider.

The extension service further reaches untrained farmers. Its coverage can be understood through the range of awareness of extension advice. The survey indicates that 93 percent of the surveyed households were aware of extension advice. The proportion of households who were aware of extension advice was highest in irrigation villages (97 percent, which is about twice the farm households that directly attended the extension training). However, the coverage appears slightly less in extension villages (92 percent).

Farmers are becoming aware of extension advice through multiple sources. The first major source is other farmers—i.e. 61 percent of the interviewed households were aware of extension advice through this source. Other major sources of extension advice are government extension workers, NGOs, and radios/TVs. Notably, farmers also become aware of extension advice from 'merchants/traders'. The extension advice from this source reaches 20 percent of the surveyed households.

The extension service from the Government and NGOs has larger coverage in extension villages and to some extent in rural road villages. In extension villages, 58 percent of the households become aware of extension advice from the Government extension workers and 52 percent have heard of it from NGOs. In irrigation villages, more farmers tend to become aware of extension advice from other farmers/friends and radios/TVs. Unlike in extension villages, extension advice from merchants/traders plays a more significant role—i.e. some 41 percent of farmer households

Figure F.2. Sources of Extension Advice



Source: PER Survey of farmer perception in 9 villages (February–March, 2010).

Table F.2. Types of Extension Advice that Farmers Received

% of households

		Extension			Irrigation			Rural roads			
		Vill. 1	Vill. 2	Vill. 3	Vill. 4	Vill. 5	Vill. 6	Vill. 7	Vill. 8	Vill. 9	**Total**
1	Rice farming	26	95	100	85	86	100	85	0	13	**71**
2	Cash crop	26	0	19	38	50	20	10	0	25	**20**
3	Vegetable	100	25	71	62	50	13	5	22	25	**45**
4	Livestock	0	40	33	69	50	60	40	78	75	**43**
5	Fertiliser application	74	90	95	69	79	67	55	11	0	**68**
6	SRI	0	80	86	31	43	80	30	0	0	**43**
7	Water management	43	70	71	38	50	47	40	0	0	**46**
8	Pest management	83	75	86	54	71	67	65	11	0	**65**
9	Organic farming	22	40	43	31	7	20	10	0	0	**22**
10	Compost making	57	70	95	77	79	67	30	11	0	**59**
11	Post harvest	74	0	5	0	29	27	10	0	0	**20**
12	Other	35	50	57	23	29	40	15	0	0	**32**

Source: PER Survey of farmer perception in 9 villages (February–March, 2010).

in irrigation villages become aware of extension messages from merchants/traders. This implies that availability of irrigation encourages interaction between farmers and merchants/traders on agricultural extension.

The extension messages that farmers have learned are largely in the forms of rice production, application of fertilizers, pest management/control, and compost making. Among farmers directly learning from extension advice, 71 percent reported having learned rice production techniques, while the share of households receiving extension advice on application of fertilizers, pest management/control, and compost making ranges from 59-68 percent. About 43-46 percent of households attending extension courses have learned vegetable cultivation, livestock raising, water management, and SRI. The coverage of extension services on cash crop production, organic farming, and post harvest techniques is lowest, at about 20-22 percent of extension participants.

Impact of extension services. The adoption rate among farm households that were receiving extension services appears high, but they only managed to apply some parts of the extension package they learned. About 67 percent of farm households partially applied what they learned from the extension courses into their actual farming practices. Full adoption is very low (about 6 percent) and found only in two of the extension villages.

Among those having received extension advice, about 27 percent did not apply even part of the extension package they received. They did not apply the extension advice because a lack of working capital and agricultural inputs were their major constraints. Other reasons were because the adoption extension advice requires extra labor. Lack of water availability to supply farmland also constrains farmers from adopting the techniques. Some farmers explained that they did not apply the extension advice because they did not understand it or sometimes because they did not believe in the extension advice.

The partial adoption is most commonly observed and the rate is highest in irrigation villages (87 percent), followed by extension villages (67 percent, excluding 14 percent of full adoption). This implies that the adoption rate of the extension services is likely supported by the existence of the irrigation system. Though the adoption rate in irrigation villages is not far higher than that in extension villages, it is because those extension villages are also characterised by the availability of irrigation systems. Nevertheless, the adoption rate is far lower in villages that have no irrigation such as Puchrey Chang village (Mondulkiri) or in villages where irrigation is limited such as Choim Tamao village (Kampong Cham) while in villages with better availability of water supply from irrigation the adoption rate is even up to 93 percent in Damnak Kanseng village (Pursat), though much adoption is only partial.

Table F.3 presents data on adoption rates for extension advice and perceptions of its usefulness. The table demonstrates that extension advice works better in extension villages than in other villages, which again confirms the supporting role of the irrigation schemes to the effectiveness of the extension service. Though they only partially adopted the advice, none of farmers in irrigation villages found the extension service useless, 26 percent viewed extension advice as very useful, and the rest have benefited in some degree from their adoption of the extension advice.

Table F3. Adoption of the Extension Service and its Usefulness

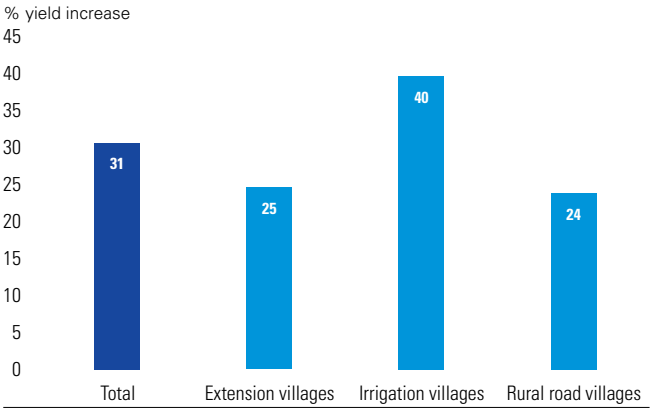
	Contact Rate (%)	Adoption Rate (%)		Usefulness of Extension (%)				Mean Score	Effect on Yield (% change)
		Partially	Fully	1	2	3	4		
Overall	53	66.7	6.3	6	38	42	14	2.6	30.7
Extension villages	**71.1**	**67.1**	**14.3**	**13**	**34**	**50**	**3**	**2.4**	**24.7**
1 Koh Toch	76.7	77.8	0	11	37	44	8	2.5	16.7
2 Chuntul Maek	66.7	52.4	28.6	10	33	56	0	2.5	30.9
3 Sameth	70	68.2	18.2	16	33	49	2	2.4	24.9
Irrigation villages	**46.7**	**86.7**	**..**	**..**	**33**	**40**	**26**	**2.9**	**39.6**
4 Voiyeav	43.3	68.8	0	0	60	27	13	2.5	27.4
5 Trang	46.7	100	0	0	32	42	26	2.9	33.4
6 Damnak Kanseng	50	93.3	0	0	20	47	33	3.1	55.4
Rural Road villages	**41.1**	**45.5**	**..**	**1**	**65**	**24**	**10**	**2.4**	**23.8**
7 Angkal	66.7	60	0	0	60	27	12	2.5	23.8
8 Choim Tamao Keut	30	36.4	0	9	82	9	0	2	..
9 Puchrey Chang	26.7	30.8	0	0	100	0	0	2	..

Source: PER Survey of farmer perception in 9 villages (February–March, 2010).
Note: The contact rate refers to the proportion of the households that are aware of extension messages. the adoption rate refers to the proportion of household that adopt extension messages, either fully or partially. The usefulness score is a subjective score with 1= not useful and 4 = very useful.

The farmers in extension villages also value the usefulness of the extension advice in their farming practices, but the degree of its usefulness is less compared to that in the irrigation villages. As extension villages also have irrigation and water, the lower degree of usefulness may on one hand be due to different types of extension services and could on the other hand be explained by the fact that irrigation systems in these villages have long been in existence well before the introduction of the extension service. These to some extent reduce the perception of farmers on the usefulness of the extension adoption.

Figure F.3 presents the impact of extension advice on agricultural yields. In average, exposure to extension services increased yields about 30 percent. The increase of yields was highest in irrigation villages, which saw a yield gain of about 40 percent. The increase is not simply the single effect of the extension with support from irrigation, but also relates to other unreported factors such as fertilizers, land preparation, and weeding that would also contribute to yield increase.

Figure F.3. Effect of Extension on Yield Reported by Farmers



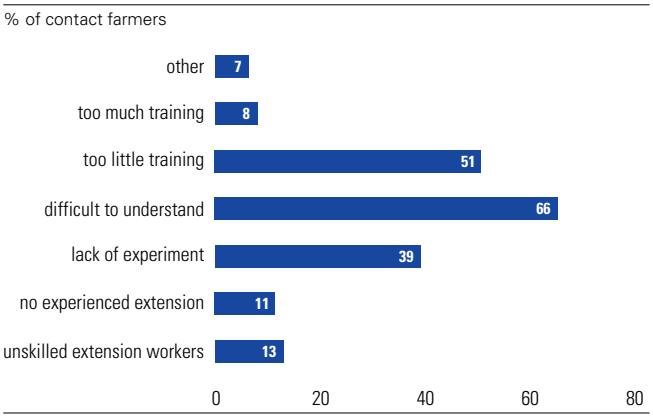
Source: PER Survey of farmer perception in 9 villages (February–March, 2010)

The effect of extension on yields indicates that farms that partially adopted extension advice produce higher increases in yield, compared to farms with full adoption of the extension advice. The comparison shows that partial adoption increases yield by 31 percent while full adoption produces only 23 percent higher yield. This could be explained by fact that adaptation of extension messages is very farmer specific and depends on specific farm conditions. This further supports the argument that extension services would need to provide customized messages which responds more closely to farmer demand, rather than one size fits all advise.

While gaining less yield compared to farms partially adopting the extension advice, farms with full adoption are likely to benefit more from lower production costs and reduced pest infestation. The survey shows that farmers fully adopting the extension advice reported their satisfaction from lower costs. However, it does not necessary explain the net benefit of both types of adoption.

Main issues. Figure F.4 below illustrates the views collected from nine villages in the survey concerning problems with the extension service. About two thirds of the respondents said that the training by the extension service was difficult to understand and about half of them found the training was insufficient. Furthermore, about 40 percent of the respondents complained that the extension service lacked experiments or field demonstrations for farmers. This means that in many cases the extension services may have tended to deliver theoretical messages, rather than more demand driven advise which is being complemented with field trials to demonstrate and optimize the advise to farmers.

Figure F.4. Main Problems with Extension Services Reported by Farmers



Source: PER Survey of farmer perception in 9 villages (February–March, 2010)

Irrigation

Access to irrigation system. All villages among both irrigation and extension villages have access to some forms of water sources and irrigation structures such as reservoirs, rivers or streams, ground water, canals, and pumps. In rural road villages, Angkal village (in Prey Veng) has access to an irrigation system, Puchrey Chang (a remote ethnic

village in Mondulkiri) has no access to any type of irrigation, while Choim Tamao (Kampong Cham) has access to a traditional small stream that could be used for supplementary irrigation in the wet season and also for irrigating some dry season rice.

