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Indonesia Agriculture Public Expenditure Review 2010

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Acknowledgment

Acronyms

AAHRD	Agency for Agricultural Human Resources and Development of MoA
ACIAR	Australian Centre for International Agricultural Research
ADB	Asian Development Bank
ADII	Agriculture, Development, and Innovation Index
AgGDP	Agricultural Gross Domestic Product
AIAT/BPTP	Assessment Institutes for Agricultural Technology or *Balai Pengkagian Teknologi Pertanian*
AMFR	Agency for Marine and Fisheries Research of the Ministry of Marine Affairs and Fisheries
APBN	State Budget (*Anggaran Pendapatan Belanja Negara*)
APER	Agriculture Public Expenditure Review
Bakor PPK	Fishery and Foresty Extension Coordination Agency
Bappenas	National Development Planning Agency (*Badan Perencanaan Pembangunan Nasional)*
BOP	Operational Expenses (*Belanja Operasional Pegawai*)
BPS	Central Bureau of Statistics (*Badan Pusat Statistik*)
BSc	Bachelor of Science degree
CGIAR	Consultative Group for International Agricultural Research
CIFOR	Center for International Forestry Research of CGIAR
DAK	Special Allocation Fund *(Dana Alokasi Khusus)*
DG	Directorate General
DPR	Parliament/House of Representatives (*Dewan Perwakilan Rakyat*)
DPRD	Regional Parliament
FAO	Food and Agriculture Organization
FAOSTAT	FAO Statistical Database
FEATI	Farmer Empowerment through Agricultural Technology and Information
FORDA	Forestry Research and Development Agency of the Ministry of Forestry
GDP	Gross domestic product
GMM	Generalized Method of Moments
GoI	Government of Indonesia
HET	Regulated Urea Price
IAARD	Indonesian Agency for Agricultural Research and Development of the Ministry of Agriculture
IARC	International Agricultural Research Center
ICAR	Indian Council for Agricultural Research
Inpres	Presidential Instruction (*Instruksi Presiden*)
IPB	Bogor Agricultural University (*Institut Pertanian Bogor)*
IPTTMO	Intellectual Property and Technology Transfer Management Office
Keppres	Presidential Decree (*Keputusan Presiden*)
M&E	Monitoring and evaluation

MoA	Ministry of Agriculture
MoF	Ministry of Finance (*Departemen Keuangan*)
MoFo	Ministry of Forestry
MoNE	Ministry of National Education (*Departemen Pendidikan Nasional*)
MoMAF	Ministry of Marine Affairs and Fisheries
MoPW	Ministry of Public Works
MSc	Master of Science degree
NAARM	National Academy of Agricultural Research Management
NCAED	National Center for Agricultural Extension and Development
O&M	Operations and Maintenance
OLS	Ordinary Least Squares
PhD	Doctor of Philosophy degree
PNS	Civil Servant (*Pegawai Negeri Sipil*)
R&D	Research and Development
RISTEK	State Ministry of Research and Technology
RKA-KL	Ministry Work Plan and Budget (*Rencana Kerja dan Aggaran Kementrian/ Lembaga*)
Rp	Indonesian Rupiah
RPJM	Medium-Term Development Plan (*Rencana Pembangunan Jangka Menengah*)
WISMP	Water Resources and Irrigation Sector Management Program
WUA	Water Users Association
WUAF	Water User Association Federation

Executive Summary

The agriculture sector has been and will continue to be key for poverty alleviation efforts in Indonesia

Farming continues to provide a livelihood for a large share of Indonesia's poor. Indonesia has a solid record in poverty reduction and its success in reducing poverty from around 40 percent to only 11 percent from 1976 to 1996 was, to great extent, the result of large increases in agriculture productivity. Agriculture continues to provide a livelihood to approximately 40 percent of Indonesia's population, and improvements in agriculture productivity and diversification towards higher-value-added commodities are likely to have a significant impact on the income of the poor.

Agriculture in Indonesia is highly labor intensive, making little use of capital investments, reflecting the relative factor endowments of the country. Growth that is labor intensive will continue to create employment for a large share of the workforce but it is unlikely to result in significant increases in per capita income for agriculture workers. Farmers' welfare will largely depend on raising incomes in rural areas and this will ultimately require creating greater value-added. Investment in agriculture needs to focus on increasng agricultural growth through greater productivity by deepening capital investment and moving towards higher value-added commodities, rather than through an input-driven approach.

Indonesia was very successful in increasing agriculture productivity during the 1970s and up to the early 1990s, but productivity stagnated during most of the 1990s, partly as a result of declining public investments

Agriculture productivity increased through the 1970s and up to the early 1990s, primarily as a result of public investment in public goods, but productivity increases have slowed since the early 1990s. During the years of the Green Revolution, Indonesia invested heavily in its irrigation network, research and development (R&D), extension services, and rural infrastructure, as well as subsidized private agricultural inputs (fertilizer, seeds, credit, etc.). Agriculture total factor productivity increased by 2.35 from 1968 to early 1990s. By the early 1990s, Indonesia had achieved high yields across several commodities, including rice and cereals. Unfortunately, during the 1990s, the upward trend in productivity slowed, exacerbated by declining levels of private and public investment, and total factor productivity declined by 0.58 annually from 1993 to 2001.

Recent efforts to support agricultural production have resulted in increased output in a number of commodities. Production of food crops for domestic consumption, in particular rice, has increased in recent years, and Indonesia achieved self-sufficiency in rice in 2008. Preliminary analysis suggests that this stemmed from increased cropping intensity on existing farmland, a result of improved irrigation management and favorable weather conditions coupled with significant government support in the form of input subsidies, rather than an increase in productivity. Certain crops with significant private sector participation such as horticulture and estate crops are showing large productivity increases.

Public spending on agriculture has increased significantly in the last decade, but a large share of that spending has been allocated to subsidizing private inputs

Public spending on agriculture experienced a significant increase in recent years. The share of spending going to agriculture doubled from 2.7 percent in 2001 to 5.6 percent in 2009. Over the past decade, public spending for agriculture increased considerably relative to agricultural GDP. The share of agriculture spending over agricultural GDP increased from 7 percent in 2001 to 34 percent in 2009, indicating that the increase in spending did not result in a significant increase in agricultural production.

Almost 50 percent of public spending for agriculture was executed at the subnational level by 2009. In 2001, 68 percent of spending on agriculture (excluding subsidies) was executed by the central government. In 2009, the central government was responsible for only 51 percent. The special allocation fund (DAK), some of which is earmarked for agriculture and irrigation, has provided greater resources to sub-national governments, particularly after 2006. Districts play an increasingly important role in the delivery of public goods and services. Analysis at a broader level shows how sub-national governments spend a significant share of the increased fiscal resources on government administration, which has become their main priority, constraining their ability to provide good quality public services.

Reflecting stated Government of Indonesia priorities, programs which seek to increase food crop production have received the largest budgetary allocation. The MoA's goals are to (i) increase food security; (ii) enhance competitiveness and the value added of agriculture products; and (iii) improve farmers' welfare. In the Ministry of Agriculture, units that support food security programs have received significant budgetary allocations, such as the DG of Food Crops and DG of Food Security Agency. This focus often comes at the expense of support for other higher-value products, as shown in the decreasing share in the budget of DG of Horticulture (from 6 percent in 2003 to 3 percent in 2009) or the Quarantine Agency (from 8 percent in 2003 to less than 5 percent in 2009). Reallocating resources to units that provide support for commercial agriculture would support farmers in becoming competitive in crops with greater value added and more growth potential.

The Ministry of Agriculture is executing a large share of its budget by providing direct grants to farmers and farmers' groups under an array of projects. Since 2007, the MoA has allocated nearly 40 percent of its budget in the form of cash transfers to farmers and farmers' groups, classified as 'social aid' (Bantuan Langsung Masyarakat/ BANSOS). Social aid is partly being used to provide community public goods, e.g. warehouse and agriculture terminal infrastructure, but in some years almost 100 percent of the funds are financing private inputs. While these cash transfers support farmers, this also means that a large share of the MoA's budget cannot be used for the provision of public goods and services. To the extent that the provision of private inputs have a lower impact on productivity, social aid is unlikely to have a significant impact on productivity.

The Ministry of Agriculture needs to have in place a comprehensive information management systems that will not only enable it to evaluate the impact of its transfer programs on productivity and farmers' welfare but also to monitor the composition of District expenditures on agriculture. A strong M&E system would allow for identification of design faults and find ways to address these faults in further implementation thereby maximizing effectiveness in bringing about the necessary increases in agriculture productivity, as well as alleviating poverty in rural areas. This capacity would also be essential if it is going to operate a matching grant program on the basis of Districts having explicit written and monitorable plans for different agricultural expenditure areas, into which central matching grants could be placed.

The impact of public spending on productivity can be positive, but that depends on the composition of spending. While public goods and services will have a positive impact on growth, subsidizing private inputs is unlikely to have much of an impact

While the evidence on the impact of public spending on growth is mixed, there is growing evidence that public expenditure can impact development. Public spending focused on areas in which there are market failures and public good externalities has a highly positive rate of return and yields benefits that substantially outweigh the costs. In contrast, poorly implemented efforts in activities that are better suited to private activities can be counter-productive. Empirical studies suggest that the relationship between spending and growth is like an inverse U-shape. Accordingly, public spending may drive growth, after controlling for negative financing effects, up to a certain point above which additional spending may constrain growth because of the additional (and likely distortionary) financing needs. The composition of public spending can trigger a complementary effect by stimulating private spending but it can also crowd out private spending, either by reducing incentives for the private sector or by triggering public deficits and accumulated public debt in need of financing.

There is increasing evidence that the relationship between public spending and growth in agriculture is also positive. Both the volume and the composition of spending matter. Assuming a fixed amount of spending in the agriculture sector, a high share of spending on subsidies to private inputs has a negative impact on agricultural growth given the corresponding lower spending on the provision of public goods, emphasizing the concept of opportunity costs of subsidies. Although increased usage of a particular input may have a positive impact on production (e.g. fertilizer on rice production), the impact of subsidizing such inputs is often negative because it is done at the expense of providing public goods and services with a larger positive impact on production. Reallocating spending from subsidizing private inputs to providing public goods and services would have a positive impact on productivity.

The increase in public spending in the agriculture sector in Indonesia has been largely driven by an increase in spending on subsidies, therefore having a limited impact on productivity. During 2001-09, national public spending on agriculture increased from Rp 11.0 trillion to Rp 61.5 trillion, an average annual increase of 12 percent in real terms. Over the same period, the allocation of agricultural subsidies grew from 30 to 56 percent of the total budget for agriculture. Subsidies amounted to over Rp 34 trillion, which was more than four times the budget for the MoA in 2009, at Rp 8 trillion. By the end of 2009 the allocation for agriculture subsidies was four and a half times its 2001 level, while resources for the provision of public goods and services increased much less. Investments in rural roads, irrigation, extension services or research are the main drivers of agriculture productivity. Indonesia can improve the effectiveness of public spending significantly by shifting the composition of spending towards the provision of public goods and services, and away from the subsidization of private goods.

The impact of providing public goods and services on agriculture growth has been positive, while the impact of subsidies has been negative. A model estimating the relationship between public spending and growth in the agriculture sector in Indonesia finds a positive relationship between spending for public goods and growth. Spending on fertilizer subsidies, on the contrary, appears to have a negative effect. Not surprisingly, the impact of total agriculture spending on agriculture GDP per capita growth is unclear, given the opposing direction of the effects from its two components: spending on public goods vs. fertilizer subsidies. Given the opportunity cost of financing subsidies further at the expense of other agriculture spending and irrigation, which directly contribute to growth, the government should consider reallocating spending from fertilizer subsidies to public goods such as agriculture extension services, R&D and irrigation, which could lead to faster sector growth. Based on these findings, the large increase in the agriculture budget, to a large extent allocated for subsidies and transfers to farmers and farmers' groups, is likely to have a limited impact on growth in the sector.

Reforms to the existing subsidies systems can be combined with continued assistance to poor farmers, while the freed up resources could be used to provide improved public goods and services

Fertilizer subsidies in Indonesia are highly regressive, with 60 percent of the subsidies benefiting the 40 percent largest farmers. A benefit incidence analysis of fertilizer subsidies in Indonesia suggests that most farmers benefit from fertilizer subsidies. However, the 40 percent of the largest farmers capture up to 60 percent of the subsidy. Fertilizer shortages also mean that very few farmers (fewer than 10 percent in 2007) paid the price as stipulated by the MoA. The impact of the fertilizer subsidies is regressive because those rice farmers with larger paddies and/or higher revenues received greater allocations of public resources. There is no targeting of the subsidy, and as the government increased spending on fertilizer subsidies, a larger number of farmers benefited. In 2007, 96 percent of all rice farmers were paying below market prices for their fertilizer.