Table F.4. Access to and Use of Water Sources in Surveyed Villages

	Koh Toch	Chuntul Maek	Sam-reth	Voi-yeav	Trang	Damnak Kanseng	Ang-kal	Choim Tamao Keut	Puchrey Chang
	Water sources (other than rains) and irrigation system								
Reservoir		yes	yes	yes		yes	yes		
Groundwater		yes							
Canals/small stream		yes	yes	yes	yes	yes	yes	yes	
Recession									
Pump/pumping station		yes	yes		yes	yes	yes		
Lake/pond	yes					yes			
River/stream	yes		yes						
	Use of water sources and irrigation system								
Wet season rice		yes	yes	yes	yes	yes	yes	yes	yes
Dry season rice	yes	yes	yes	yes	yes	yes		yes	
Early wet season rice			yes	yes	yes		yes		
Recession farming							yes		
Cash crops	yes		yes	yes	yes	yes		yes	yes
Vegetable	yes		yes	yes	yes	yes			
Other				yes	yes				

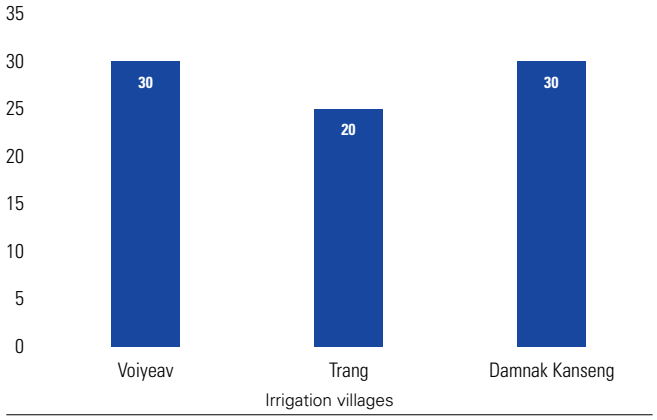
Source: PER Survey of farmer perception in 9 villages (February–March, 2010).

In irrigation villages, the irrigation systems are mainly used as supplementary irrigation in the wet season and for farm production in early wet season and dry season. Some farm households in these villages are able to plant two crops per years. Farm households in Voiyeav village (Kampong Thom) and in Damnak Kanseng village (Pursat) use the irrigation for wet and dry season rice production while farmers in Trang village (Battambang) use the irrigation system for wet and early wet season rice cultivation.

Despite the presence of an irrigation system, access to water in the dry season appears limited in all three irrigation villages. About 30 percent (58 households) and 30 percent (40 households) respectively of the village households in Voiyeav and Damnak Kanseng engage in dry season rice farming. In Voiyeav village, about 60 percent of households could use water from the irrigation for some production of fruit trees and home gardening around their yards. About 20 percent (70 households) of the households in Trang village could participate in early wet season cropping.

Two of the extension villages, Koh Toch (Kandal) and Samreth (Kampong Speu), have access to river/stream water. All village households have access to these water sources through their individual private pumps. Farm households in these two villages use water for vegetable cultivation. According to key informants in both villages, all village households practice vegetable

Figure F.5. Percentage of Village Households Having Access to Water from Irrigation Systems



Source: PER Survey of farmer perception in 9 villages (February–March, 2010)

farming using pumps as a means for irrigation. On top of vegetable production, Samreth village in particular uses the stream water for a greater variety of uses which include wet season rice, early wet season, and dry season rice.

Impact of irrigation investments. Since irrigation is used for supplementary supply of agricultural water in the wet season, especially in the time of drought, the availability of water through irrigation systems is meant to protect loss of agricultural outputs. Also, availability of water should in theory encourage farmers to improve their land and water management, and adopt new farming techniques. This will eventually have an effect on agricultural yields. Furthermore, access to irrigation systems should prepare farmers to increase the number of croppings on their land.

Table F.5 illustrates the behaviour of farmers in managing their farms in relation to access to irrigation and the impact on yield. In response to drought, farmers in irrigation and extension villages tend to make use of the water sources, either immediately when there is drought, or wait for some time before starting to use the water source. This behaviour of farmers toward water use is only commonly observed in villages where availability and access to water are not a constraint.

Farmers in rural road villages behave differently. A majority (58 percent) of them have no choice other than waiting for the rainfall when facing drought in the wet season. In particular, all farmers in Puchrey Chan village (Mondulkiri) are fully dependent on rainfall. This is because they have no or limited access to the water source. For example, only 20 percent of the interviewed households in Angkal village (Prey Veng) could access water from the village irrigation system.

Table F.5 reveals that 99 percent of the interviewed households in irrigation villages, in particular those who have access to irrigation system, were able to improve their land in the last two years. About 50 70 percent of the surveyed households in other villages improved their farmland, except Koh Toch (7 percent) and Puchrey Chang (33 percent) villages.

Table F.5. Land and Water Management

% of households

	Access to irrigation/ water source	Strategy in drought conditions		Land improvement in past two years
		use water sources right away	fully dependant on rains	
Total	83	71.1	19.3	64.4
Extension villages	**100**	**100**	**0.0**	**36.7**
1 Koh Toch	100	100	0.0	6.7
2 Chuntul Maek	100	100	0.0	50
3 Sameth	100	100	0.0	53.3
Irrigation villages	**100**	**91.1**	**0.0**	**98.9**
4 Voiyeav	100	100	0.0	100
5 Trang	100	100	0.0	100
6 Damnak Kanseng	100	73.3	0.0	96.7
Rural Road villages	**50**	**22.2**	**57.8**	**57.8**
7 Angkal	70	20	43.3	76.7
8 Choim Tamao Keut	80	46.7	30	63.3
9 Puchrey Chang	0.0	0.0	100	33.3

Source: PER Survey of farmer perception in 9 villages (February–March, 2010).

In terms of the effect on yields as reported by the farm householdss it is observed that farms in irrigation villages gain the highest yield increase, which is on average 44 percent higher than before the existence of the irrigation. The increase in farm yields in rural road villages is not much different from that in the extension villages where the average yield increase is 33 percent. Table F.5 would help to explain the effect of land improvement on farm yield in rural road villages as offset of yield gain in extension villages that are likely determined by farm access to water. However, this yield increase is basically farmers' perception on effect of public intervention and is subject to many other factors such as seeds and other inputs that are not controlled in this survey.

In addition to its supplementary use to irrigate farms in the wet season, the availability of irrigation schemes assists farmers to double their crops on their land. In irrigation villages, almost all of the households having access to the irrigation scheme have been able to double their crops since the existence of the irrigation scheme. In the case of Damnak Kanseng (Pursat) some households are even trying a third crop to test the capacity of water supply. Farmers in the villages expressed their willingness to farm a third crop, but complain about the limited capacity of water supply and also the lack of secondary and tertiary canals.

The farmers' ability to increase the number of crops appears lower in rural road villages (22 percent) and extension villages (27 percent). However, this is unsurprising since it reflects a lower coverage of irrigation in rural road villages. For Koh Toch village, all farmers practice vegetable cultivation and have been traditionally dependent on pumping water from the river. Therefore, farmers do not report changes in terms of increasing the number of crops on their land. In Samreth village, although farmers have access to river water (without reservoir) through pumps, the rehabilitation of the reservoir allows 27% of the village households to increase their number of crops while the rest also benefit from easier access to reservoir water.

Table F.6 contains a number of factors that the survey tried to understand from the perception of farmers on the level of influence that each factor may have had on yield. Of all surveyed households, 73 percent reported that the yield of their agricultural production had increased (100 percent in irrigation villages, 73 percent in extension villages, and 47 percent in rural road villages). Table F.6 presents perceptions of farmers experience yield increases concerning factor causing the increases.

Table F.6. Farmer Perception on Factors Influencing Yield of Agricultural Production

No	Factors influencing yield		perception of effect* on yield					Mean Score*
			1	2	3	4		
			% of households					
1	Irrigation/water management		4	9	29	58		3.4
2	Pest control		4	24	49	24		3.0
3	Chemical fertiliser		1	33	42	23		2.9
4	Weather/rainfall		0	35	46	20		2.9
5	Other		0	27	56	18		2.9
6	Seeds	No effect	1	40	51	9	Strong effect	2.7
7	Organic fertiliser/compost		8	32	45	15		2.7
8	Land improvement		0	42	44	14		2.7
9	Farmer skills/techniques		1	54	35	11		2.6

Source: PER Survey of farmer perception in 9 villages (February–March, 2010).
Note: * 1 = no effect, 4 = strong effect

The effect of the irrigation and water management appears more significant compared to other factors, followed by pest control, chemical fertiliser, and good weather/rainfall. 58 percent of the respondent households find irrigation

and water management has had strong effect on yield of agricultural production. All other factors also have an effect on yield. The degree of effect that other factors contribute to yield increase looks fairly good.

About 23 percent of farmers reported that the their agricultural production yields have not improved. About 44 percent of them explained that pest infection was the major cause of no yield increase and 26 percent indicated drought as the factor. Furthermore, farmers in Choim Tamao Keut (Kampong Cham) and Puchrey Chang (Mondulkiri) in the north-eastern Cambodia found that too much rain undermined their cash crop and rice production, or even destroyed their farm crops.

Main issues. According to the reports from respondent households, farmers in Koh Toch and Samreth villages did not notice any significant problems or challenges in relation to irrigation in their villages. Both villages are located on the bank of the river, and thus access the river water for their farm production by using pumps. All households in both villages practice vegetable cultivation, but Samreth also use river water for rice farming, while Koh Toch does not. Farmers in Puchrey Chang did not report problems associated with irrigation because there is no irrigation in existence in the village.

As reported by farmers, major problems with irrigation and water management include lack of water in the irrigation system, lack of distribution canals, both secondary and tertiary canals, and lack of water diversion systems. Lack of water in the system is pointed out by 85 percent of the respondents, followed by lack of distribution system (48 percent) and lack of water diversion system (39 percent). This implies that while the functioning of the supplementary canals (secondary and tertiary canals) is limited, or even absent in some cases, water is still undersupplied to the main canals.

Table F.7. Main Problems Associated with Irrigation System

% of households

Problems	Koh Toch	Chuntul Maek	Samreth	Voiyeav	Trang	Damnak Kanseng	Ang-kal	Choim Tamao Keut	Puchrey Chang	**Total**
1 Lack water	n/a	100	n/a	45	93	82	96	83	n/a	**85**
2 Poor water management	n/a	27	n/a	35	44	43	44	17	n/a	**36**
3 Discrimination of water use/access	n/a	3	n/a	5	0	4	0	0	n/a	**2**
4 Lack of maintenance	n/a	27	n/a	30	22	11	44	17	n/a	**25**
5 In-cooperative villagers	n/a	17	n/a	10	7	14	17	0	n/a	**12**
6 Lack funding support	n/a	33	n/a	5	11	7	26	0	n/a	**16**
7 Lack labour	n/a	7	n/a	0	0	0	13	0	n/a	**4**
8 Lack distribution channels	n/a	7	n/a	70	52	96	35	17	n/a	**48**
9 Lack water diversion system	n/a	0	n/a	90	44	57	26	17	n/a	**39**
# Other	n/a	0	n/a	0	33	21	22	8	n/a	**15**

Source: PER Survey of farmer perception in 9 villages (February–March, 2010).

Farmers reported also problems related to the management of water and maintenance. Both poor management of water and lack of maintenance are likely to be explained by the lack or non-existence of management committees or particular responsible agencies. As reported by key informants in the villages, the existence of FWUC is not common in these study villages. Only one village (Trang) in Battambang province had an established FWUC and it tends to work well in collecting and managing the water user fees as well as taking responsibility over the operation and maintenance of the irrigation system.

Rural roads

Coverage. Among nine villages selected for the survey, rural roads have been improved in eight villages. Koh Toch is the only village whose roads have never been rehabilitated in the past 10 years. Most roads in the study villages were last improved 2-3 years ago. Most of the responses from the surveyed households indicate that the road improvement was mainly financed by CSFs and by Government. Very few households find NGOs or private sector as source of finance.

Impact of rural road investments. All respondents in the survey agreed that rural road improvement does have a positive effect on local livelihoods. Based on farmers' perceptions, the degree of effect of rural road improvement in irrigation villages is higher than in extension and rural road villages. About 60 percent of the respondents in irrigation villages feel that road rehabilitation has improved the livelihood of people in the village a lot.

Table F.8 presents the types of benefits that rural road improvements have brought about. According to farmers' perceptions, the degree of impact of rural road improvement is high in terms of reducing transportation times, increasing the number of journeys/amount of traffic on the road, generating more economic activities in the villages, allowing more representation of traders to the village, and also improving access to local hospitals and schools. Better access to local hospitals and schools is rated higher than other benefits of rural road improvement. People also perceived that road improvements help reduce the cost of transportation, but the degree of impact was perceived to be relatively low. About 25 percent of the respondents reported that road improvements have not reduced transportation costs significantly. This is because the benefits from improved roads have been offset by increase in fuel prices that have caused transportation cost to increase.

Table F.8. Benefits of Rural Road Improvement

	Benefits		degree of effect* 1	2	3	4		Mean Score*
			% of households					
1	Easier to get to hospitals/schools, ...		0	10.8	38.8	50.4		3.4
2	Less time for transportation		0	13.8	50.4	35.8		3.2
3	More traders	No effect	1.7	23.3	50	25	Strong effect	3
4	More traffic/journeys		1.3	24.6	45.4	28.8		3
5	More economic activity		0	29.6	46.3	24.2		2.9
6	Cheaper transportation costs		25.8	31.7	30	12.5		2.3

Source: PER Survey of farmer perception in 9 villages (February–March, 2010).
Note: * 1 = no effect, 4 = strong effect

As better road conditions facilitate more arrival of traders to the village, almost all respondents agreed that more traders coming to the village creates more competition and that this has enabled villagers to negotiate better prices. About 16 percent of respondents find more arrival of traders helps farmers a lot to in getting better prices for their agricultural products.

Table F.9 illustrates the benefits of rural road improvement as perceived by villagers in quantity measures, in terms of time and cost per journey. In general, people in all surveyed villages experienced shorter travel time, compared to the time before the road improvement. Farmers spend a less time travelling the same distance since the road was rehabilitated. In travelling by motorbike to the nearest market from the village, villagers spent on average just half the time they used to before the road was rehabilitated. Among all surveyed villages, the reduction of travelling time ranges between 40-60 percent when the road is upgraded.

Table F.9. Time and cost of transportation before and after road improvement

% change

	Time per travel by motorbikes	Cost per travel by motodup	Cost per travel by cars/lorries
Total	-54.4	-15.3	-41.3
Extension villages	**-46.9**	**5.5**	**100.0**
1 Koh Toch	n/a	n/a	n/a
2 Chuntul Maek	-44.5	8.9	100.0
3 Sameth	-49.4	2.1	..
Irrigation villages	**-54.9**	**-25.0**	**-16.4**
4 Voiyeav	-52.2	12.1	-16.4
5 Trang	-60.0	-35.3	..
6 Damnak Kanseng	-52.5	-52.6	..
Rural Road villages	**-58.8**	**-18.0**	**-55.1**
7 Angkal	-52.4	-12.8	..
8 Choim Tamao Keut	-63.3	0.7	-57.1
9 Puchrey Chang	-60.5	-44.1	-55.0

Source: PER Survey of farmer perception in 9 villages (February–March, 2010).

Overall, the cost of travel/ transportation was also reduced. Unlike the case with travelling time, not all villages experienced a similar cost reduction. While villagers in Damnak Kanseng village (Pursat) and in Puchrey Chang village (Mondulkiri) find the cost per journey by motodup to their nearest market is reduced about 50 percent, farmers in Choim Tamao Keut village (Kampong Cham) and Samreth village (Kampong Speu) see almost no difference between travel cost before and after road improvement. In some villages, farmers even reported higher costs of transportation since the road rehabilitation. However, people explain that the higher cost of transportation is explained by the increased price of fuel despite the road improvement.

Main issues. As discussed above, the improvement of rural roads yields a number of benefits to local villagers and these benefits improve peoples' livelihoods. Despite this, villagers also observed some problems associated with road rehabilitation. The main problems from the viewpoint of villagers include poor quality of road, for example, because of a very thin gravel layer. About 80 percent of the respondents agreed that quality of the road rehabilitation is still limited and about 38 percent of the respondents were concerned about the lack of ongoing maintenance of the road.

In relation to the concern over the maintenance of the road, villagers indicated that the roads are continually damaged by overloaded trucks. Better roads encourage more traffic. Respondents also stated that rains further speed up the deterioration of the road, especially during the wet season.

Poor road quality and speedy deterioration of road quality determine the sustainability of the road and the benefits that people enjoy. When asked whether the benefits of road improvement will be sustainable, fewer than half of the respondents are optimistic that the benefits will stay with them. Only 30 percent of the respondents in irrigation villages agreed that roads would be destroyed even more quickly in these villages. In some cases, people do not believe that the benefits from road improvement will last longer. Only 17 percent and 3 percent respectively of the respondents in Puchrey Chang and Chuntul Maek villages think that the road will continue to benefit villagers.

Conclusions

Analysing farmer perceptions on public interventions (in particular, the extension services, irrigation, and rural roads), it is suggested that all three types of intervention do have positive impacts in improving the livelihoods of rural farmers and tend to complement each other though rural road improvement is rated highest according to farmers' perceptions. Besides their impacts on farm production and price, extension, irrigation, and rural road improvement are noted to have generated more jobs in the community, and thus extend the positive impacts to employment and wages of local labourers who are among the landless and land-poor households.

Farmers find extension helps increase their farm yields by about 20 percent, which increases household incomes. Although yields increase in irrigation villages appears higher (40 percent), it represents the combined effect of both extension and irrigation, which means irrigation adds value to the gain from extension and vice versa. The combination of the effect of extension and irrigation on yield would mean farmers could earn about 20-40 percent higher incomes from their farm products per crop, if the price of farm products was held constant. However, this is subject to the variation of production costs. The evidence suggests that while farmers may have to pay fees for water from irrigation, farmer perceptions suggest that adopting extension advice does not necessarily increase farm production costs.

Farmers also rate highly the benefits from rural road improvement. Road rehabilitation tends to add further value to extension services and irrigation. Besides reducing travel time and costs, road improvement facilitates more economic activities and allows more traders to come to the village. Farmers perceived that the arrival of more traders to their village helped them to negotiate better prices for their farm products.

ANNEX G: REVIEW OF PAST STUDIES ON THE PERFORMANCE OF PUBLIC EXPENDITURES IN CAMBODIA

Table G.1 presents examples of various CBA analysis of extension, irrigation and rural roads sectors from Cambodia. Some very high figures have been calculated, notably for extension activity and especially when this takes place at a local scale. In some cases, these probably do reflect actual performance, especially where well focused, and efficiently run programs generate direct benefits. In other cases, the high BCRs may have been achieved by ignoring the overhead costs involved in managing programs and projects. Irrigation BCRs are also highly variable and are strongly affected by the design of the schemes being rehabilitated.

Table G.1. Past Estimates of IRR and BCR in Cambodia

Source	IRR	BCR	Comments
Research			
ACIL 2006	31-67%	4.0-10.0	AQIP Final Activity Completion Report, whole project 31%, seeds 39%, post harvest 43%, vegetables 67%
Extension			
IFAD 2009	11%	1.6	RLIP Appraisal in isolated areas (Kratie, Preah Vihear and Ratanakiri), for seeds, fertiliser and water management
Abrams 2008	19%	2.9	Ex-post evaluation of DFID support for Seila and NCDD
Abrams 2009	21-84%	3.0-12.0	Ex-post evaluation of nationwide Seila support 2002-06: agronomy (21%) and livestock (84%)
GRM 2006	8-63%	1.4-10.0	CAAEP II Activity Completion Report, nationwide, based on DAE Routine Activity Monitoring data
IDE 2008	67%	11	Ex-post self-evaluation of private extension services
Irrigation			
ADB 2008	14-20%	2.1-3.0	Feasibility Study for CWRSMP in Seam Reap, Kampong Thom and Banteay Meanchey
Abrams (pers. comm. 2010)	20%		Proposed target for CBAPP projects in all rural infrastructure
IFAD 2009	44-55%	5.5-8.0	TSPRSDP Appraisal for Banteay Meanchay, Seam Reap, Kampong Thom and Kampong Cham mixed support for local infrastructure, production, livelihoods
Rural Roads			
Abrams 2003 (unpublished research)	6-25%	1.0-3.7	Abrams research on Seila programme gives IRR of 25% with maintenance, 6% without
Abrams 2008	25%	3.7	Ex-post evaluation of DFID support for Seila and NCDD
MRD 2004	-7-74%	1.1-11.5	Ex post evaluation of CSF 2003 Seila funding, 10 roads in 5 provinces - average 33% with maintenance, 25% without
URS 2010	25-40%	2.8-5.0	RILGP MTR suggesting IRRs of 25%-40% if maintained, but much lower and possible <12% if not
Intech 2006	18-35%	2.7-5.0	SEACAP final report: IRR 35% with maintenance and 18% without, depending on traffic. Paving needs >50 veh/day