Reforms to the fertilizer subsidies system could yield significant fiscal savings, which can be used to continue providing support to poor farmers. The fertilizer subsidy is achieving an increase in fertilizer usage and rice yields, but it is doing so at a very high cost. Reforming the current system of subsidizing fertilizer could yield significant fiscal savings. One option would be to better target subsidies. In 2008, the Government of Indonesia would have saved over Rp 9 trillion by targeting the fertilizer subsidies to the smallest 60 percent of farmers. Another option would be to eliminate the subsidy and compensate poor farmers for higher fertilizer prices through cash grants to address credit constraints that farmers may face. This would minimize price distortions and allow farmers to use the optimum combination of inputs. Fiscal savings from the removal of the subsidy would be more than enough to

finance a cash transfer program to compensate poor farmers for increased fertilizer prices and to improve the delivery of public goods and services. An array of options exists for using newly freed resources, such as investments in agricultural R&D, extension services, and irrigation.

A reallocation of spending should be combined with renewed efforts to improve the efficiency through which key services are provided, in particular in the areas of R&D, extension services and irrigation

Research and Development

Although Indonesia has significantly increased public spending on agricultural R&D between 2001 and 2007, the level of spending is still low compared with other Asian countries. In real terms, Indonesia's public spending on agricultural R&D increased between 2001 and 2007, however, public spending on agricultural R&D in Indonesia was only 0.22 percent of the agriculture output in 2003. This was at a similar level to Laos (0.24 percent), while much lower than Malaysia (1.92 percent) and the Philippines (0.46 percent). Countries that are strong suppliers of quality agriculture research, such as Brazil and India, invested substantially more, with ratios above 1.5 percent. Besides innovation, the R&D sector can also seek to improve productivity through the adaptation and adoption of new technologies from other countries. Thus besides improved spending patterns, the quality of R&D can be further enhanced through closer collaboration with other countries.

The low level of spending is further exacerbated by an ineffective spending mixture, which emphasizes non-researcher staff salaries. The quality of agricultural R&D outputs has been undermined by a significant increase in the salaries of staff at MoA, mostly for non-research staff, and operational and maintenance (O&M) spending. Only 19 percent of the staff in 2008 was classified as researchers and this ratio has declined in recent years as a result of recruitment of non-research staff and the loss of researchers who retired. Reallocation across spending compositions will provide some resources for research projects and incentives to attract qualified staff. In the longer term, MoA needs to aggressively recruit quality researchers to conduct high quality R&D.

The development of a knowledge-intensive innovation system will need to be based on strategic partnerships and linkages both within and outside Indonesia to enhance access to national and global best practices, which can transform the national agricultural research agency (IAARD) into the center of research excellence it is striving for. Development of research networks and research placements (nationally and internationally) will also help to decrease the relative isolation of Indonesian agricultural science. There is also a need to develop a system for applying mature technologies developed by the research system so as to increase uptake by farmers and improve acceptance by local government institutions. This objective can be achieved through a system of national and international research- extension-farmer linkages including partnerships, consortia, and dissemination methodologies, partnership of IAARD with overseas research entities to improve productivity/ sustainability in key basic production systems supported by a system of competitive grants.

The fragmented structure of agricultural R&D in Indonesia between several line ministries fosters inefficiencies, hinders inter-ministerial coordination, and weakens linkages between research, extension services and ultimately farmers. Greater coordination could be achieved through the establishment of a council system, the reallocation of resources towards tailoring research that emphasizes all agricultural needs, and the utilization of ICT for strengthening research-extension-farmers linkages. An agricultural R&D council would establish an institutional arrangement where policy-making resides in a governing council consisting of the ministers involved in agricultural R&D. To improve linkages with the end-users, the council should include extension workers and farmers in joint decision-making through coordinating committees or meetings. Greater utilization of ICT would strengthen research extension farmer linkages, particularly as the cost of connectivity declines.

Greater expenditure efficiencies can also be achieved through improving Central-level coordination of the provincial Assessment Institutes for Agricultural Technology (AIATs) that have consistently accounted for a over a third of the IAARD budget every year. Instead of AIAT centers being positioned with agro-ecological zone specializations and intended to serve all Provinces concerned by the specific AEZ research, decentralization has created incentives for each Province to claim or set up their own AIAT. This resulted in an increase in physical AIAT centers,

less cooperation, and more fragmentation of funding sources and hence more complicated budget management, with no evident gain in AIAT output efficiency. Central level coordination and/or cross-Province cooperation will be needed to improve the efficiency of the AIAT network.

The government can set incentives to induce the private sector to invest more in agricultural R&D. Through intellectual property protection, firms can be assured they may retain rights to the findings of their research, which can enable the recovery of their investment on generating knowledge. Furthermore, authorities can also help overcome collective action problems by changing institutional arrangements, such as the provision of fiscal incentives or matching grants. These actions may serve to make private investment in R&D more appealing and generate greater interest to develop new agriculture knowledge and better farming techniques.

Extension services

Agriculture extension spending in Indonesia doubled over 2006-09 as a share of agricultural GDP. Extension services are highly decentralized and all three levels of government are executing a component of the budget. The central government's spending for extension ranged between 10-15 percent of the MoA's total budget. This increase in spending from 0.54 to 1 percent of agriculture GDP was largely driven by decentralizing the provision of extension services to the local level and a large recruitment effort of contractor workers by the MoA. Central government extension spending increased by 62 percent driven primarily by two big pushes in 2006 and 2009. These large increases mostly went to finance salaries, the result of the central government hiring a large number of contractors to be trained as extension workers and based at the district level.

Decentralization has created a lack of clarity over funding responsibilities across different levels of government. Central government funding of decentralized responsibilities creates perverse incentives, leading districts to underinvest. The mixed performance of public services delivery in the agriculture sector at the subnational level has led the central government to intervene. Two clear examples of this are seen in the increase in central government transfers for operational expenses (BOP) and the hiring of contractors by the MoA at the district level, with around 1/3 of all extension workers being hired directly by the central government. By trying to compensate for the lack of funding in the districts, the MoA has assumed this expense and encroached into the districts' mandate. This is setting a perverse incentive for greater under-funding of services at the local level going forward. Instead of complementing public spending, the transfers are substituting sub-national spending for extension. The current system of dual staffing and accountability across PNS and contractor staff is undermining the ability of districts to guide and provide quality extension services. To strengthen the provision of extension services at the district level, the funding responsibility, accountability and direction of contractor extension workers should be fully transferred to the districts, combined with renewed efforts to build their capacity and ensure they can provide high quality extension services to farmers.

The educational attainment of most extension workers is below bachelor degree level. Nearly 60 percent of all extension workers do not hold a bachelor degree. Extension workers in Indonesia receive little training, an essential element in ensuring that farmers receive quality agriculture advice. Since 2007, the total number of training participants decreased significantly and was half the figures reported in 2004. In addition, the training figures suggest that workers mostly took courses in administrative skills (non-related to agriculture, for example managerial or computer training). In the case of contracted extension workers, prior to deployment they only received two weeks of initial training that could hardly bring them up to speed in terms of acquiring quality agriculture knowledge to transmit to farmers.

The Agency of Agricultural Human Resource Development (AAHRD) at the Central level needs to take the leadership in providing appropriate training at entry-level as well as refresher training for all extension workers in close coordination with Districts. The extension agencies at the district level should set incentives for workers to improve their knowledge base and establish a training program in consultation with AAHRD that effectively utilizes the six central-level agricultural extension colleges and the sixteen provincial training centers. From an efficiency point of view, it is preferable for AAHRD to expend resources in building the human resource capacity of the extension workers nationally rather than providing operational costs (Belanja Operasional Pegawai/BOP) that

is the responsibiliity of the districts. AAHRD needs to establish clear policy guidelines for a clear career development path that is based on continual training and refresher courses for extension workers. From a medium-term perspective, districts in consultation with AAHRD can set incentives (scholarships, performance assessments by farmers) to recruit and retain better-qualified staff.

Only about half of the total number of districts in Indonesia has followed the Extension Law that mandates setting up a unified extension agency. As of November 2009, 57 percent of total districts and 73 percent of total provinces had established unified extension agencies. Districts that have established a unified extension agency tend to better align central and sub-national priorities, reflecting stronger linkages between their planning and budgeting, and enjoy greater coordination. Not only are unified districts providing better quality extension, but stronger linkages between planning and budgeting have translated into higher disbursement ratios and synchronization across programs. The establishment of unified extension agencies has fiscal implications. While a unified extension agency is likely to be beneficial, this will create fiscal responsibilities in terms of salaries, goods and services, and administrative costs, and will require reallocating spending from those agriculture Dinas that housed extension activities previously to the newly established extension agency. Additional investments may be required to provide IT solutions to strengthen linkages to new technologies. To ensure the implementation of the Extension Law, the Government of Indonesia can help districts shoulder the burden of an additional agency and issue the necessary guidelines for unification of extension services.

The quality of the extension services delivered depends greatly on the linkage to new technologies and to innovative agriculture research. Extension staff needs to have access to the R&D institutions that produce this knowledge and connectivity to wider hubs of agriculture research. The adoption of new technologies and crop-management techniques can be improved through the provision of internet connectivity at the district level and better upstream linkages to the R&D institutions, in particular the AIATs and their outputs, to ensure that extension workers and farmers have simple and timely access to national and international agricultural R&D centers and knowledge networks. The delivery of extension services through ICT solutions employing cellular phones has proven very effective in countries such as India and has been piloted in Indonesia in the province of Lampung. ICT solutions can expand the coverage of the services one extension worker could provide contacting farmers through text messages. It would require, however, significant initial investment to provide connectivity to isolated rural areas.

Irrigation

Investing on irrigation will yield high returns in terms of agriculture productivity. According to the World Development Report 2008, estimates of economic returns for investments in effective water systems are on average 15-20 percent, excluding the social gains they entail. Research in Indonesia has shown that irrigation has a significant impact in reducing poverty. There is a strong relationship between provinces with greater coverage of irrigated land (primarily in Java) and higher rice yields. To a large extent, this is because irrigation is one of the main inputs for rice production and Javanese provinces are not only better irrigated but have stronger water management institutions, through well-functioning Water User Associations (WUAs). In provinces with greater coverage of irrigated land, farmers harvest paddies more intensively and land is more productive.

Since the start of decentralization, the responsibility for operating the main irrigation network is shared across all three levels of government according to the size of the command area and cross-boundary occurrence. The central government is responsible for the bulk water supply in strategic basins and irrigation systems larger than 3,000 hectares or cross provincial systems. The provincial government has jurisdiction over the management of irrigation systems with a command area of between 1,000 and 3,000 hectares and cross district systems. Finally, the district level manages irrigation systems smaller than 1,000 hectares. The tertiary units are the full responsibility of the farmers through their WUAs and the Water User Association Federations (WUAFs). Operation and maintenance is the responsibility of each government level for the networks under their authority, while rehabilitation and investments are primarily funded through the central government budget and transfers to the region (DAK). This division of responsibilities is leading to low spending on operation and maintenance by the districts. Local gov-

ernments are anticipating rehabilitation funds by the central government and therefore underinvesting in O&M. Increasing DAK transfers and the rehabilitation budget have created an incentive for districts to under-spend on O&M and await a rehabilitation "bail-out" by the central government.

In order to address the deteriorating quality of the irrigation network, provinces and districts need to allocate more resources towards O&M and assume a portion of the rehabilitation cost (according to local fiscal capacity). Local governments have little incentive to adequately invest or even increase their O&M budgets because they do not bear the cost of the central government's rehabilitation grants. The cost of rehabilitating the provincial and district networks should be shared between the central and local governments according to fiscal capacity. This would create an incentive to maintain the network because it is significantly cheaper to fund regular maintenance operations than to support rehabilitation projects.

Given the high returns to investing in water systems, the quasi-public-good nature of the investment, and Indonesia's water needs, irrigation requires greater resources to develop an adequate and timely supply of water to rural areas all year round. While there are efficiency gains to improving current spending patterns, greater investment is needed to address Indonesia's irrigation needs. Sub-national governments are responsible for a large share of the irrigation budget as a result of decentralization, but additional funds would expand coverage and meet rehabilitation, and O&M needs in the regions. Across islands in Indonesia investment needs differ: many provinces off-Java require new investment to increase the coverage of irrigated land, while Javanese provinces need to invest resources to rehabilitate the irrigation network. As agriculture production in Java becomes more commercially oriented, there should be a greater role for private sector investment in technically more sophisticated water control systems and technology.

Introduction

Context

The objective of this study is to improve the effectiveness of public spending in agriculture, thereby enhancing productivity and increasing farmers' welfare. Improving the effectiveness and efficiency of spending in the sector will facilitate a supply response, allowing Indonesia to benefit from higher value-added agricultural products and take advantage of rising food and commodity prices. Changes in supply networks and global demand present an opportunity for productivity increases and diversifying into higher value-added products (horticulture, livestock) — one that Indonesia has yet to fully realize. Such a shift will require a different type of public support in order to facilitate the efforts of small farmers to diversify into integrated supply chains.