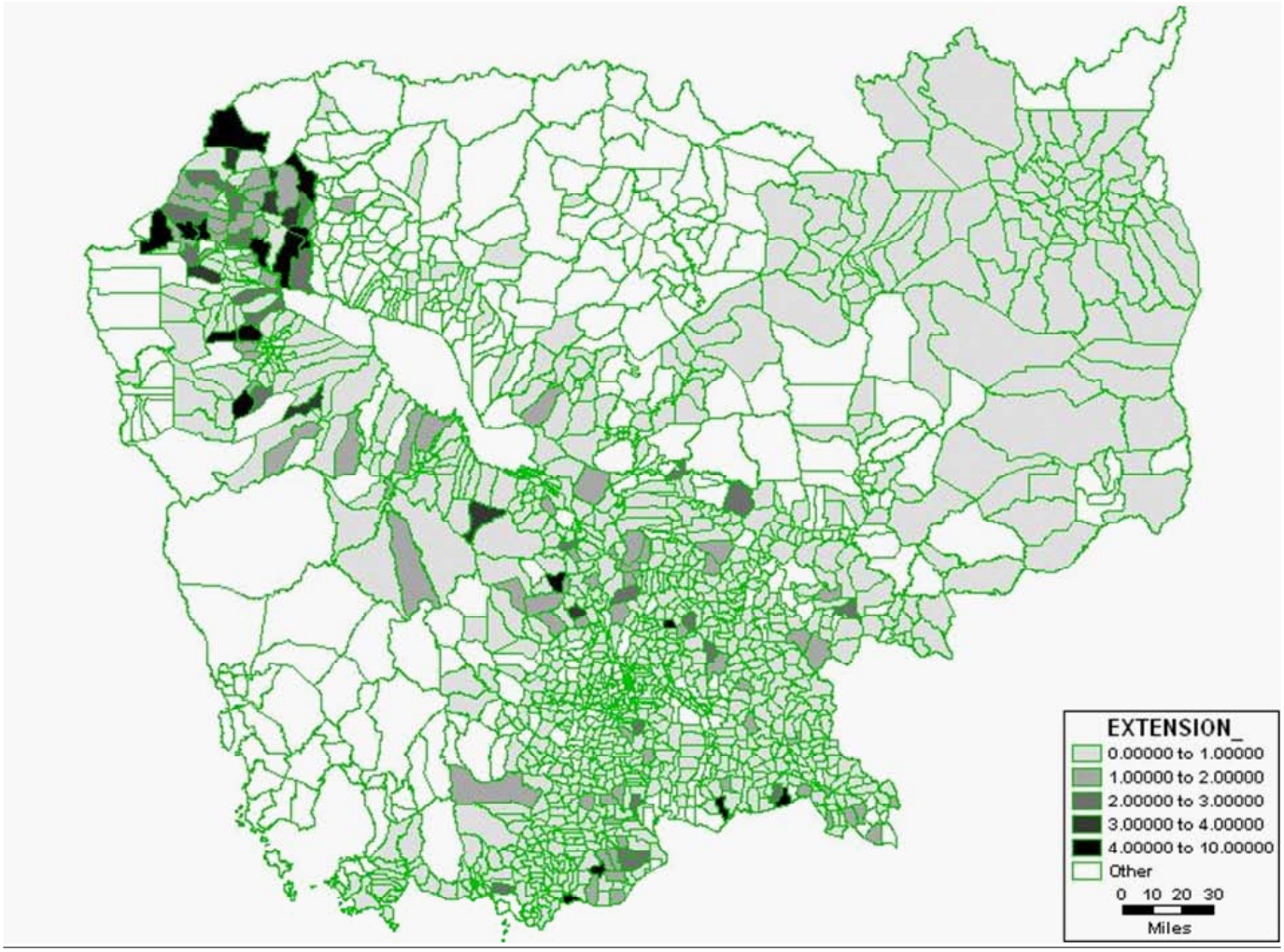
Source: ???.

ANNEX H: GEOGRAPHICAL VARIATION IN EFFECTIVENESS

Case studies and project documents suggest that there is a wide variation in the performance of public expenditure in different locations in Cambodia, reflecting the physical potential, the social and economic conditions and the degree of spatial amenities. Partly in response to this diversity, the Government could use different approaches on their expenditures in different locations. There are some general patterns that could be expected to apply.

(a) Extension is likely to be most effective in areas where existing crop yields have not yet achieved their full potential. The potential would ideally be calculated from soil quality and from the availability of land and water, which could be calculated from soil and land use maps. The gap between actual and potential yields is likely to be higher in high potential areas, simply because potential yields are higher. However, this is a simplification as there are also extension messages that are designed for more extensive rainfed production, which can also provide good returns if existing yields are very low.

Figure H.1. Illustrative Variation in BCR for Extension: 2007



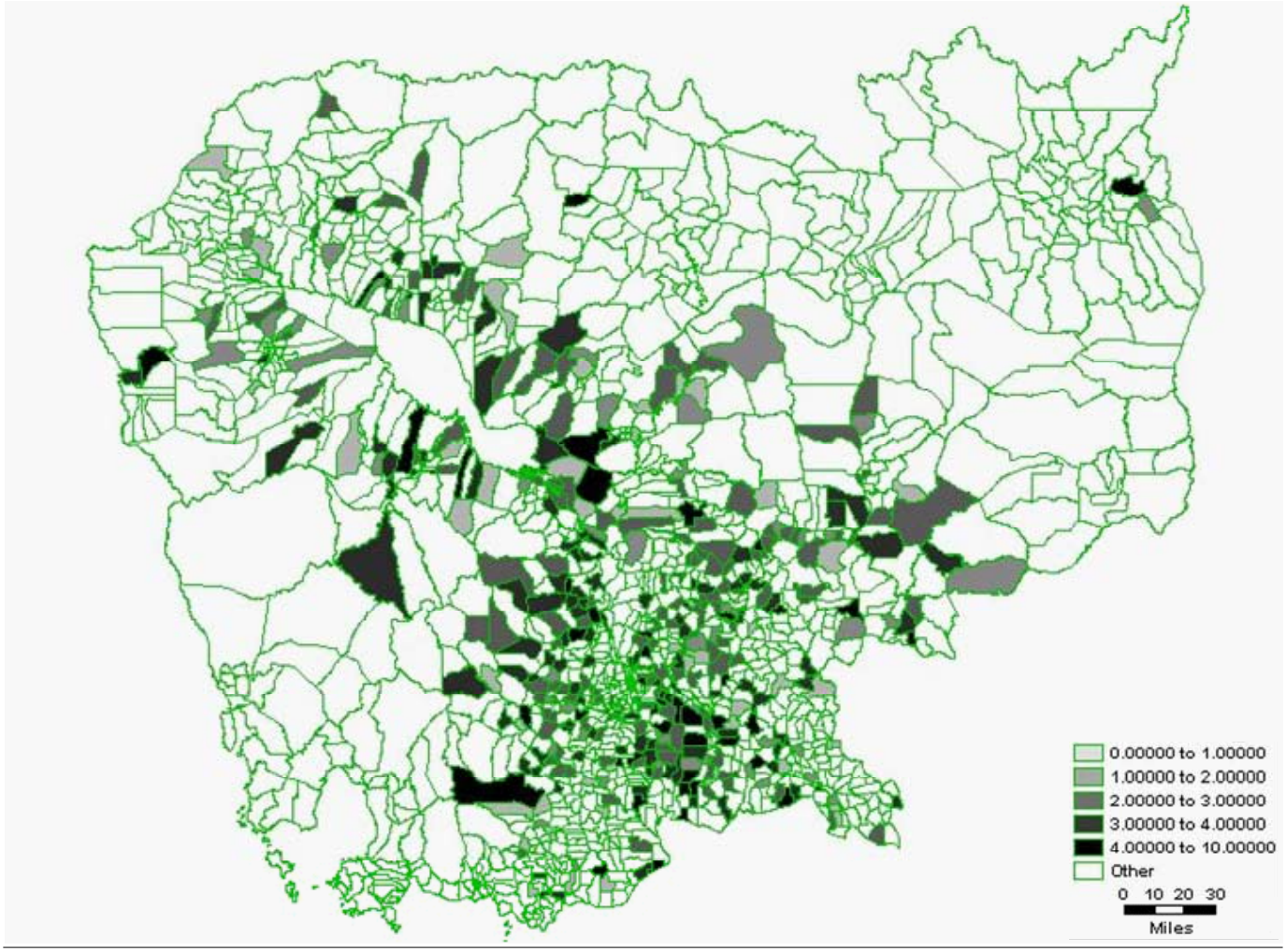
Source: ???.
Note: White cells have incomplete data. The BCR methodology is applied to each commune, using data from the commune database for current yields and soil quality. BCRs are high for communes in which the actual yields are well below the potential indicated by the soil quality.

(b) For irrigation, the BCR is dictated primarily by whether there are good sites for irrigation. Whilst some good sites for new irrigation will exist, the highest returns are normally provided when existing schemes are rehabilitated. An illustration of the potential variation in irrigation performance is given by the data in the commune database on the actual and potentially irrigable areas for each commune, combined with information on actual yields for irrigated and non-irrigated cultivation.

(c) For rural roads, the performance of public expenditure is affected by the length of rural roads, the current state of the roads, the population served and the level of agricultural production. A commune with relatively short lengths of road currently in poor condition, with high population and good economic potential will have the highest BCRs for rural roads.

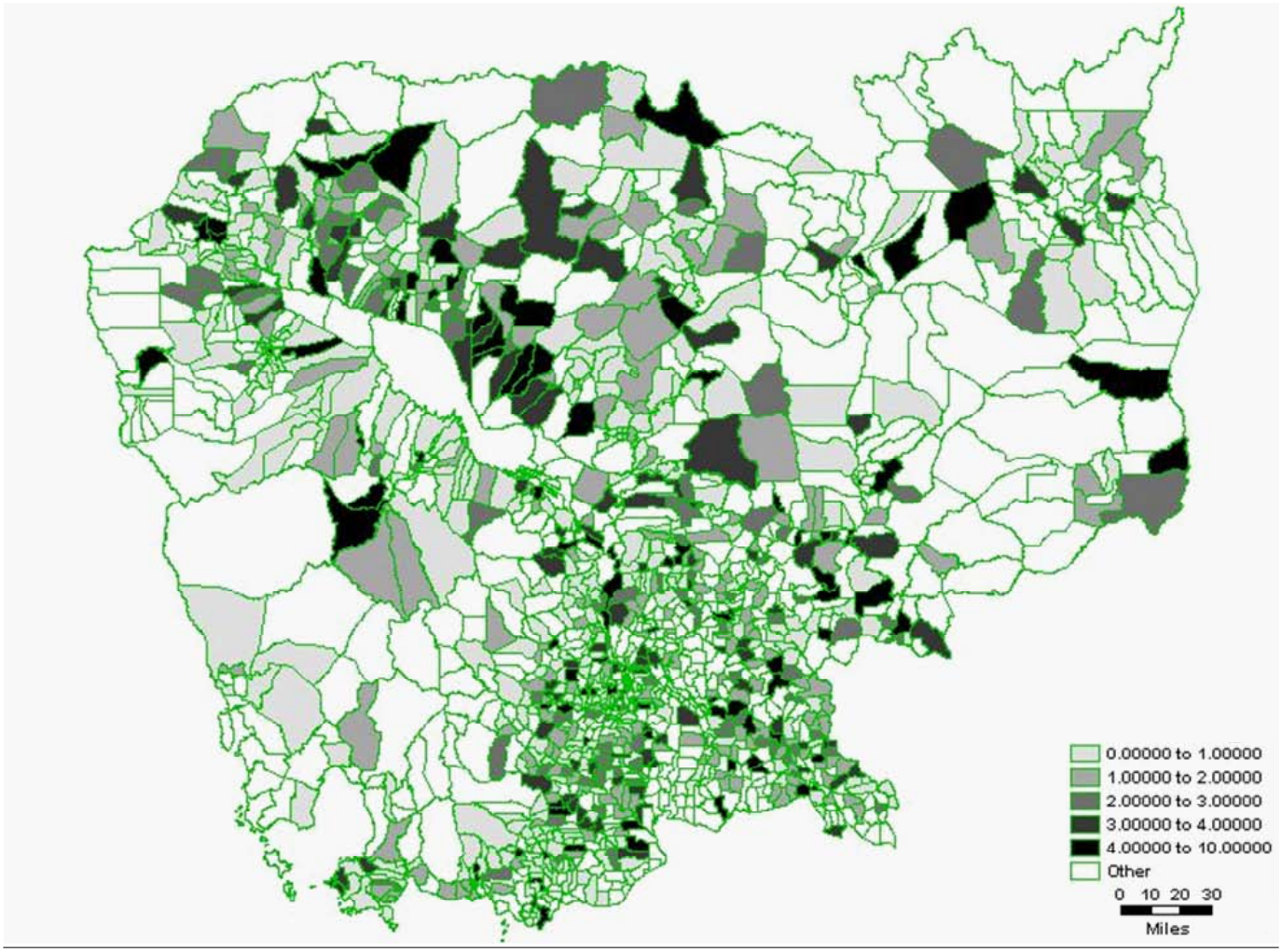
Figures H.1 to H.3 present illustrative maps of the geographical variation in BCRs for the main types of public expenditure, based on the commune database and using the principles described above.