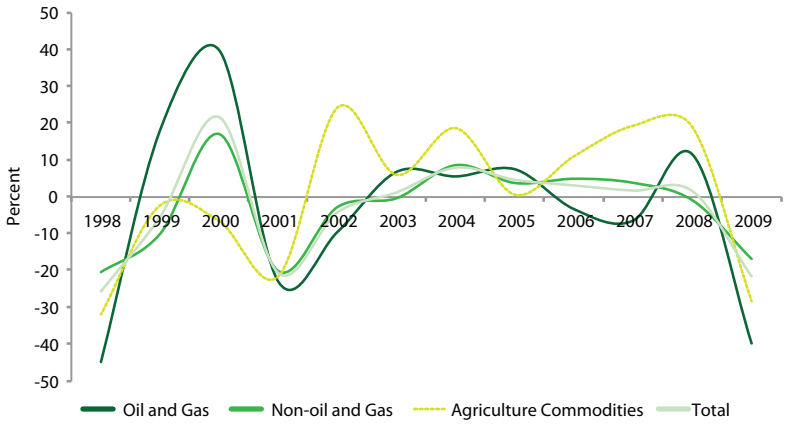
Agriculture continues to provide income to two thirds of the country's poor and is the main driver of economic activity in rural areas. Indonesia has a solid record in poverty reduction and its success in reducing poverty from around 40 percent to only 11 percent from 1976 to 1996[1] was, to great extent, the result of large increases in agriculture productivity. After the 1998 financial crisis, agriculture became an important safety net for many of those who lost their jobs in urban areas and were able to find an alternative employment (although often taking a significant reduction in income).

Production of food crops for domestic consumption, in particular rice, has increased in recent years. Indonesia achieved rice self-sufficiency in 2008, at a time when many Asian countries faced high international food prices. Preliminary analysis suggests that this increase in rice production stemmed from increased cropping intensity on existing farmland. While rice yields and farmland statistics reflect little change, favorable weather conditions coupled with improved irrigation management and significant government support in the form of input subsidies (in addition to relatively good weather), allowed rice farmers to increase the number of harvests in 2008.

Agriculture is a significant contributor to Indonesia's non-oil and gas exports. Since 2002, Indonesia's non-oil and gas exports growth figures have received a boost from the country's leading agricultural commodities: oil palm/ crude palm oil, rubber, spices, cocoa, tea, coffee, farmed fish and shrimp. In 2005-08, while other exports where reporting declining growth, agriculture exports reflected significant year-on-year growth, with an expansion of over 20 percent in 2008. Exports of crude palm oil constituted about 9 percent of the total value of Indonesia's non-oil and gas exports in 2009, providing a significant contribution to the income and employment opportunities in rural areas, particularly for small farmers.

1 McCulloch, Neil, and Timmer, C. Pieter (2008), "Rice Policy in Indonesia: A Special Issue

Figure 1: Growth of Indonesia's export values (real 2007)

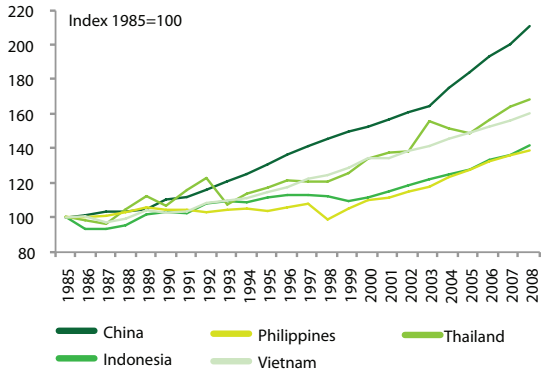


Source: BPS, World Bank staff calculations.

Public investment in public goods was largely behind Indonesia's success in increasing agricultural productivity through the 1970s and up to the early 1990s. But productivity increases have slowed since the early 1990s. During the years of the Green Revolution, Indonesia invested heavily in its irrigation network, research and development (R&D), extension services, and rural infrastructure, as well as subsidized private agricultural inputs (fertilizer, seeds, credit, etc.). By the early 1990s, Indonesia had achieved high yields across several commodities, including rice, cereals and potatoes.[2] Unfortunately, during the 1990s, the upward trend in productivity slowed, exacerbated by declining levels of private and public investment.

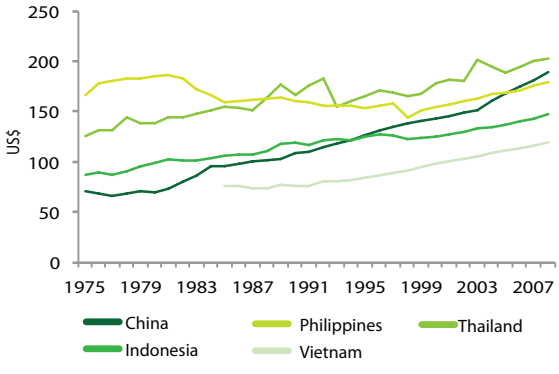
As a result of low productivity increases, Indonesia is now lagging behind many Asian peers in moving people out of agriculture and into other higher value-added activities. In many Asian countries people are exiting the agriculture sector and moving towards other higher value-added sectors — a reflection of faster industrialization in these countries. More so than its Asian neighbors, Indonesia relies heavily on agriculture. In 2008, over 40 percent of the workforce still derived its livelihood from low-productivity work in agriculture and related areas, which led to lower value-added per worker compared with other countries in Asia, such as China, Vietnam and Thailand (Figure 2). Only 30 percent of the workforce is employed in higher value-added activities, either as employees in the formal manufacturing and service sectors, or as employers in organized enterprises.[3] Therefore, the agriculture sector will continue to play a key role in any development strategy for Indonesia. This study aims to shed light on the areas in which Indonesia's agriculture sector could use resources more efficiently and effectively to improve the public support provided to the sector.

Figure 2: Agriculture value-added per worker



Source: World Bank estimates using WDI data.

Figure 3: Agriculture GDP per capita (constant US$, 2000)



Source: FAOSTAT.

2 World Bank (1994), "Indonesia, Stability, Growth and Equity in Repelita IV".

3 World Bank (2010f), "Indonesia Jobs Report", forthcoming

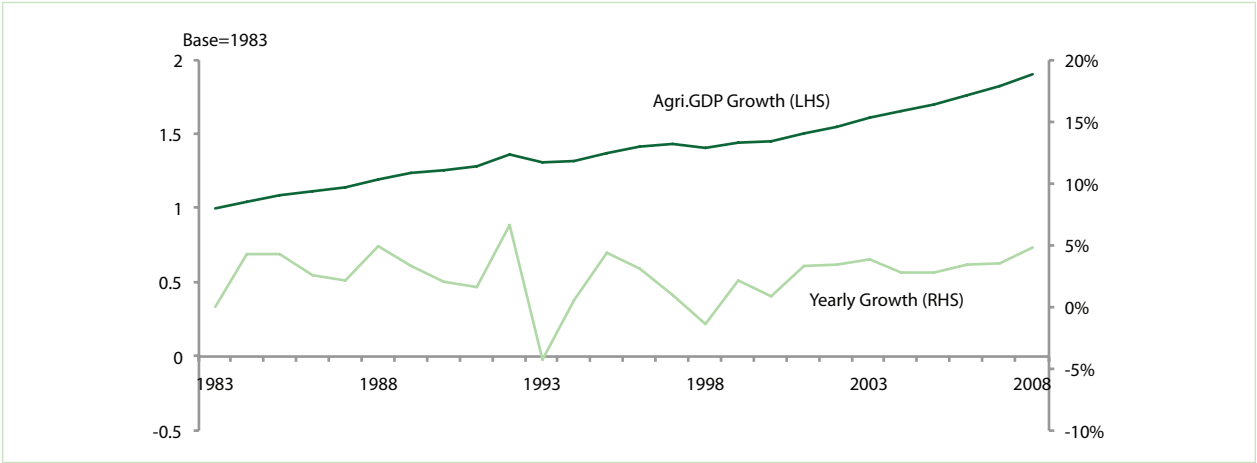
Chapter 1

Indonesia's Agriculture Performance

1.1. Agricultural Production

Historically, Indonesia's success in poverty reduction has been supported by progress in agriculture, and this continues to be an important driver of growth and poverty alleviation. A closer look at past growth suggests three marked periods of evolution in agricultural output. Prior to the 1990s, Indonesia's agriculture sector was booming; these were the days of the so-called Green Revolution, with annual growth of 5 percent. Then, the decade of the 1990s saw stagnation, with growth slowing and the sector suffering significant volatility following the financial crisis.[4] However, after 2001, agriculture GDP picked up, with an average growth of around 3 percent annually. Given the size and level of diversification of the Indonesian economy, not surprisingly over the past years agriculture has grown at a much slower pace than other sectors in the economy. While other sectors were more dynamic, for example the industry and services sectors grew by over twice as much for 2005-08, this was largely centered around Jakarta and a few other urban centers. Thus, in rural areas workers are not exiting agriculture and have fewer income-generating options.

Figure 1.1: Agriculture GDP growth 1983-2008 (base=1983), yearly growth (RHS)



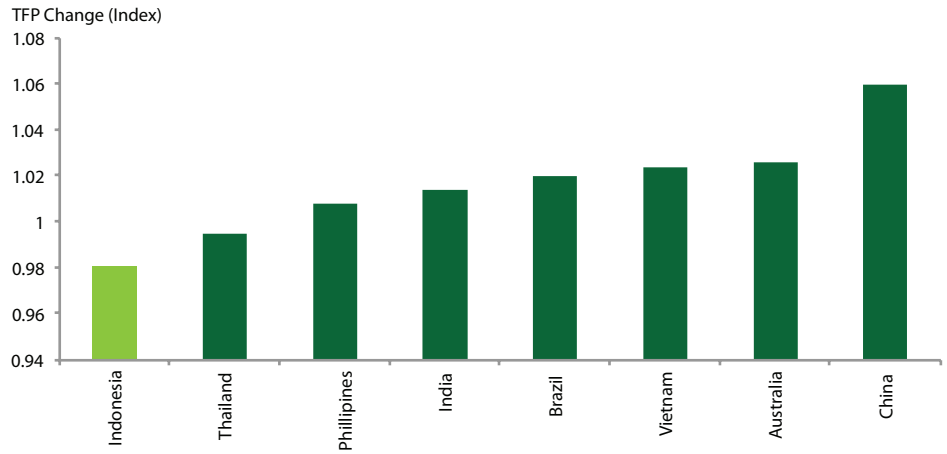
Source: BPS.

While output has increased steadily, Indonesia's agricultural productivity growth (total factor productivity, or TFP) has slowed since the early 1990s and is low compared with its Asian peers. Agriculture TFP growth fell from annual gains of 2.35 percent in 1968-92 to annual contractions of 0.58 percent from 1993 to 2001. Fuglie (2009) attributes half of this early growth to the expansion of conventional inputs (crop land, labor, livestock, and fertilizer) and about half to TFP growth. The use of modern industrial inputs (chemical fertilizers and power machinery) grew rapidly from very low initial levels and, by the 1990s, agricultural growth relied almost entirely on increases in con-

4 In 1993–2001, agricultural output growth averaged only 1.5 percent per year and TFP growth only 0.6 percent year (Fuglie, 2009).

ventional factors as productivity stagnated. Low Investment in irrigation and the effects of financial and political crises, contributed to the slowdown in total factor productivity, undermining the quality of much of the network along with under-funding of the O&M budget. In addition, agricultural extension services suffered from the various changes to their institutional structure and serve fewer farmers after decentralization. However, productivity has once again started to grow since 2000, averaging 3 percent per year.[5] Commodity diversification, primarily driven by the private sector, seems to be behind this trend, with horticulture and estate crops witnessing the largest increases in productivity. Finally, Coullie et al (2005) use a similar methodology to illustrate how Indonesia's TFP was much lower than that of Thailand, the Philippines and other Asian peers[6] (Figure 1.2).

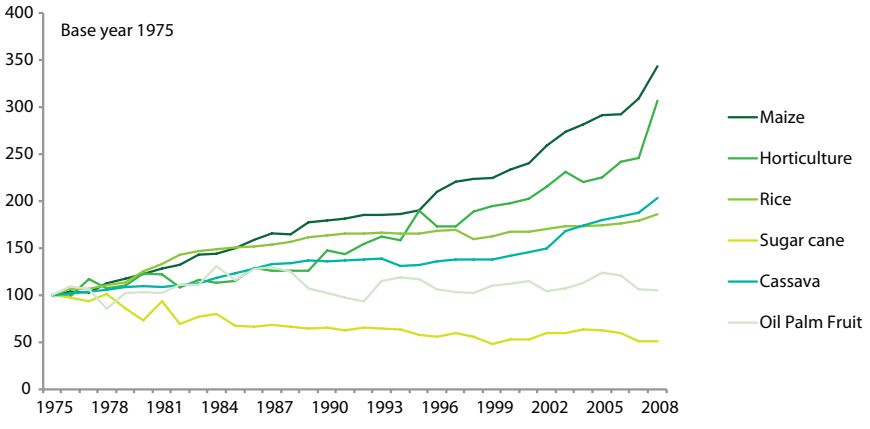
Figure 1.2: TFP change across countries, 1980-2000 (index)



Source: Coullie et al,2005.