Figure H.2. Illustrative Variation in BCR for Irrigation: 2007



Source: ???.
Note: White cells have incomplete data. Returns to irrigation are based on the figures in the Commune Database for the total area and actually cultivated area for the wet and dry season and for the actual yields achieved on irrigated land for the wet and dry season.

Figure H.3. Illustrative Variation in BCR for Rural Roads: 2007



Source: ???.
Note: White cells have incomplete data. National average unit costs for rehabilitation are applied to the figures in the Commune Database for the length of roads. The benefits are calculated for the improvement in road status that will be generated by rehabilitation, by the population served, the distance travelled and the level of production that will be marketed from the commune. No account has been taken of distance to laterite source, which would tend to favour communes in the West and North.

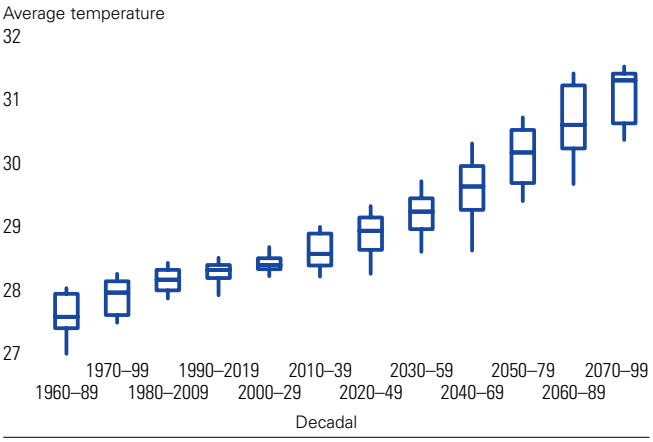
The figures above should be treated as illustrative. The preliminary indication from the figures suggests that there seems to be a relatively higher concentration of potential spatial benefits for extension expenditures in the Northwest (including Tonle Sap region. For irrigation, the spatial variation seems to suggest that the highest potential returns on irrigation expenditures comes from main rice growing areas in Northwest (Tonle Sap region) and Southwest (i.e. the "rice belt"). This result makes an intuitive sense as rice is a main focus of irrigation investments. For rural roads, the potential is again scattered across much of the country, reflecting the wide variation in circumstances, although the maps seem to support the assumption that returns to road investments are highest in areas of high agriculture potential and high population densities (with some outlying areas in Northeastern Cambodia). The maps suggest that, in view of the scattered range of circumstances, Government prioritisation should focus on establishing procedures that assess the returns to each individual intervention rather than on attempting to establish regional priorities.

ANNEX I: CLIMATE CHANGE AND PUBLIC EXPENDITURES

The Royal Government of Cambodia (RGC) is in the final stages of preparing the Second National Communication (SNC) to the UN Framework Convention on Climate Change (UNFCCC). The SNC includes a Vulnerability and Adaptation (V&A) Assessment. The Climate Change Department in the Ministry of Environment has conducted a substantial analysis of climate change projections as part of the preparation of the V&A for Cambodia. This has included compilation of past data and analysis using the PRECIS model and analysis of 14 Global Climate Models (GCMs) (Masutomi 2009). The results of this analysis are discussed in turn.

Average Temperatures. Historical trends show that temperatures in Cambodia have increased by about 1˚C since 1960 and will increase by at least 2˚C by the end of the century, based on the PRECIS extrapolations, as shown in Figure I.1. The PRECIS analysis has been verified against actual data and the correlation is strong, with an R2 of 0.85.

Figure I.1. Historical Trends in Cambodian Temperature: ^{O}C, 1960–99



Sources: V&A for Second National Communication, Climate Change Department and Dr Rizaldi Boer.
Note: Calculations based on use of the PRECIS model – see precis.metoffice.com

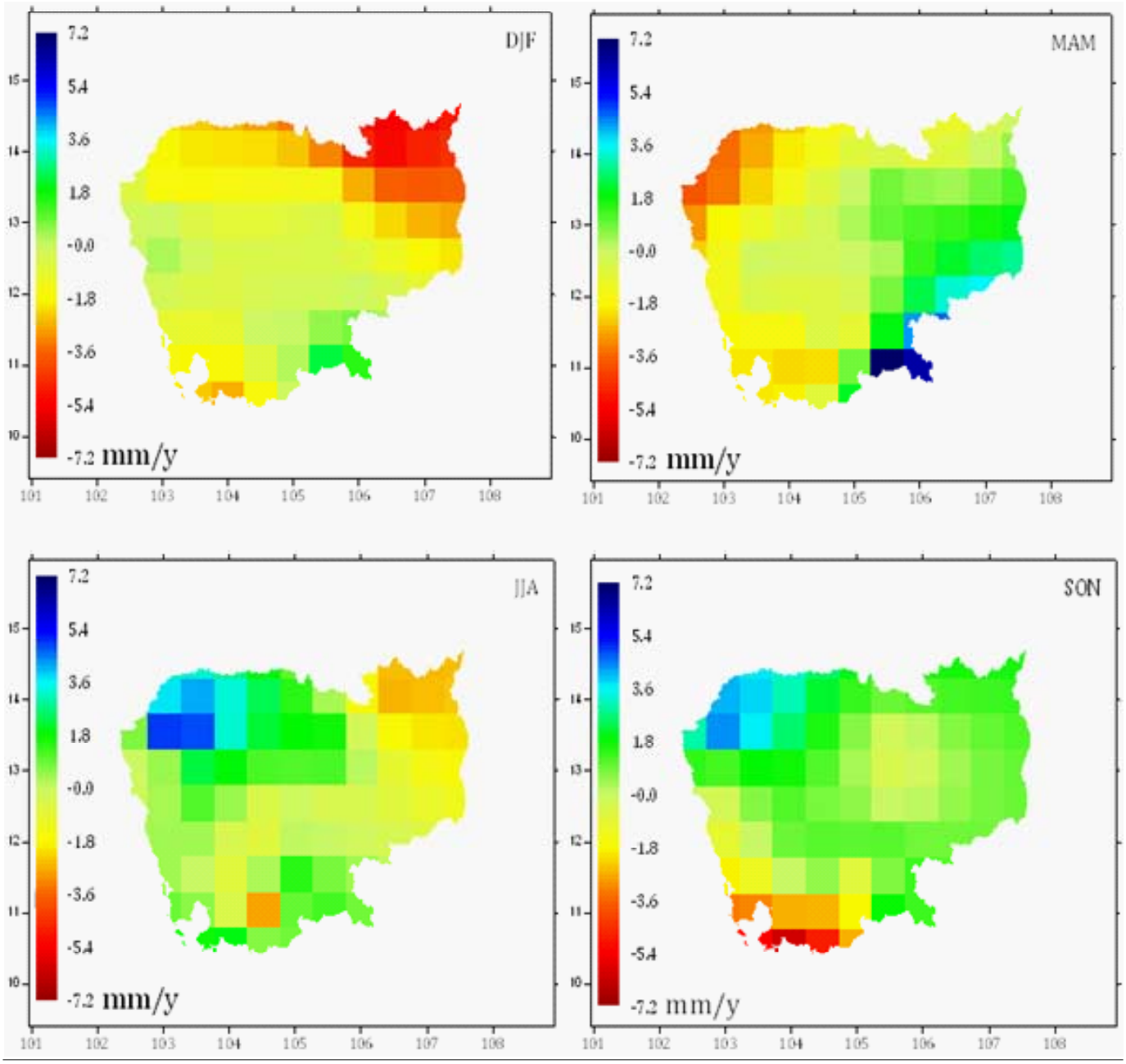
Total Rainfall. For rainfall, there is wide geographical variation in past trends and projections. Both the PRECIS and GCM analysis have been done on 100km grid squares. The results of the PRECIS analysis are presented in Figure I.2, which shows the dry season quarters in the top two maps and the wet season in the bottom two maps. For the dry season, rainfall has tended to decrease in most parts of the country, except for parts of the South and East. Reductions have typically been by about 2 mm/yr. In the wet season, there has been some tendency for rainfall to increase across most parts of the country, typically by 1 or 2 mm/yr, although parts of the Southwest have had a decline in rainfall in the later wet season.

The GCM projections have used a high emissions scenario (SRESA2) and low emissions scenario (SRESB1). The rainfall projections for each scenario are presented in Figures I.3 and I.4, showing the seasons across and the periods down the array. Red colouring indicates that most GCM models predict a decrease in rainfall and blue colouring indicates that most models predict an increase.

Key conclusions are:

- under the high emissions scenario, dry season rainfall will probably decrease and wet season rainfall increase in all periods;
- the probabilities of change for dry season are higher than for wet season;
- the wet season may start later; and
- with the low emissions scenario, trends are similar but with lower probabilities, except that wet season rainfall may decrease from 2050.