Indonesia's agricultural productivity also varied according to the type of commodity. While the yields of horticulture (fruit and vegetables) and maize have continued to increase over the past 15 years, the growth of rice yields have not been as dynamic since the early 1990s, and the growth of sugar yields are on the decline. Indonesian horticulture yields experienced the highest growth and today production is three times greater per hectare than in previous decades (Figure 1.3). Similarly, maize yields have risen significantly and across commodities reflect the highest growth at three and a half times their yields in 1975. Conversely, while a leading rice-producer in Asia, after Indonesia's rice yields grew rapidly in the 1970s and 1980s, these have stagnated since the early 1990s. Growth of rice yields have only picked up again since 2008.

Figure 1.3: Indonesia yields for agricultural commodities, 1975-2008 (index 1975=100)



5 Fuglie, K.O, (2009). Sources of growth in Indonesian agriculture, Journal Productivity Analysis.

6 Coullie et al (2005) measure total factor productivity (TFP) using the Malmquist index methods for a sample of 93 countries over the

Over time and across Asian countries, growth of Indonesia's yields for horticulture and maize are impressive. Growth of the horticulture sector is remarkable because Indonesia's yields went from being the lowest in 1975 across Asian countries to become the highest, at 15 ton/ha, surpassing China and Vietnam. This suggests that the country enjoys an important comparative advantage in the production of these commodities. Maize production tells a similar story: the country now ranks second after China, with 4 tons/ha, and slightly ahead of Thailand, which was producing twice as much per hectare in 1975, and not far behind Vietnam, which has experienced a similar growth path. Exports of maize have increased since early 2000, in response to growing demand for livestock feed and, quite recently, as a raw material for ethanol manufacture.[7]

Figure 1.4: Horticulture

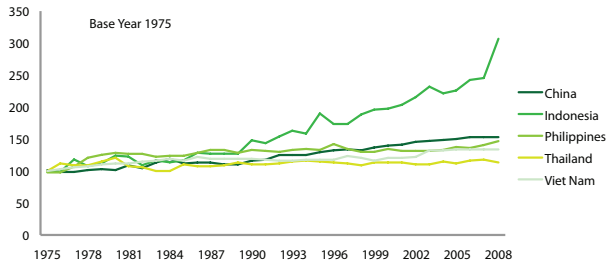
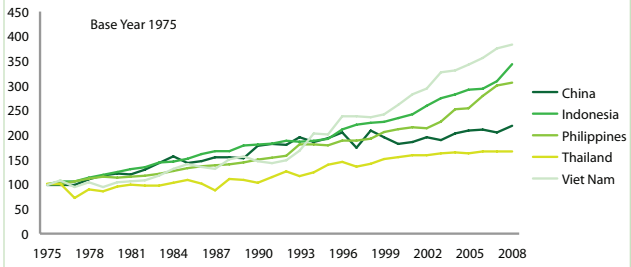


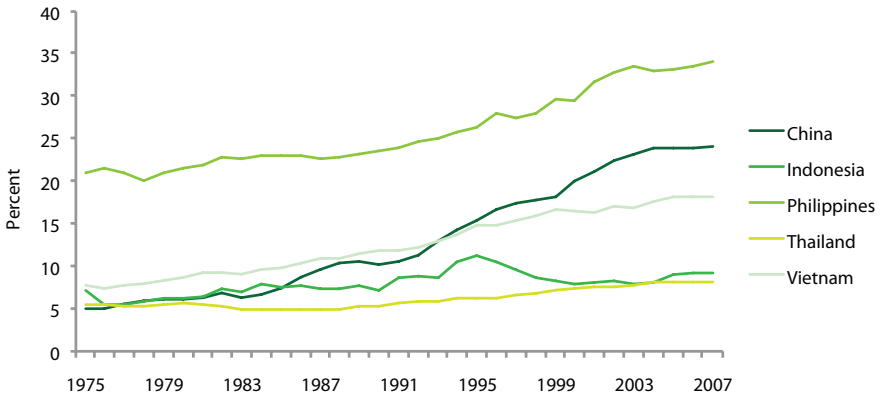
Figure 1.5: Maize



Source: faostat.fao.org.

The increasing productivity of horticulture has not translated into increasing resources for this sub-sector. Despite outperforming food crops in terms of productivity increases, the share of land devoted to horticulture has hardly increased since the mid-1970s (Figure 1.6). To a large extent, this may be a reflection of the government prioritizing the production of food crops for domestic consumption. Public support for rice absorbs a large share of public spending and guides agricultural policy, partly crowding out support for other commodities where Indonesia seems to have a comparative advantage across the region. Supporting higher value-added commodities could have a direct impact on increasing rural farmers' welfare as discussed in Box 1.1 below.

Figure 1.6: Horticulture as a percentage of arable land, 1975-2007



Source: FAOSTAT.
Note: Harvested Area as a percentage of Arable Land.[8]

Indonesia's increasing resources to support rice production have not translated into accelerated growth of yields. Rice has been the main priority commodity for the government and is supported by a significant share of the agriculture budget (as seen in Section II). The country remains an important rice producer with production only

7 Kleinberg, 2009.

8 Arable land: land under temporary agricultural crops, temporary meadows for mowing or pasture, land under market and kitchen gardens and land temporarily fallow (less than five years). Data for "Arable land" are not meant to indicate the amount of land that is potentially cultivable.

below China, but its yields have stagnated since the 1990s (Figure 1.7). While Indonesian rice yields were among the highest in 1975, greater productivity growth was seen in other Asian countries and today only Thailand reports lower growth over time (Figure 1.8). Nonetheless, in 2001-09, rice yields per hectare grew at a modest but steady pace, averaging 1.3 percent growth annually (BPS), with higher rice production in 2008 and 2009 that was partly attributed to increasing cropping intensity, favorable weather conditions, and improvements in water supply and the management of irrigation system.

Figure 1.7: Rice yields, (index 1975=100)

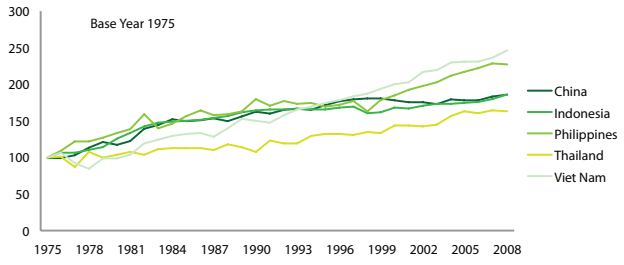
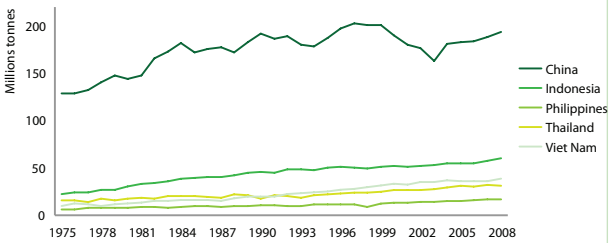


Figure 1.8: Rice production, 1975-08



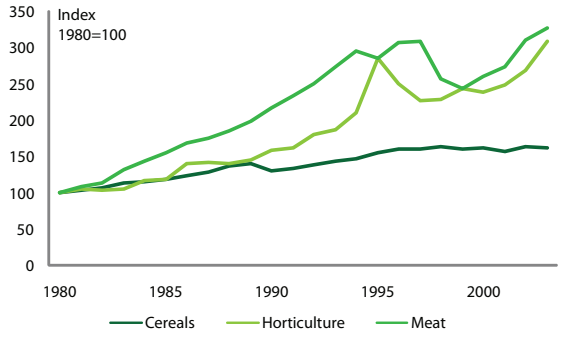
Source: faostat.fao.org.

Box 1.1: Rice self-sufficiency vs. promoting higher value-added commodities

Rice is a key commodity in Indonesia, because it is an integral component of the rural economy and links many people through services, labor and trade. It is also central to the government's objective of achieving food self-sufficiency. Today, the country retains its position as one of the largest rice producers in Asia, with high rice yields per hectare. However, yields growth has declined over the past decade.

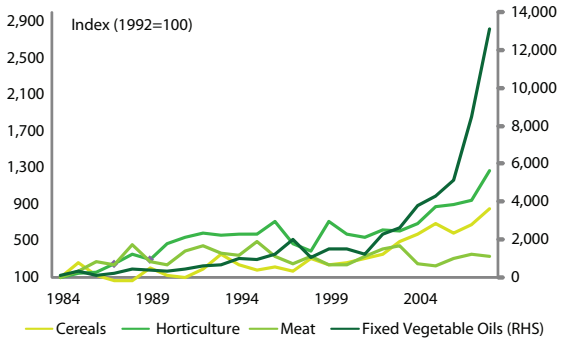
The goal of achieving self-sufficiency in domestic rice production has absorbed a significant share of agricultural resources. Horticulture, livestock and other higher value-added products (e.g. flowers) are driving global agriculture markets through the emergence of global supply chains. Similar to other developing countries, Indonesia has a seen growth in both productivity and exports of horticulture and livestock, as the country modernizes and income levels increase.[9] Higher value-added products are also the main source of increased demand, where the annual average growth of horticulture (5.4 percent) and meat (5.5 percent) was more than twice growth in cereals (2.2 percent) in 1984-2004 (Figures below). In addition, research has shown that participation in global supply chains can increase farmers' incomes by 10-100 percent (WDR, 2008).

Domestic consumption



Source: faostat.fao.org.

Domestic exports by value (index 1992=100)



Source: comtrade.un.org.

9 World Bank (2007). "Horticultural Producers and Supermarket Development in Indonesia."

The evidence suggests that only those farmers at the higher end of the scale (larger land plots, more education, and enhanced capacity to invest) are able to benefit from new agriculture opportunities (WDR, 2008). The government has therefore a role to play in strengthening the access of farmers to markets and in allowing them to participate in markets for higher value-added products. This should translate into increased budget allocations to programs in the Ministry of Agriculture that support diversification of farmers to higher value-added products (e.g. more resources to DG Horticulture, DG Livestock or the Quarantine Agency) and re-focusing of spending of certain DGs to support higher value-added agriculture (e.g. Human Resources Agency or the Agricultural Research Agency).

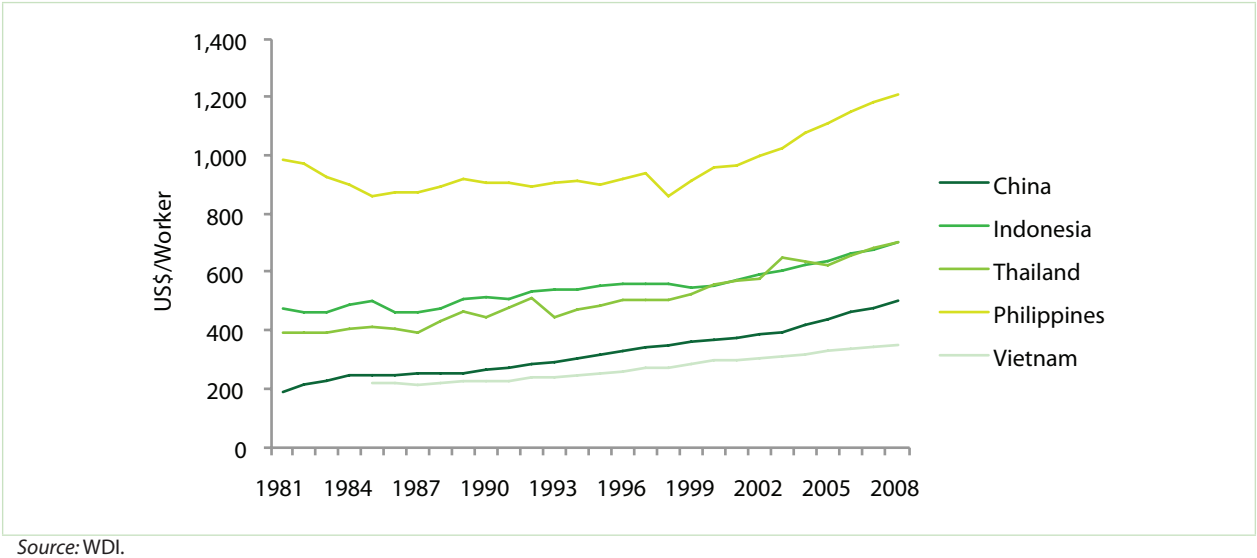
Source: World Bank (2010). "Agriculture Public Spending and Growth" Policy Note in "Indonesia Agriculture Public Expenditure Review", (forth coming).

1.2. Use of Agriculture Inputs

A significant increase in yields as seen in several commodities can be accomplished by increases in total factor productivity or through greater use of agriculture inputs. Thus, a closer look at the current use of inputs in Indonesia suggests production is highly labor intensive, reflects little capital investment, and certain crops such as rice significantly use subsidized fertilizer (i.e. urea fertilizer). This is probably a reflection of the country's factor endowments.

While there has been a steady decrease on agricultural employment in most Asian countries, the return of agriculture output per Indonesian farmer is slowly increasing. This shows that agriculture continues to play an important role in the economy and the sector's GDP continued to grow, while the share of agriculture to total employment decreased by an average 1.5 percent over the past decade. The value-added per worker in Indonesia is still significantly lower than that in the Philippines, but comparable to Thailand and higher than China and Vietnam. Indonesia relies more heavily on agriculture than other Asian peers and, therefore, reflects higher value-added per farmer. Thus, labor productivity is high and most of the output is highly concentrated in certain areas that also happen to be the most heavily populated, namely the provinces in Java, Bali, and particular parts of Sulawesi and Sumatra (see map in Annex 5, Figure A5.2).

Figure 1.9: Labor productivity: Agriculture GDP per agri-worker (US$, constant 2000)

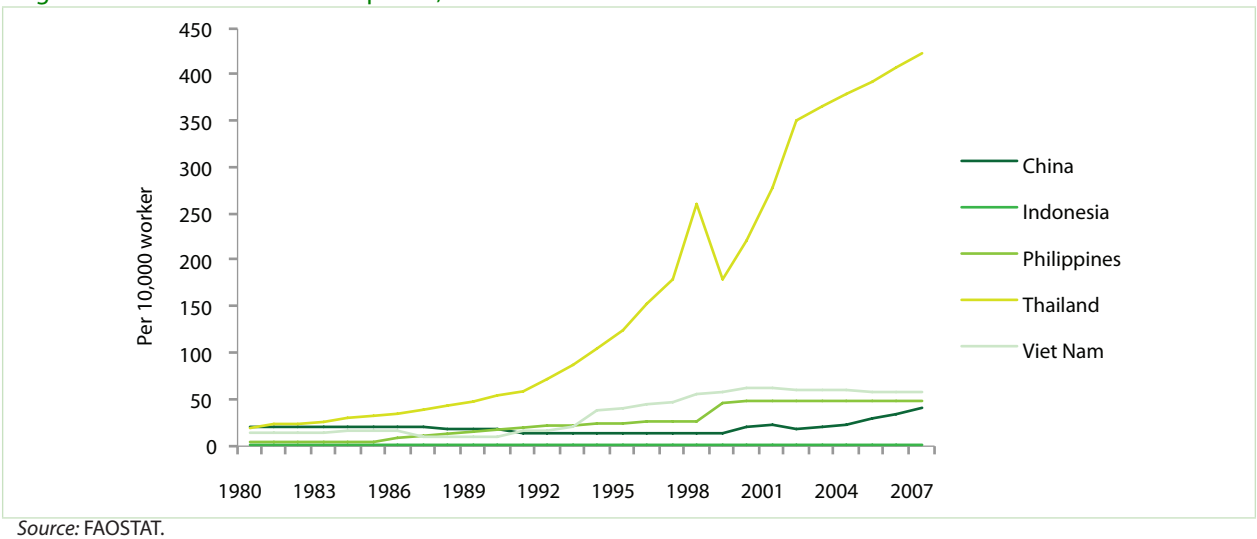


Source: WDI.

There is low adoption of modern technology and capital investment in rural areas, as suggested by Indonesia's low tractor usage. Up to 2007, Indonesia had one tractor per 10,000 agricultural workers, among the lowest in the region (when considering both manual and 4-wheel tractors). This low tractor usage is a reflection of the structure of the Indonesian agriculture sector that is composed of small farmers with an average plot size of less than 1 hect-

are. Greater capital investment in this setting is costly as farmers can hardly capture economies of scale. Because other Asian countries have higher wages, are less heavily populated, and face greater land-constraints, they have incentives to ensure deeper capital investment and move workers towards other sectors.

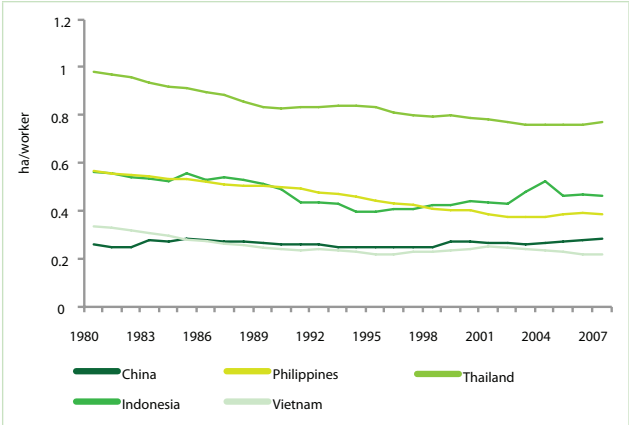
Figure 1.10: Number of tractors per 10,000 workers



Source: FAOSTAT.

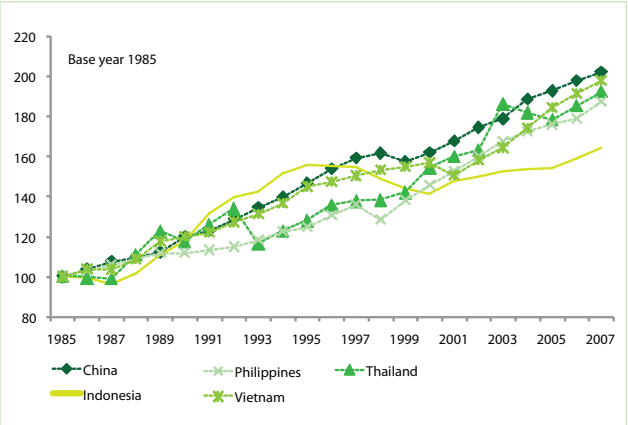
Among ASEAN peers, land productivity (agriculture output per ha of arable land) in Indonesia was high from the late 1980s till the financial crisis in 1997-98. In comparison to the region, Indonesia enjoys considerable amounts of land available for agriculture and the ratio of arable land per worker was close to that of the Philippines, varying from around 0.3 ha to 0.55 ha per worker over the past three decades. During 1980s, the availability of arable land increased significantly, a trend that reversed for most of the 1990s. After the financial crisis of 1997-98, this accelerated due to land deforestation that made more land available for agriculture production, particularly in outer Indonesia (Fuglie, 2009). Prior to the financial crisis, Indonesia reflected the highest output per hectare of arable land across the region, but after the contraction of sector GDP and facing accelerated rates of land deforestation it dramatically declined. Over the past decade, Indonesian land productivity has picked up again but at a lower rate than countries such as Thailand, Vietnam and the Philippines.

Figure 1.11: Arable land per worker, 1975-03



Source: WDI.

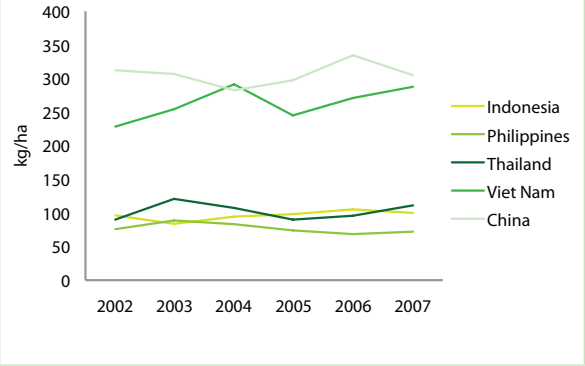
Figure 1.12: Land productivity growth: growth rate of real agriculture GDP per ha of arable land (index 1975 = 100)



Source: WDI.

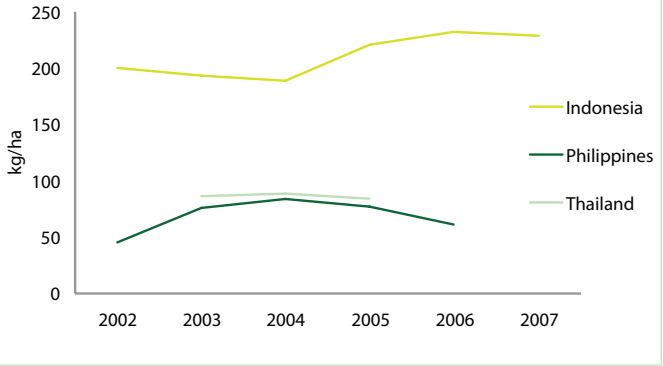
As a result of the fertilizer subsidy, which focuses mostly on urea, the usage of urea in Indonesia is more than double the levels per hectare seen across other Asian countries. The average use of urea fertilizer per hectare in Indonesia is high, at over 230 kg per hectare in 2008. In the case of food crops, its usage is more intense and on average surpasses the recommended levels by the MoA (ranging from 200-250 kg/ha depending on soil quality across islands). The use of urea has increased significantly with the higher spending on fertilizer subsidies after 2005 and figures from the 2007 BPS Rice Cost Structure survey show that smaller rice producers use twice as much urea per hectare and harvest higher yields than larger farmers. This has led to an over-intensification of land use in certain areas.[10] In contrast, the use of macronutrient fertilizer (NPK), which is not heavily subsidized,[11] is relatively low and at the same level of usage as seen in Thailand and the Philippines. Interestingly, China has the highest rice and maize yields, and uses mostly NPK fertilizer (Figure 1.13).

Figure 1.13: NPK fertilizer consumption, 2002-07



Source: FAOSTAT.

Figure 1.14: Urea consumption, 2002-07



Source: FAOSTAT, *Indonesia: Fertilizer Producers Association (APPI/Asosiasi Produsen Pupuk Indonesia).

In general, these figures on the use of inputs illustrate how agriculture in Indonesia is highly labor- intensive and makes use of little capital investment. This is not surprising because it reflects the country's factor endowments and, given the abundant availability of workers at relatively low prices and Indonesia's small-scale farming, there are strong incentives for labor to become an important input for production, and one that substitutes for capital investment. Deepening capital investment is not the only way to achieve higher productivity and diversification towards higher-value-added crops. Capacity building and institutional strengthening, as is emphasized in the rest of the report, will likely lead to higher total factor productivity (TFP) and will ensure that capital investments achieve good results.

Growth that is labor intensive will continue to create employment for a large share of the workforce but it is unlikely to result in significant increases in per capita income for agriculture workers. Employment is a key government concern and, going forward, agriculture will continue to play an important role in growth, job creation, and poverty alleviation. However, farmers' welfare will largely depend on raising incomes in rural areas and this will ultimately require shifting toward greater value-added activities. Further investment in agriculture needs to focus on increasing agricultural growth through greater productivity by deepening capital investment and moving towards higher value-added commodities, rather than through an input-driven approach. The next sections focus on analyzing current spending levels for agriculture as well as the allocation of these resources.

10 Urea usage is reflecting price distortions in input markets, which has led small farmers to substitute alternative inputs (other fertilizer, better seeds) for subsidized urea, as suggested by the increase in the demand for non-urea fertilizer following the removal of subsidies in the aftermath of the 1999 financial crisis. (See World Bank (2010d). "Fertilizer Subsidies in Indonesia," Policy Note in "Indonesia Agriculture Public Expenditure Review", forthcoming).

11 The Government is keenly aware of the negative environmental externalities of excessive urea use. Subsidies on compound fertilizers (NPK) have been increased by 450,000 tons since 2008 as part of the strategy for expanding NPK use.

Chapter 2

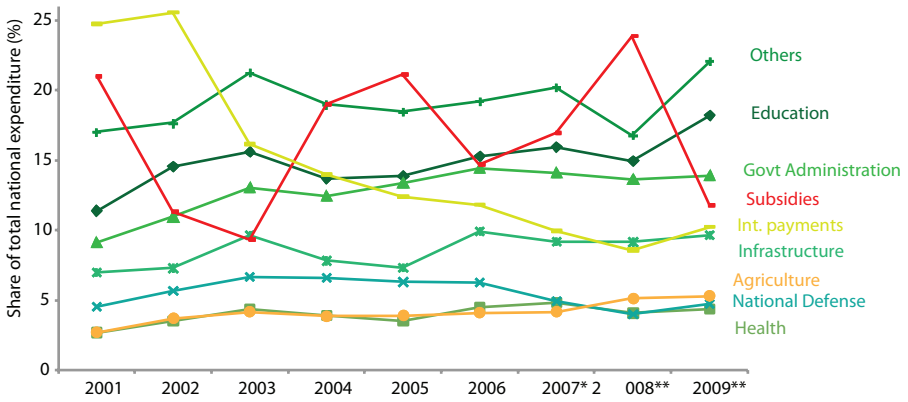
Trends in Agriculture Public Spending in Indonesia

This section provides a brief review of public spending trends in the agriculture sector in Indonesia over the past decade. The section also looks at how decentralization has created perverse incentives to spend inefficiently in agriculture sector at the sub-national level and how greater intra-sectoral efficiency could be achieved to increase growth in the sector. The section looks in particular at the level of spending that goes towards subsidizing private inputs, arguing that to a large extent such spending occurs at the cost of providing better public goods and services.

2.1. Public Spending at the Central Government Level

Public spending for agriculture has experienced an increase in recent years. As Figure 2.1 illustrates, there was a substantial increase of the share of government spending on agriculture, which doubled from 2.7 percent in 2001 to 5.6 percent in 2009. Agriculture now receives the third largest allocation by sector after education and infrastructure.