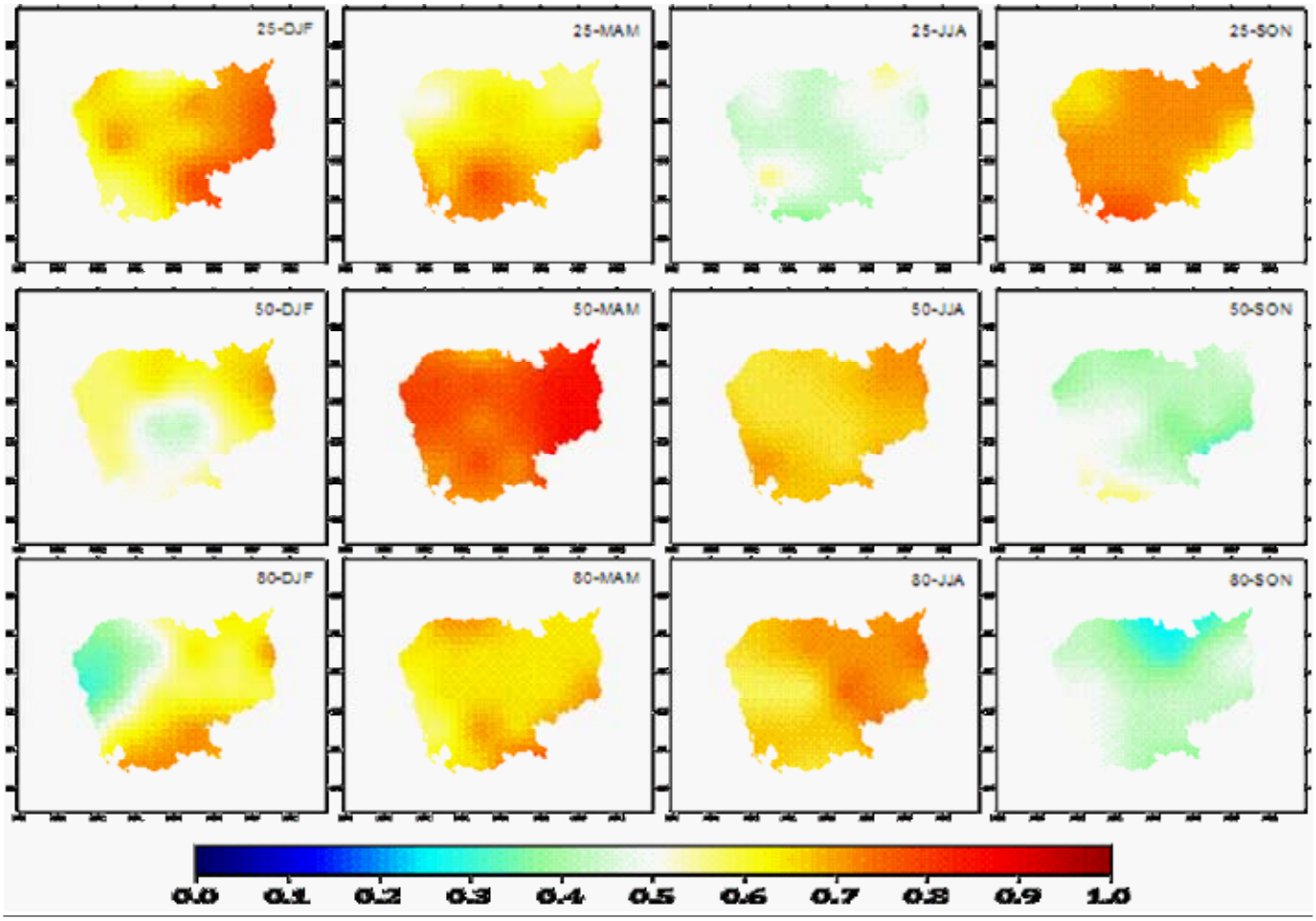
Figure I.2. Historical Trends in Rainfall for Different Quarters: mm, 1960–2000



Sources: V&A for Second National Communication, Climate Change Department and Dr Rizaldi Boer.
Note: Data are derived from the PRECIS model – see precis.metoffice.com. Each graph presents the average annual change in rainfall (in mm/yr) from 1960 to 2000 for one quarter. Clockwise from the top left, the quarters are Dec/Jan/Feb, Mar/Apr/May, Jun/Jul/Aug and Sep/Oct/Nov. The scale is presented on the left, with orange to red colours denoting reductions and green to blue denoting increase. The x and y axis are the geographic grid for the national map.

Figure I.3. GCM Rainfall, by Season – Low Emissions Scenario: mm/yr 2025/2050/2080

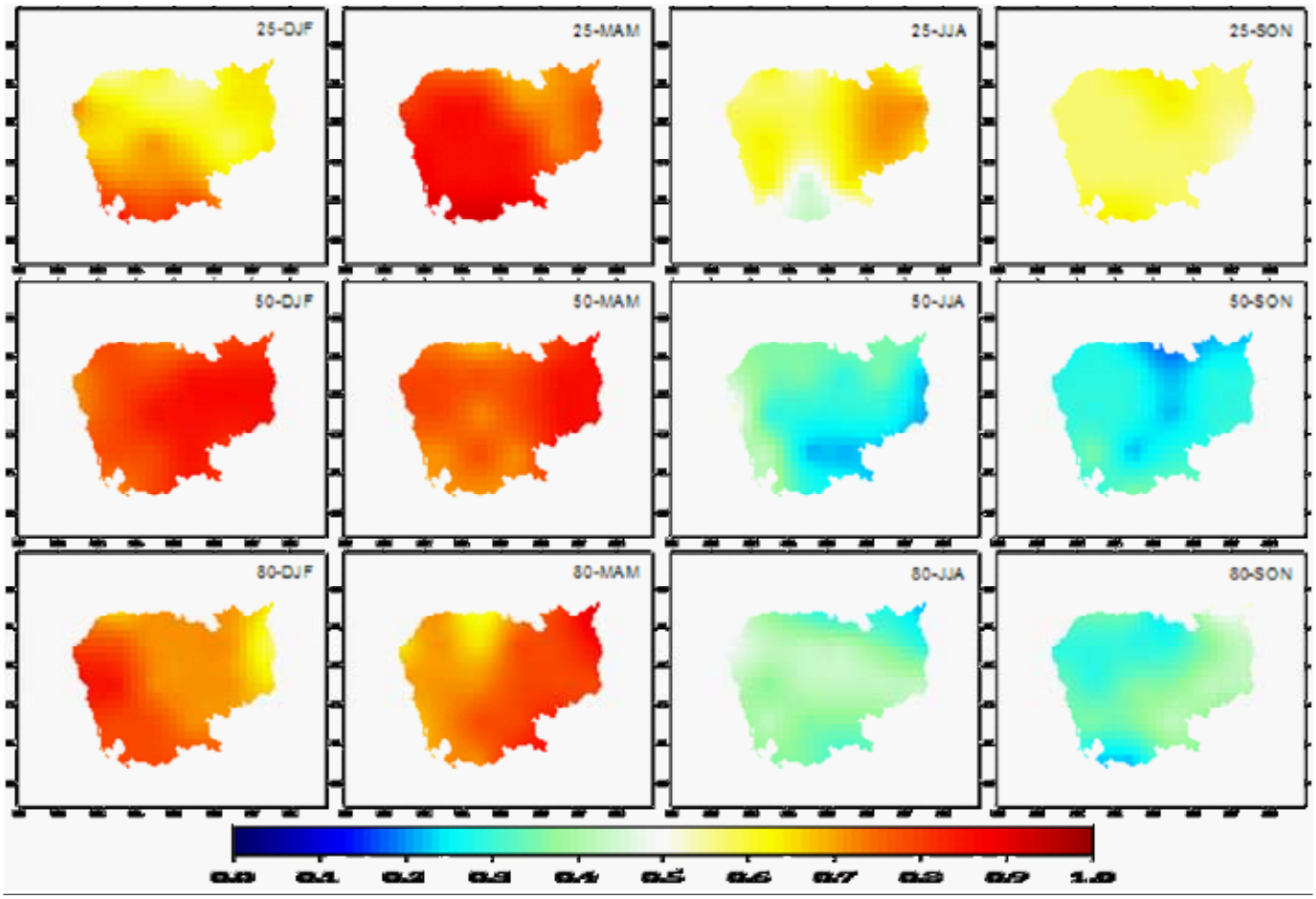
All models predict rainfall will decrease



Sources: V&A for Second National Communication, Climate Change Department and Dr Rizaldi Boer.
Note: Projections of average annual change in rainfall (mm/yr) derived from synthesis of 14 Global Climate Change Models. The top row presents projections for 2025, the middle row for 2050 and the bottom row for 2080. The first column is for Dec/Jan/Feb, the second for Mar/Apr/May, the third for Jun/Jul/Aug and the final column for Sep/Oct/Nov. Red colouring indicates that most GCM models predict a decrease in rainfall and blue colouring indicates that most models predict an increase.

Figure I.4. GCM Rainfall by season – High Emissions Scenario: mm/yr 2025/2050/2080

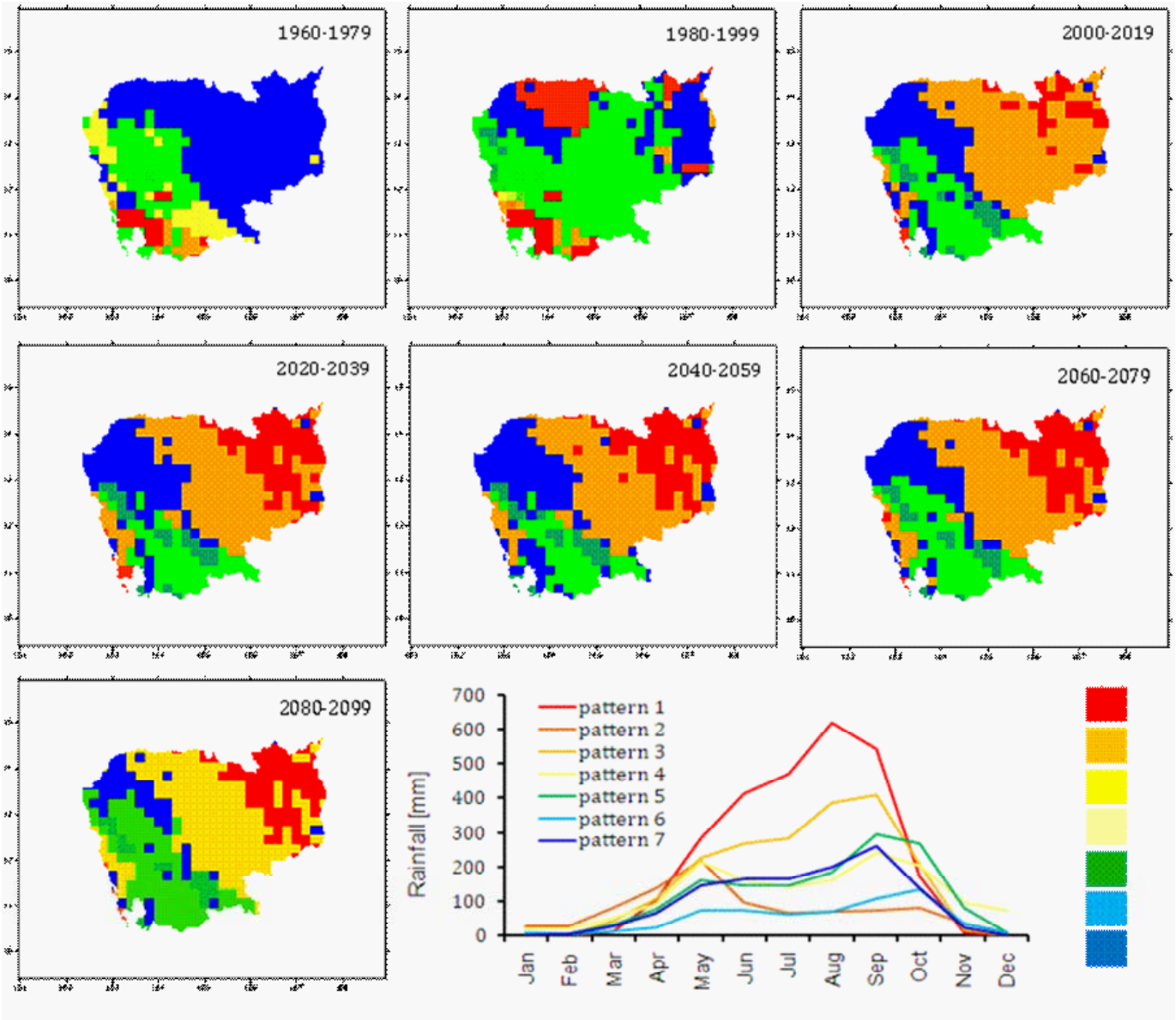
All models predict rainfall will decrease



Sources: V&A for Second National Communication, Climate Change Department and Dr Rizaldi Boer.
Note: Projections of average annual change in rainfall (mm/yr) derived from synthesis of 14 Global Climate Change Models. The top row presents projections for 2025, the middle row for 2050 and the bottom row for 2080. The first column is for Dec/Jan/Feb, the second for Mar/Apr/May, the third for Jun/Jul/Aug and the final column for Sep/Oct/Nov. Red colouring indicates that most GCM models predict a decrease in rainfall and blue colouring indicates that most models predict an increase.

Seasonality. The V&A analysis defines 7 rainfall patterns and considers how these have changed since 1960 and will change by 2099. Figure I.5 shows the projections for the high emissions scenario. The figure suggests that there will be a trend towards substantially heavier rainfall in the wet season in the Northeastern Cambodia, but with less change in the Western and Southern parts of the country.

Figure I.5. Changes in Seasonality of Rainfall: 1960–2099

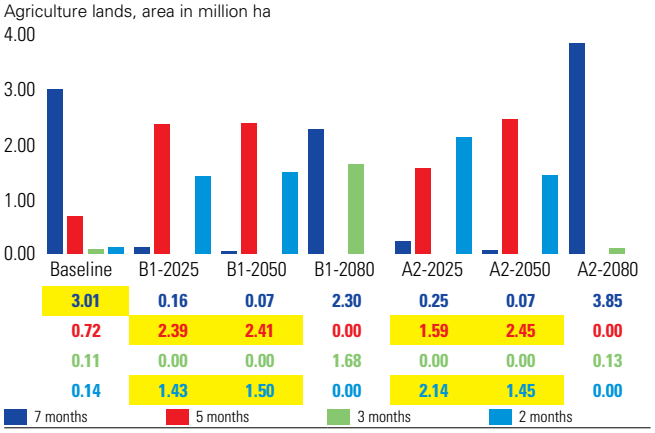


Sources: V&A for Second National Communication, Climate Change Department and Dr Rizaldi Boer.
Note: Each colour presents a different pattern, as described in the line charts, bottom right, which presents average monthly rainfall in mm for each pattern. Each graph presents the dominant patterns of seasonality.

The V&A analysis also includes some indication of seasonality of soil moisture balance, after taking into account the combined effects of rainfall and temperature. These suggest that the growing period (as determined by soil moisture) will shorten in 2025 and 2050, but will then lengthen, as shown in Figure I.6.

Flood and Drought Frequency. The V&A analysis does not consider trends in the frequency of drought and flood risk. However, estimates of this can be derived by combining an analysis of changes in the intensity of rainfall with the V&A analysis on changes in total rainfall. Estimates of rainfall intensity can be taken from Endo et al. (2009), who examined 50 years of historical data from SE Asia (see Figure I.7). The analysis suggests that south and east will have more floods and less droughts, whilst the opposite applies to the north and west.

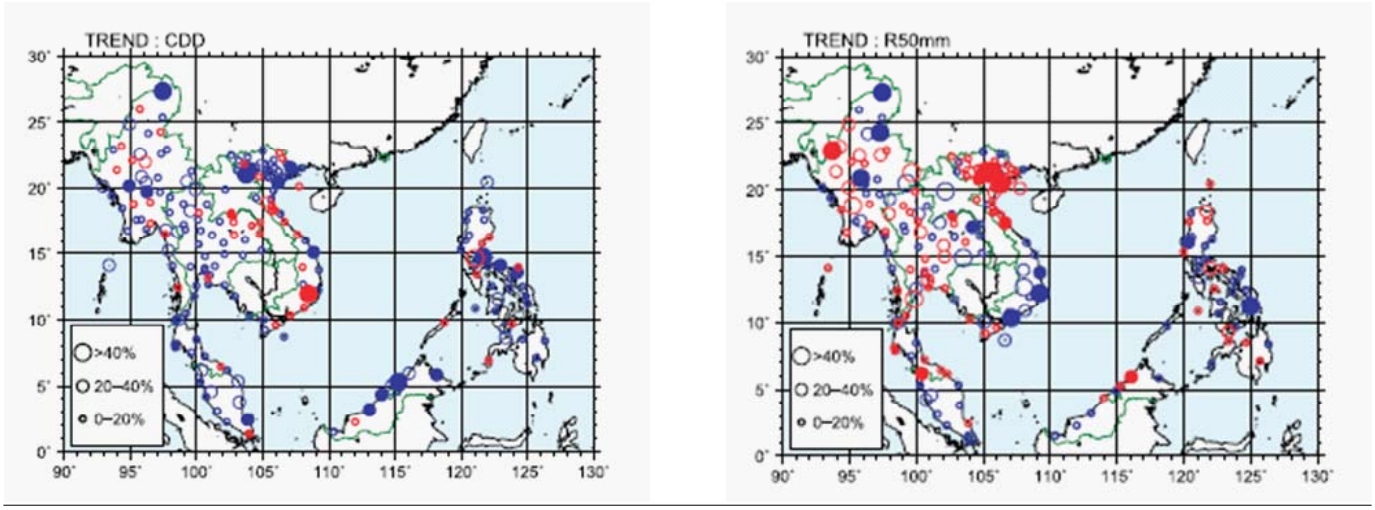
Figure I.6. Impact of Low and High Scenarios on Growing Season: season length in months 2025–80



Sourcea: V&A for Second National Communication, Climate Change Department and Dr Rizaldi Boer.
Note: The chart and data present the area of cultivated land that has growing seasons of the specified length. The chart above presents the data in the cells beneath, with the first (blue) column presenting the area that has a 7 month growing season, the second (red) column giving the area with 5 month growing season etc. The first column present the current (baseline) situation. The next three columns (labelled B1), present the B1 scenario for the three years concerned and the final three columns present the situation for the A2 scenario. Cells highlighted in yellow show the cells with largest areas.

Drought days are defined as days in the wet season when there has been no rain for at least 14 days. An analysis of past daily rainfall patterns at Pursat, going back to 1912, gives average annual rainfall of 1,332 mm, average rainy days per year of 106 and average number of drought days of 8. The analysis suggests that an increase of 1 drought day is caused by a reduction in annual rainfall of 40 mm and by having 5 fewer rainy days. Thus, if total wet season rainfall were to increase by 2mm per year, the frequency of drought would decrease by 12.5 percent (i.e. 1 drought day per year) after a period of 20 years.

Figure I.7. Trends in Heavy Rain Days (left) and Consecutive Dry Days (right): confidence in direction of change, 1912–2008



Source: Endo et al 2009.
Note: The left graph presents historical trends in rainfall concentration, measured as the number of days with more than 50mm rain. The right graph presents historical trends in drought, measured as the number of consecutive dry days. Blue dots present an increase and red dots present a decrease. The size of the dot is proportional to the percentage change over the period mean. Solid dots are significant at the 5% level.

Impact on agricultural productivity. The V&A uses historical climate and rice production statistics to estimate that every additional 10 mm of wet season total rainfall adds 6,500 tons (or about 0.1 percent) to rice production. This is used to calibrate the Decision Support System for Agro-technology Transfer (DSSAT) model so that the impact of changes in rainfall can be simulated. The analysis was undertaken in 9 rice growing areas, where the required

soil information was available. With total rainfall increasing by between 1 and 2 mm/year in the South and East, production in these areas may increase by 1 percent over 50 years as a result of the increasing rainfall pattern. In the North, rainfall may decrease by a similar amount, resulting in an equivalent reduction. The net effect of total rainfall changes on rice production is therefore likely to be small.

The impact of changes in flood and drought frequency may be more important than changes in total rainfall, in view of the opportunities for public expenditure to support the development of new varieties and increased water storage to deal with this increased variability. The analysis of flood and drought days suggests that, over 50 years, drought days may decrease by about 25 percent in the South of the country, with the opposite trends in the North.

Losses from drought and flood vary greatly, but have been about 5.5 percent of total production over the last decade, equivalent to about 400,000 tons per year, with a total value of about $80 million. If losses were proportional to the number of drought and flood days, then this could increase by 25 percent, or $20 million over the next 25 years. Reducing these losses already provides opportunities for public expenditure and these opportunities will be increased as a result of the increased frequency of flood and drought events.

The PRECIS analysis for the V&A also allows an exploration of the changes in seasonality of rainfall. The analysis suggests that there will be changes in the start and duration of the wet season. Because temperatures are sufficiently high at the end of the wet season to allow most crops to mature, there would be limited impact on crop production if the wet season started and finished later, especially if light-insensitive varieties are used. Therefore, the main effects of seasonality are the loss of production that would occur if the wet season became shorter. The V&A analysis suggests that wet seasons could shorten by at least a month in many regions, although this effect could be reversed after 2050 in the low emissions scenario.

In most crop growing regions, the wet season will still be sufficiently long to allow for one rice crop to be grown, especially if short maturing varieties are used. Thus, the main loss of production would come from the inability to double crop. In 2007, late wet season rice was grown on over 500,000 ha, or about 25 percent of total rice area with total value of $200 million. Much of this would be under threat from a shortened growing season. In addition, a large part of the vegetable crop is grown as a second wet season crop and this would also be greatly affected by a reduced wet season. There are therefore strong benefits to be gained by breeding and extension for shorter growing varieties and for investment in water storage that will allow crops to mature beyond the end of the rainy season.