Figure 2.1: Agriculture spending in comparison with other sector,2001-09

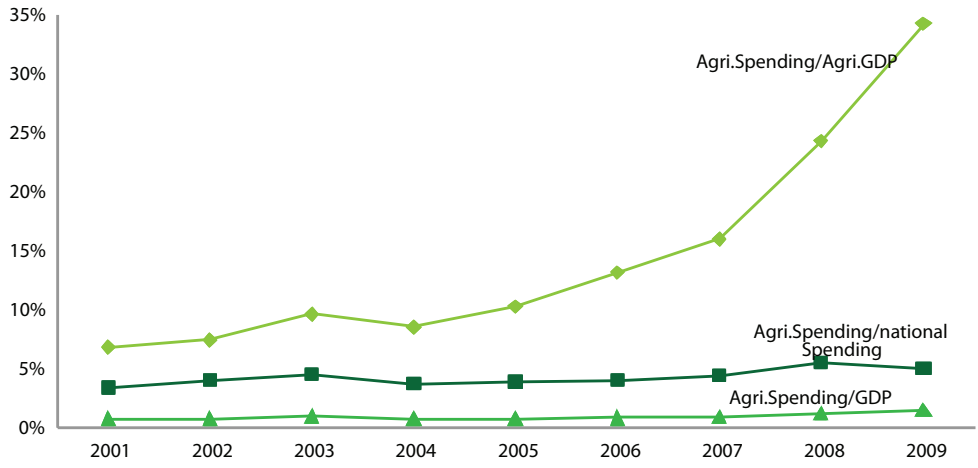


Source: World Bank 2009b.

Over the past decade, public spending for the agriculture[12] sector has increased considerably relative to agricultural GDP. This was the result of large budget increases from decentralization across all sectors and a significant increase in subsidies. The share of agriculture spending over agricultural GDP increased dramatically from 7 percent in 2001 to 34 percent in 2009, indicating that the increase in spending did not result in a significant increase in agricultural production (Figure 2.2).

12 National agriculture expenditure includes expenditure on agriculture and irrigation within the central function/sector and sub-national budgets, and central government subsidies closely related to agriculture (e.g. seeds, fertilizers, and food subsidies).

Figure 2.2: Agriculture spending in Indonesia, 2001-09 (%)



Source: World Bank staff calculations, based on data from MoF and BPS.

The increase in public spending in the agriculture sector has been largely driven by an increase in spending on agricultural subsidies. During 2001-09, national public spending on agriculture increased from Rp 11.0 trillion to Rp 61.5 trillion, an average annual increase of 12 percent in real terms. However, over the same period, the allocation of agricultural subsidies grew from 30 to 56 percent of the total national budget for agriculture. Among these subsidies, the fertilizer subsidy accounted for 54 percent of all subsidies (Rp 18.5 trillion), followed by rice subsidies,[13] seeds and credit.

Public spending on fertilizer subsidies has increased far more than production costs for the industry. In the manufacture of fertilizer, natural gas is the main input, and between 2007 and 2008 the increasing cost of gas worldwide drove international urea prices upwards by 50 percent. However, the fertilizer subsidies grew even faster, at 142 percent over the same period, suggesting that production costs are not the sole driver of increased spending. Findings from a policy note on fertilizer subsidies carried out as an input for this report show a significant increase in the number of farmers benefiting from subsidies, which may explain the general increase in subsidies. Most rice producers benefited from the subsidy program, regardless of the size of their paddies or their individual wealth. As further elaborated below, the impact of the fertilizer subsidies is regressive because those rice farmers with larger paddies and/or higher revenues received greater allocations of public resources.

When looking across agriculture sub-sectors, budget shares allocated for irrigation and R&D decreased during 2001-09. The share of public spending for irrigation decreased from 40 to 17 percent, while the share for agricultural R&D decreased from 2 to 1 percent (Figure 2.3). A closer look at absolute figures for irrigation in 2001-09 show the budget grew by 4% annually, while the budget for R&D increased by 8% yearly over the same period (Figure 2.4). Similarly, the combined budget share of spending towards: food crops, horticulture, livestock, and marketing sub-sectors experienced a continuous fall in spending from 29 to 26 percent over the same period.

13 Raskin is not a subsidy to agricultural inputs, but primarily an instrument to subsidize rice consumption for the poor. To the extent that it increases domestic demand for rice and it is partly used to stabilize prices and therefore provide an incentive for increased rice production, it will also have an impact on rice production. In any case, we include it as an agricultural subsidy as the Ministry of Finance does, but note that it is not entirely a subsidy to agricultural production.

Figure 2.3: National agriculture spending share, 2001-09 (%)

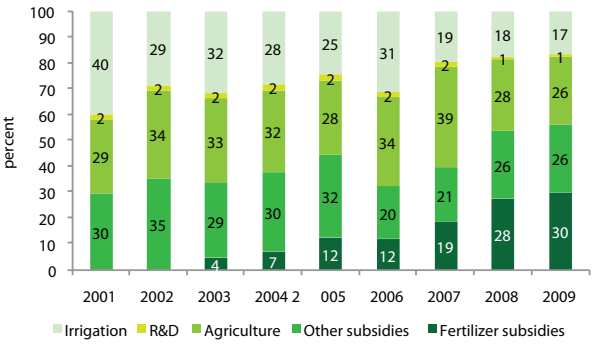
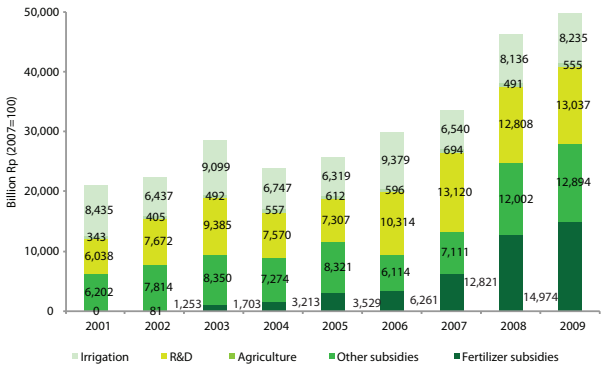


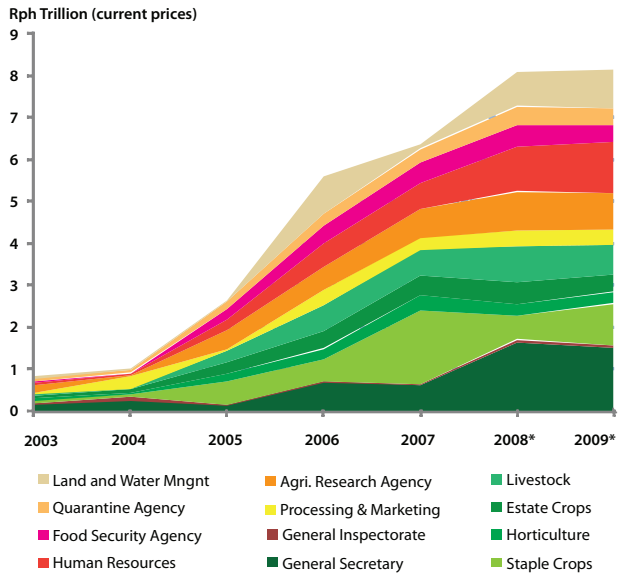
Figure 2.4: Agriculture spending, 2001-09 (Rp billion, 2007 prices)



Source: World Bank staff calculations, data from MoA, MoF, and World Bank SIKD database.

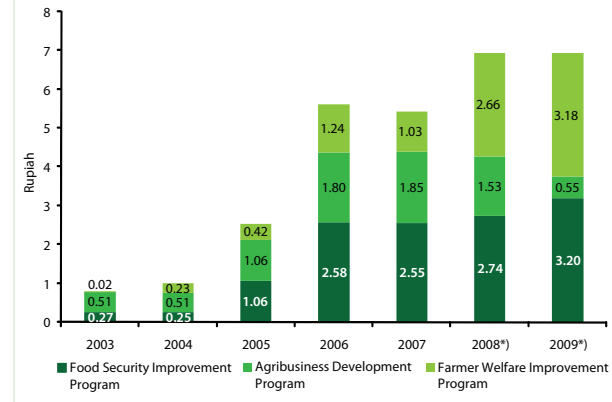
Government spending at all levels of government is geared towards supporting the objective of achieving self-sufficiency in rice, a key concern in Indonesia. When looking at allocations in the MoA, those Directorates General (DGs) that can help support the food self-sufficiency program obtain a larger MoA budget share. A significant amount of public resources was invested to increase the production of food crops through the DG of Food Crops and DG of Food Security Agency (Figure 2.5). This focus often comes at the expense of support for other higher-value products, as shown in the decreasing share in the budget of DG of Horticulture (from 6 percent in 2003 to 3 percent in 2009) or the Quarantine Agency (from 8 percent in 2003 to less than 5 percent in 2009), which is key for exports. Moreover, two trends are visible in the allocation of the budget across programs: (i) both the food security and the farmer welfare programs have seen significant budget increases; and (ii) the allocation to the agri-business development program has decreased both in real and relative terms.

Figure 2.5: MoA spending by function/echelon 1, 2003-09



Source: MoF and MoA.

Figure 2.6: MoA budget by program, 2003-09



Source: MoA.

At the central level, exclusing subsidies, spending is dominated by direct transfers to farmers. Since 2007, the MoA has allocated nearly 40 percent of its budget in the form of cash transfers to farmers and farmers' groups. Social aid[14] was partly used to provide community public goods, e.g. warehouse and agriculture terminal infrastructure, but it also financed private inputs for farmers. A closer look at the activities financed by social aid showed that spending for private inputs ranged from 62 to 97 percent of resources in 2006-09. While these cash transfers support farmers in their farming activities, over 40 percent of the MoA's budget cannot be used for the provision of public goods and services that only the government can provide. To the extent that the provision or subsidizing of private inputs have a lower impact on productivity and growth (see the following section for empirical evidence), social aid spending is unlikely to have a significant impact on productivity. The next chapter discusses in more detail cash transfer programs and ways in which the government could improve them. It also provides supporting evidence that subsidizing private inputs does not have a positive impact on agricultural GDP.

The shift of resources from subsidizing private inputs to provision of public services will need to be accompanied by an improvement in governance, capacity, and monitoring and evaluation in the agriculture sector. The current emphasis on input subsidies is a result of political dynamics at the beginning of the decade wherein Parliament wanted to put in place public expenditure activities to benefit farmers (voters) as directly as possible and that avoided all the leakage of the traditional MoA programs that passed through public procurement processes and concerns with both the capacity and governance in the Ministry of Agriculture. This resulted in moving resources out of the public procurement processes and transferring resources directly to farmers. This report will argue that resources should be used for the provision of public goods and services, and as such there is a need to move resources back to programs being implemented by the Ministry of Agriculture. Part of the strategy of shifting from subsidizing private inputs to providing public goods will now be dependent on the public institutions in the agriculture sector being able to convince lawmakers that they can deliver efficiently high quality public services. This report provides policy recommendations that will enhance the sector's capacity for better governance at the central and sub-national level.

The main challenges now lie at the local level and ensuring spending at this level becomes more efficient. The analysis has so far focused on central government spending. However, decentralization has increased the resources transferred to provinces and districts, which have assumed a greater role in supporting the agriculture sector. As a result, the challenge now at the local level lies in spending these newly transferred resources more efficiently, particularly in ways that can generate higher returns to investment and support private activity. The next section focuses on the particular challenges created by the transition towards decentralization, in particular as these affect the agriculture sector.

2.2. Decentralized Spending

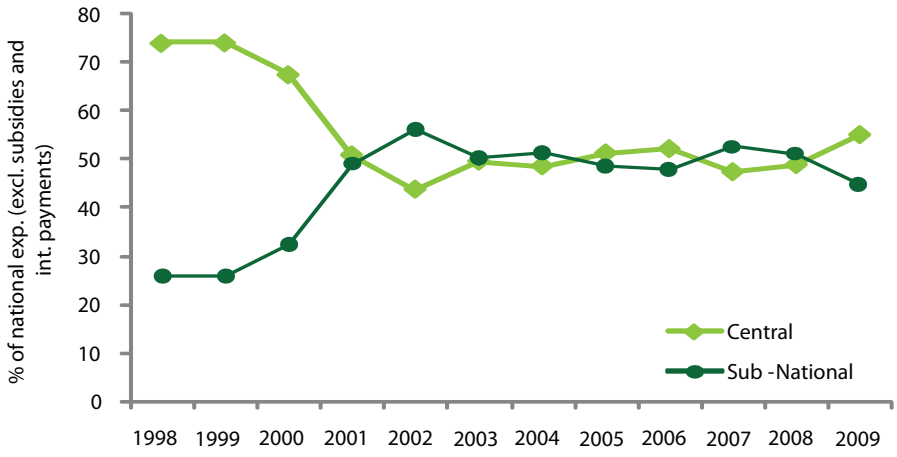
Decentralization has brought public services closer to the end-user in particular areas, such as extension services and irrigation, but at the same time it has also rendered the authority of the central government and the MoA more distant. The process has devolved substantial funds and agriculture responsibilities to sub-national governments. Since the beginning of decentralization early in the past decade, a significant share of national spending has been transferred to favor sub-national governments in providing support for agriculture. While in 1998 the central government spent 72 percent of total spending, this share today accounts for only about 55 percent (Figure 2.7).

Today, the central and sub-national governments share the role of supporting agriculture sector development. The tasks in setting agriculture development priorities and objectives are facilitated by the Coordinating Ministry for Economic Affairs, the Ministry of Agriculture (MoA), Bappenas, and the Ministry of Finance (MoF). Meanwhile, for issues related to agriculture infrastructures such as irrigation and rural roads, the MoA collaborates with the

14 Social aid (Bantuan Sosial) is one of the economic classification of the Indonesian budget system. In the case of the MoA, it refers to cash grants disbursed to farmers' associations, churches, and community groups at the local level that mostly fund private inputs in the agriculture sector.

Ministry of Public Works (MoPW). At the district level, the office of the district head acts as the center of policy formulation and coordination of agricultural policies and objectives. Bappeda plays the role of coordinating and sorting inputs for agriculture at the sub-national level, while the Dinas carry out implementation of policies.

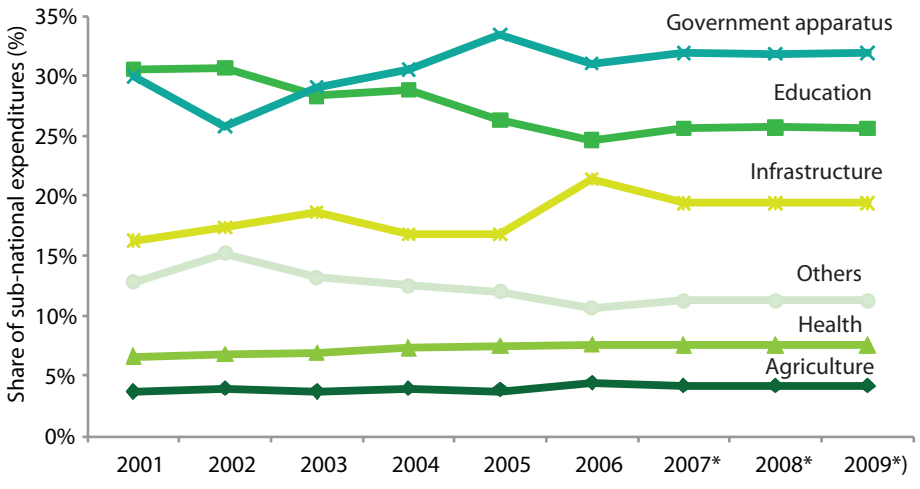
Figure 2.7: Share national spending pre and post-decentralization



Source: World Bank 2009b.

After decentralization, the government administration remains the largest spending item at the sub national level. Provinces and districts spent about one third of their resources on administration. Since 2003, spending on government apparatus has overtaken education as the leading sector. Spending for agriculture in the same period remained stagnant at 4 percent during 2001-2009. Findings from some public expenditure studies at sub national level[15] illustrate how in recent years districts have spent an increasing share of the decentralized fiscal resources on government administration. The studies reveal that government apparatus and administration stands around 20 to 50 percent of total provincial or district expenditure and in some cases it exceeds the total expenditure for other key sectors such as infrastructure, health and education combined.

Figure 2.8: Sub-national spending on various sectors, 2001-09 (%)

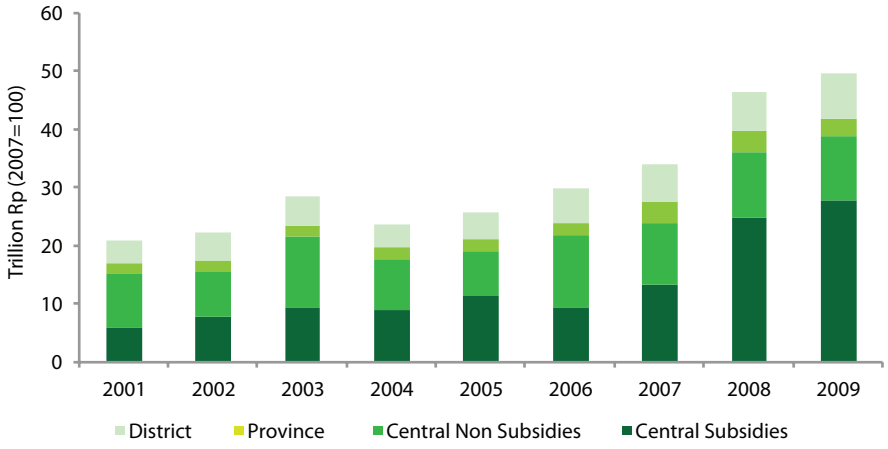


Source: World Bank staff calculations based on data from the World Bank SIKD database.
Note: *) is a projection.

15 World Bank (2005). "Papua Public Expenditure Analysis Overview Report"; World Bank (2008). "Gorontalo Public Expenditure Analysis"; World Bank (2009). "East Nusa Tenggara Public Expenditure Analysis"; World Bank (2008). "Aceh Public Expenditure Analysis"; and World Bank (2007). "Nias Public Expenditure Analysis".

The special allocation fund (DAK) transfers, some of which are earmarked for agriculture and irrigation, have provided greater resources to sub-national governments, particularly after 2006. In the past three years, sub-national governments have embraced an increasing role in financing agriculture sector development. This is mainly due to the increase of DAK transfers for irrigation and agriculture. In 2001, 68 percent of spending for agriculture (excluding subsidies) was executed by the central government. In 2009, the central government was responsible for 51 percent of spending (Figure 2.9).

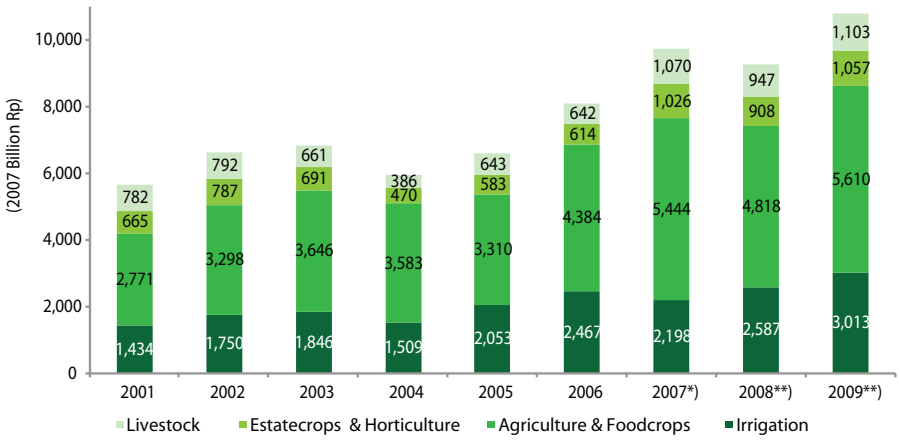
Figure 2.9: Agriculture spending trends of the three levels of government, 2001-09 (Rp trillion, 2007 prices)



Source: World Bank staff calculations, data from MoF and the World Bank SIKD database.

Districts and provinces spend a significant share of their agriculture budgets on foodcrops and/or irrigation. Sub-national spending by agricultural Dinas (Figure 2.10) shows that foodcrops and irrigation combined accounted for 80 percent of all resources for agriculture at the sub-national level in 2009, reflecting the priority given by the central government to the production of foodcrops. In 2006-08, the share of the agriculture budget that sub-national governments (both provinces and districts) allocated for water systems grew from 29 to 38 percent, with spikes in spending for the years when the central government increased transfers to the regions, in particular in 2001 and 2006. In addition, the provincial role in irrigation spending has become more prominent and budget allocations at this level of government have increased significantly since 2001.

Figure 2.10 Agriculture spending by sub-sector, 2001-09 (Rp billion, 2007 prices)



Source: World Bank staff calculations, data from the World Bank SIKD database.
Note: *) and **) are projections.

Box 2.1: Agriculture public spending in selected provinces and districts: fieldwork

An analysis of spending at the sub-national level is relevant in Indonesia's context because sub-national governments are responsible for a significant share of spending. The analysis of spending at the sub-national level uses a dataset with sub-national public spending data that includes all districts and provinces in Indonesia. This dataset collects information at an aggregate level allowing a review of inter-sectoral allocations of funds at the provincial and district levels. A more in-depth analysis of public spending at the district level, particularly in functions that are largely decentralized, such as the tertiary irrigation network or extension services, is carried out through field visits and detailed analysis of budget books in a limited number of districts and provinces.

The selected districts and provinces reflect diversity in importance of agriculture, rice production, and poverty levels, with particular attention to geographical diversity. At the provincial level, the analysis covered East Java, an important economic area, and East Nusa Tenggara (NTT), a much dryer climate with far poorer agricultural conditions. The districts visited were: Subang (West Java), Lamongan (East Java), Tanggamus (Lampung), Gorontalo (Gorontalo), Pinrang (South Sulawesi), Kupang (NTT), and Simalungun (North Sumatra). Their geographical locations can be seen in the figure below. While this analysis is not representative of the entire country, it highlights interesting trends across these sub-national governments.

Selected provinces and districts

Districts play an increasingly important role in the delivery of public goods and services. Analysis at a broader level shows how sub-national governments spend a significant share of the increased fiscal resources on government administration, constraining their ability to provide good quality public services. A more detailed analysis of key areas of support for agriculture (in particular, irrigation and extension services) in the sections ahead largely focuses on the role of districts and how to improve spending patterns at the sub-national level.

Chapter 3

Does Public Spending for Agriculture Have an Impact on Growth ?

3.1. What Do We Know About the Impact of Public Spending on Growth?[16]

While the empirical literature on the impact and magnitude of public spending on growth is mixed, there is growing evidence that, at the macroeconomic and microeconomic levels, public expenditure can impact development.[17] Public investment focused on areas in which there are market failures and public good externalities has a highly positive rate of return and yields benefits that substantially outweigh the costs. In contrast, poorly implemented efforts in activities that are better suited to private activities can be counter-productive.

There are limits to the positive impact that public spending can have on growth and both the composition and the level of spending matter. Regarding the level of public spending, empirical studies suggest there is an inverse U-shaped[18] relationship . Accordingly, public spending may drive growth, after controlling for negative financing effects, up to a certain point above which additional spending may constrain growth because of the additional (and likely distortionary) financing needs. Several empirical studies find that public expenditure exhibits positive growth effects, whilst controlling formally for the government budget constraint under certain fiscal policy conditions[19] (for example, fiscal stability and a relatively small government budget size).[20] Along these lines, the composition of public spending can trigger a complementary effect by either stimulating private spending or providing additional counterpart funding for growing private sector investment. On the contrary, other budget items can crowd out private spending, either by reducing incentives for the private sector or by triggering public deficits and accumulated public debt in need of financing. This reduces the credit available for the private sector and, in the long run, leads to higher interest rates.

There is increased evidence of a positive relationship between public spending and growth in the agriculture sector. Evidence provided by a research project from FAO in 20 countries in Latin America shows that public spending in rural areas has a positive impact on agricultural growth (Alcott et al, 2006). The study also shows that both the volume and the composition of spending matter. Assuming a fixed amount of spending in the agriculture sector, a high share of spending on subsidies to private inputs has a negative impact on agricultural growth given the corresponding lower spending on the provision of public goods. Lopez and Galinato (2007) find similar results and argue that the positive impact of public spending on rural incomes is primarily dependent on the composition of

16 From: World Bank 2010. "Agriculture Public Spending and Growth" Policy Note in "Indonesia Agriculture Public Expenditure Review", forthcoming.

17 There is much debate about the drivers of the so-called "East Asia Miracle", but it is becoming clearer that rising human capital due to improvements in primary and secondary education made an important contribution. Vandenbenbussche, Aghion and Meghir (2005) conclude that there is a link between human capital accumulation, or education attainment, and growth.

18 As suggested by Barro (1998), Tanzi and Fee (1997).

19 Haque and Kim (2003), Bose et al. (2005), Adam and Bevan (2005) and Moreno-Dodson (2008).

20 Gemmel, 2007 and Moreno-Dodson 2008 provide empirical support for the view that in a developing country context, "productive" public expenditure triggers jointly a growth-enhancing effect. There is growing evidence suggesting a higher growth pay-off from macroeconomic stability and public spending in countries characterized by relatively better public sector governance.

spending. They estimate that a 10 percent reallocation from subsidizing private goods to providing public goods can increase per capita agricultural income by 5 percent. In a related piece of work by Santos and Ortega (2006), the authors show how the share of the budget allocated to subsidizing private inputs has a significant negative impact on the efficiency of public spending. All these studies emphasize the concept of opportunity costs of subsidies. Although increased usage of a particular input may have a positive impact on production (e.g. fertilizer on rice production), the impact of subsidizing such inputs is often negative because it is done at the expense of providing public goods (e.g. research on newer varieties or improvements to the irrigation network) with a larger positive impact on production.