Implications for public expenditures. In theory, the production changes due to climate change are marginal. There are substantial additional benefits to be gained from production of new crop varieties that are adapted to new climate conditions. The order of magnitude of these benefits can be illustrated by considering the implications of crop varieties that are able to withstand an additional week of dry period during the growing season. If varieties could be developed that were able to survive one additional day of drought or flood, they would reduce average losses from drought from about 5.5 percent to about 5.0 percent of total production, which would be worth a total of about $8 million if all farmers were able to benefit from the seeds. Given the current unit cost of varietal development of about $1 million, the BCRs for improving the drought and flood resilience are high, provided that widespread adoption takes place.

In practice, much of the benefits of improved drought and flood resilience will come from a gradual diffusion of adoption. However, the extension services can accelerate this process. They can also generate substantial additional benefits associated with helping farmers adapt to climate change, especially through changes in cultivation practices and cropping choices.

Returns to irrigation are also likely to increase as a result of the increased importance of storing water to protect against increased drought and flood frequency and a shortened wet season growing period. If irrigation water were used to ensure the survival of a crop during a shortened rainy season the benefits from that irrigation water would be about twice the benefits gained from standard wet season supplementary irrigation.

The marginal increase in frequency of flood events will increase the frequency of major repairs and the importance of designing rural roads to survive floods, which may add some additional costs to rural road rehabilitation. However, the effects of these factors on the overall benefits of rural roads will be small, compared to the effects on research, extension and irrigation.

Current climate change priorities. Current priorities for climate change activities are defined in the NAPA and will soon be further elaborated for the Pilot Program for Climate Resilience (PPCR). Table I.1 lists the priority projects defined in the NAPA and shows that 7 of the 16 non-health priorities are associated with investments in agricultural water management. This is consistent with the analysis in this chapter, which stresses the importance of irrigation in preparing for climate change. The NAPA priorities give less weight to extension, although priority 3f, on Integrated Farming, does address extension needs in a pilot manner. There is no recognition of the potential importance of research to produce new varieties that are more drought and flood resilient, whilst also being short duration. Projects of this type are included in NAPAs in other countries and this appears to be a gap in the Cambodian NAPA.

Table I.1. NAPA Priorities

1a	Rehabilitation of Multiple Use Reservoir in Takeo
1b	Rehabilitation of Multiple Use Dams in Takeo and Kampong Speu
1c	Community and Household Water Supply in Coastal Provinces
2a	Flood Protection Dykes
2b	Rehabilitation of Upper Mekong and Provincial Waterways
2c	Rehabilitation of Multiple Use Canals in Kampot
3a	Vegetation Planting for Flood and Windstorm Protection
3b	Strengthening Community Disaster Preparedness
3c	Water Gates and Culverts Construction
3d	Safe Water Supply for Rural Communities
3e	Small Scale Aquaculture Ponds
3f	Household Integrated Farming
3g	Rehabilitation of Coastal Protection Infrastructure
4a	Community Irrigation Systems
4b	Community Mangrove Restoration and Sustainable NRM
4c	Community-Based Soil Conservation in Koh Kong
	Plus 4 health projects related to biopesticides, health centres and malaria

Source: NAPA.

Current expenditure patterns are determined by a complex political and economic process. This process is driven by a range of objectives, including the reduction of poverty and promotion of growth. Adaptation to climate change will require some adjustment of expenditure allocation, but the proportion of expenditure that needs to be switched to activities that promote adaptation depends on national circumstances.

In a country like Cambodia, where the pattern of climate change is both more mixed and more uncertain than in some countries, it is common to argue that expenditure priorities should go to 'low regret' options that combine standard national goals with adaptation, thus leading to low regrets if climate change projections will not materialize as projected. The low regret policy recognises the possibility that adjustments in favour of climate change expenditure could be too great.

To date, climate change activities have focused on the definition of specific projects under the NAPA and the PPCR, rather than on potential adjustments in expenditure patterns. Realignment of capital expenditure can be achieved through dedicated financing of projects that have some climate change motivation. Donor funding procedures are already in place to ensure that part of donor funding is sensitive to climate change needs. Government financed development expenditure is driven by strong political and economic concerns. These are focused on importance of immediate economic growth, as a means of generating the resources that could be used for more sustainable

environmental management in the future. These priorities include a relatively high importance for irrigation, which will be consistent with climate change adaptation. The low priority assigned to research and extension, however, is not consistent.

The budget processes for recurrent spending also need to take into account the implications of climate change. In particular, climate change will increase the importance of funding routine research and extension activities and irrigation maintenance.

The PER analysis provides some guidelines on the target performance that NAPA activities should be expected to achieve. In particular, it suggests that activities associated with research and extension should be able to achieve BCRs of over 3.0. Those involved in irrigation should achieve BCRs of similar levels, especially when they are focused on providing protection from possible crop losses as a result of an early end to the wet season. Rural roads are largely unaffected by climate change and do not feature in NAPA proposals.

ANNEX J: A PROPOSED OUTLINE FOR A POSSIBLE APPROACH TOWARDS DEVELOPING AGRICULTURE SECTOR SWAP

Sector Wide Approaches (SWAps) have been used in a number of countries as a way of providing greater Government ownership, strengthening policy dialogue between donors and the Government, with resulting changes in policy environment, improving coordination within the donor community, thereby reducing transaction costs, and ensuring better continuity of funding.

Full SWAps involve donors providing funds, alongside Government funding, for a whole sector, against a coherent and agreed policy framework, and a set of common implementation arrangements. In order to maximise local ownership, funds are ideally channelled through the Government budget, relying on Government procedures for expenditure approval and reporting. SWAps are normally implemented against a costed work program, including targets and performance indicators and donors often base some disbursements on achievement of key targets or milestones in the work program.

Internationally, the SWAp modality has worked quite well in social sectors (i.e. health and education), including Cambodia, where the public services provided tend to be relatively homogeneous (and pure public goods) and largely under Government control.

The Cambodian experience of the education sector SWAp has revealed two important lessons. First, effective, coherent and agreed policy and strategy framework can provide the instrument for Government and donors to work more effectively together. Secondly, the donor community is still concerned with fiduciary risk and is not ready at this stage to move to a full SWAp with resources being channelled and managed entirely through the Government budget system. In the education sector SWAp, only one donor, the EU, has engaged in providing sector budget support as part of its engagement in the SWAp, and the majority of resources continue to be channelled through parallel arrangements including a basket fund.

SWAps tend to work less well in agriculture, which is private sector by its nature and involves a large heterogeneity in its functionality, which put it often outside Government and donor control (i.e. relationship between public expenditures and sector growth rates). The institutional framework is more complicated, with value chain functions (production, input supply, distribution and trade), which is being carried out by the private sector. In this case, the private sector is more critical than the public sector in terms of the overall functioning of the sector.

All the signs are that a full SWAp, including the use of Government financial management arrangements, is unlikely to be possible in any sector in Cambodia until the general improvements in PFM reforms, including reporting and accounting procedures that allow departmental spending to be properly monitored, are more deeply embedded. Whilst PFM reform procedures are leading to improvements, there is still a long way to go before donors can be persuaded to have their resources fully managed through Government systems.

In the case of agriculture and irrigation, it would also be unrealistic to expect a SWAp to be put in place in the foreseeable future. However, some of the benefits of SWAps could be achieved through developing a partial SWAp in one or more priority functional areas, especially in ones which are more public goods in their nature. These could be supported by a Joint Fund (sometimes known as a pool or basket fund), financed by willing donors, and managed

Table J.1. An Outline of a Possible Partial SWAp for Agricultural Research and Extension, and Irrigation

	Research and Extension	Irrigation Efficiency
Wider Objectives	• farmer adoption of improved farming practices	• increased area of irrigation
Specific Objectives	• improve consistency and effectiveness of national extension service • improve continuity and effectiveness of research • integration of research & extension	• improve the share of irrigation expenditure being spent on secondary and tertiary rehabilitation and on maintenance
Funding	• $1mn in Y1, rising to $2mn/year from Y2, if government funding increases • additional $0.5mn/year for TA pool	• $2mn in Y1 rising by $2mn each year
Period	• 5 years extendable	• 5 years extendable
Milestones		
Y1 and all years	• a comprehensive and coherent medium term policy and strategic plan for research and exten¬sion is jointly agreed by Government and DPs • work programs and costed annual operational plans for CARDI, Department of Extension and other technical support departments including activities, targets and indicators put in place • MOU signed by partners to govern systems and procedures for joint planning, management, monitoring and review, and budgeting for the work programs and plans • targets for farmers contacted & adopted • targets for new crop varieties developed • progress reports on activities & targets • end-of-year joint review	• a comprehensive and coherent medium term policy and strategic plan for irrigation maintenance is jointly agreed by Government and DPs • work programs and costed annual operational plans listing schemes, target areas, targets and indicators, outline IRRs, FWUC status, and costs • MOU signed by partners to govern systems and procedures for joint planning, management, monitoring and review, and budgeting for the work programs and plans • progress report on actual area irrigated, ex-post IRRs and FWUC status • schemes entered in CISIS • end-of-year joint review
Year 2	• national extension approach • supply of foundation seed up 10% and improved seed up 25% • end-of-year joint review	• study of remote sensing data on actual irrigated area • end-of-year joint review
Year 3	• reduce unit costs by 5% • supply of foundation seed up 10% and improved seed up 25% • end-of-year joint review	• share of total spending on secondary and tertiary rehabilitation up 10% • share on maintenance up 5% • end-of-year joint review
Year 4	• 10% reduction in donor funding share • end-of-year joint review	• 10% reduction in donor funding, with half the balance taken up by FWUCs • end-of-year joint review
Year 5	• 10% reduction in donor funding share • end-of-year joint review	• 10% reduction in donor funding, with half the balance taken up by FWUCs • end-of-year joint review
Risks	• dependency on donor funding • inability to sustain incentives • competition between departments	• dependency on donors for secondary & tertiary irrigation and maintenance

Source: ???.

jointly by Government and development partners, which would allow for a joint Government/donor funding release mechanism, but would allow donors to retain some control of financial approval, reporting and review.

A partial SWAp supported by a Joint Fund should provide many of the benefits of ownership, coordination and continuity that are provided by a SWAp, and would help prepare for the possibility of a full SWAp later. At present, sectors where a partial SWAp could be appropriate and feasible are research and extension, and perhaps also irrigation (from the point of improved efficiency of public spending). This PER shows that agricultural extension has been already heavily supported by the donor community in recent years, and there may be a scope for improved efficiency from better coordination of donor spending, as well as coordination of work between Government extension services and donor funded projects.

The objectives and activities of the partial SWAp should be guided by the SAW. Table J.1 provides an outline of the key features for a potential partial SWAp operation in the areas of research and extension and irrigation efficiency. The details of the design of a partial agriculture sector SWAp, would need to be worked out through a dedicated exercise. The context for a SWAp is currently quite complex as the PFM reforms move forward, at a deliberate but rather slow pace. It would be thus important to fully understand the shape, pace and progress of PFM reforms (particularly for policy and budget planning, program budgeting and the use of BSPs, procurement, financial reporting, monitoring and audit) which would impinge on the design of a SWAp activity.