3.2. The Role of the Public Sector in Agricultural Development

Agriculture is a private activity, but the public sector plays an important role by setting the enabling environment for it to flourish. Thus, public policy should correct for instances in which the market fails to allocate resources efficiently, and minimize price distortions faced by both farmers and consumers, while promoting inclusive growth. In practice, this translates into interventions along several dimensions:

i) Correcting for externalities, which requires making people pay (or be paid) for the cost and benefits of their actions, such as discouraging the over-use of fertilizer leading to pollution, or rewarding advances in R&D with a patent;
ii) Providing for public goods that are not efficiently and sufficiently produced by the market (e.g. building rural roads and irrigation systems, providing extension services and agricultural marketing, and funding more agricultural R&D);
iii) Addressing information asymmetries, eliminating information gaps so that farmers and consumers can make informed decisions on what to produce, with what level of inputs, and at what price (for example certifying product input and output quality standards, ensuring plant and animal health); and
iv) Regulating against monopolistic behavior that reduces social welfare by, for example, having lower outputs sold at higher prices.

There are trade-offs between the provision of public goods and subsidization of private inputs. Governments that heavily subsidize private goods do so at the expense of deepening investment in public goods that have much higher returns. Investments in rural roads, irrigation, extension services or research are the main drivers of agriculture productivity.[21] Agricultural public goods also have a multiplier effect and generate positive externalities for society as a whole. Governments can significantly improve the quality of public expenditure in agriculture by shifting the composition of spending towards the provision of public goods and services, and away from the subsidization of private goods.

The impact of subsidizing private inputs on productivity is unclear. The literature on public spending and growth suggests that the record of governments subsidizing private inputs is, at best, mixed, although a large number of governments spend a considerable share of their budget doing just that. The impact of subsidizing private inputs at the expense of the provision of public goods on productivity is often negative. Subsidizing private inputs often represents only a transfer of resources with no impact on the consumption of that input, and even if the subsidy increases its use, its impact on productivity is unclear (e.g. there are diminishing returns on fertilizer usage so, beyond a certain point the additional use of fertilizer may not have any impact, or even a negative impact, on production).

21 Spending on public goods is likely to have higher returns than private goods, as discussed in the policy note "Agriculture Public Spending and Growth", in Indonesia Agriculture Public Expenditure Review (2010), World Bank, (forthcoming).

3.3. The Impact of Public Spending on Growth in the Agriculture Sector in Indonesia

Using time series data, a policy note prepared for this report empirically tests the relationship between agriculture public spending and the growth rate of agriculture GDP per capita in Indonesia over the past 30 years[22] (for detailed results see Annex III). By looking at different specifications with both OLS and GMM econometric techniques, this relationship is explored while taking into account specific characteristics and innovations in the Indonesian context.[23]

The overall results show that spending on agricultural public goods has a statistically significant positive effect on the agriculture GDP per capita growth rate, after controlling for the effects of non-agriculture GDP per capita growth and private inputs (arable land and labor). Table A.3.2 in the Annex III presents the results obtained with the OLS and GMM econometric methods indicating that spending on public goods is a positive driver of the growth rate of agriculture GDP per capita, while spending on fertilizer subsidies appears to have a significant negative effect. Not surprisingly, the impact of total agriculture spending on agriculture GDP per capita growth is unclear, given the opposing direction of the effects from its two components: agriculture and irrigation vs. fertilizer subsidies. The GMM findings show a more significant effect than OLS that is in line with international evidence and the literature exploring the impact of public spending on growth in the agriculture sector.

Spending on public goods in the agriculture sector in Indonesia has driven agricultural growth. This positive effect is associated only with the agriculture and irrigation public spending component. Given the opportunity cost of financing subsidies further at the expense of other agriculture spending and irrigation, which directly contribute to growth, the government should consider reallocating spending from fertilizer subsidies and other private input subsidies to public goods such as agriculture extension services, R&D and irrigation, which could lead to faster sector growth.

22 From: World Bank 2010a. "Agriculture Public Spending and Growth" Policy Note in "Indonesia Agriculture Public Expenditure Review", forthcoming.

23 Different function specification were considered taking into account previous analyses of the impact of public spending in the agriculture sector. See for example Lopez and Galinato (2007).

Chapter 4

Improving the Intra-sectoral Allocation of Spending: Public vs. Private Goods

4.1. Supplying Agriculture Public Goods vs. Subsidizing Private Inputs

Over the past decade, public spending on agriculture has increased in real terms, but agriculture public goods have not been the main beneficiary of these resources. In 2001-09, national spending on agriculture increased from Rp 11 trillion to Rp 61.5 trillion, an average of 12 percent per year in real terms. This was the result of large budget increases, a major spending boost from decentralization across all sectors, and a push for agriculture subsidies in recent years (mostly fertilizer subsidies). In 2009, Indonesia directed over 56 percent of its agriculture resources through direct subsidies for seeds, credit, fertilizer and rice (Figure 4.1), amounting to over Rp 34 trillion, which was more than four times the budget for the MoA in 2009, at Rp 8 trillion. As Figure 4.2 shows, by the end of 2009 the allocation for agriculture subsidies was four and a half times its 2001 level, while resources for irrigation remained flat, and agriculture spending doubled over the same period.

Figure 4.1: Share of national agriculture spending

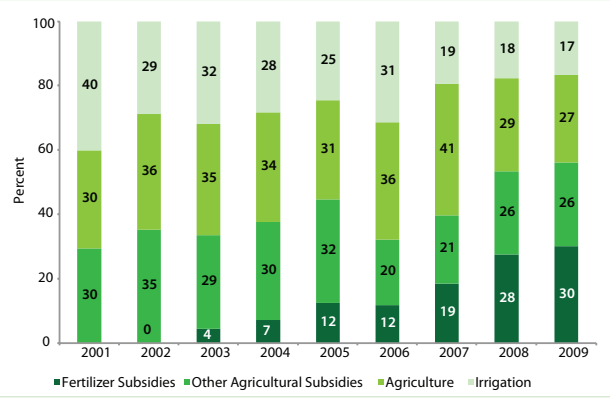
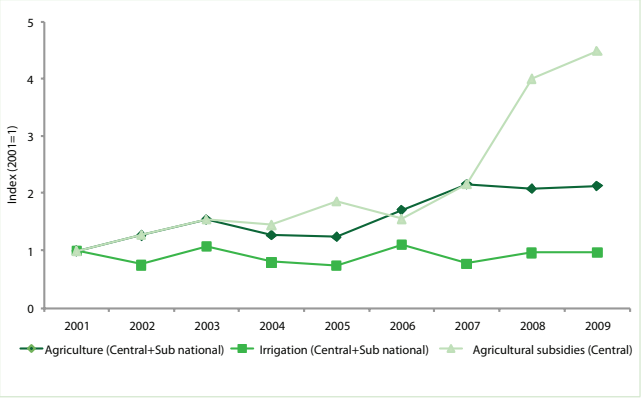


Figure 4.2: Spending on agriculture, index 2001-09



Source: World Bank staff calculations, MoA.

By allocating a large share of its budget (40 percent) towards direct transfers to farmers (social aid), the MoA has been subsidizing private inputs further. As illustrated in Figure 4.4, social aid is disbursed through cash grants to farmers' associations, churches and community groups at the local level that mostly fund private inputs. A closer look at the social aid spending of the DG of Food Crops shows that most spending was channeled to support seeds and agricultural equipment. Other DGs similarly use social aid spending to provide private inputs such as water pumps, cattle and other goods. The DG Land and Water also provides funds to farmers and farmers' associations for the maintenance and operation of irrigation infrastructure, funding primarily community level goods and services.

Figure 4.3: MoA budget by economic classification, 2005-09[24]

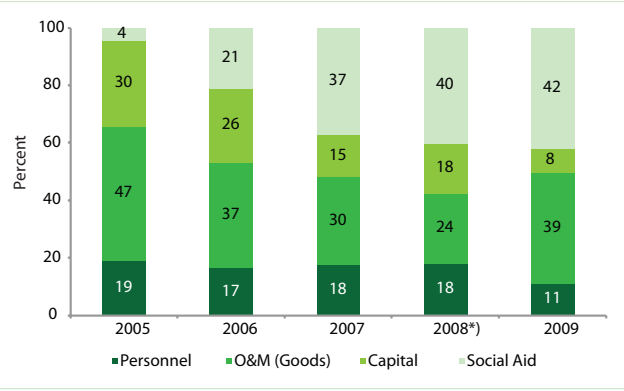
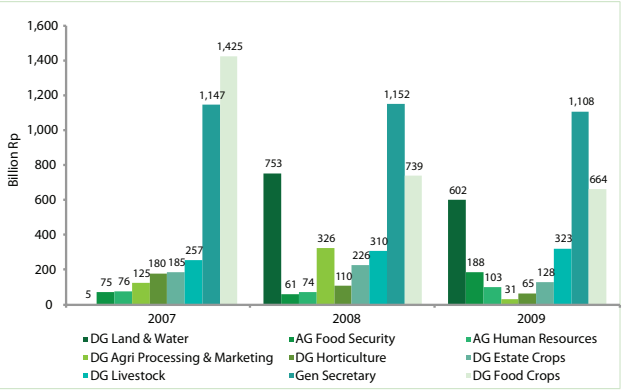


Figure 4.4: MoA: "social aid" budget, 2007-09



Source: MoA and MoF.

Implementation of cash transfer programs requires a strong monitoring and evaluation system to assess the efficiency of such programs. It is important to assess the overall impact on agricultural productivity and farmers' welfare. There is a role that social aid spending can play by funding participatory projects at the local level. However, at the level of 40 percent of the budget of the Ministry of Agriculture this funding leaves little room for investments on other public goods, such as irrigation, extension services and agricultural R&D. In addition, social aid has become a vehicle for accelerating disbursement by avoiding cumbersome government procedures, but the impact of subsidizing private inputs on agricultural productivity is at best uncertain. Evaluation of these programs in ways that are similar to those conducted in other countries would allow for the identification of design faults and find ways of addressing these faults in future implementation. Box 4.1 provides a good example of how effective monitoring and evaluation in PROCAMPO, a similar program implemented in Mexico, greatly improved the design of the program.

Box 4.1: Income support program, PROCAMPO – The power of impact evaluation

Procampo is an income support program (in the form of cash transfers) launched by the Mexican government in 1994 to compensate grain farmers for income losses due to the liberalization brought by NAFTA. The program, worth US$1.3 billion in 2005, accounts for over 40 percent of all public spending for agriculture and reaches up to 85 percent of the ejidatarios, which are often the poorest farmers in the country. Some features of the program have contributed to its success: (i) the program, which provides eligible farmers with a fixed payment per hectare, is decoupled from current production, and the only conditionalities are to have grown certain crops in the three years prior to 1994 and to continue working the land (cropping, livestock, forestry or for environmental purposes); (ii) the subsidy is given to the user of the land, not necessarily the owner; (iii) the subsidy is given on a seasonal basis, so farmers that were double-cropping receive the subsidy twice in a year; (iv) important multiplier effects[25] by providing a stable and predictable income source, addressing credit market constraints of many farmers who had land but no capital and enabling farmers to invest in riskier and higher-yielding investments; and (v) the use of the commercial banking system to distribute the subsidy has improved access of farmers to financial services.

The same program features that contribute to its success also present challenges: (i) by making per hectare payments this means that the largest farmers who may not need the subsidy in the first place capture a large share of the subsidy;[26] (ii) landless farmers (often the poorest in rural areas) are bypassed by the program; (iii) seasonality also means that farmers who were better off (double-cropping, access to irrigation) receive today the largest subsidies; and (iv) payments are tied to farmers continuing to work the land, increasing the opportunity costs of beneficiaries diversifying away from agriculture into higher-value activities.

24 The reduction of personnel expenditures in 2009 is the result of the reclassification salaries from contractors into the "O&M" goods category.
25 Cord and Wodon 2001 estimate that 1 peso of PROCAMPO translates into 2 pesos for the household.
26 The 45 percent smallest farmers (with farms below 5 ha) capture only 10 percent of the total subsidy.

The program's M&E system, with yearly surveys of recipients and non-recipients across the country, allows for detailed annual impact evaluations. These evaluations show that the program has been successful in supporting farmers' welfare, accounting for a significant share of the income of the poorest farmers. However, it has not been successful in diversifying cropping patterns. Only 5 percent of all beneficiaries had switched crops after 12 years of PROCAMPO. The evaluations have been used to improve the program over the years. The coverage of farmers was amended from those who grew grain to other crops in order to expand the program to other poor farmers. The regressive nature of the program has been widely criticized, which led to paying a higher per-ha subsidy to farmers with farms below 5 ha. To maximize the impact of the subsidy on farmers' credit constraints, the subsidy is paid before the planting season. Qualification certificates can be used as collateral with banks, using future payment streams for productive investments.

Source: World Bank 2004, Cord and Wodon 2001, GEA 2006, Sadoulet et al 2001.

In certain instances, providing subsidies to private inputs may be desirable as a way of correcting for market failures. These "market smart" interventions (or "smart subsidies") in input markets can become a policy tool to overcome market failures, such as imperfect information, high transaction costs, or missing credit markets. The challenge for governments then is to identify the root of the market failure and seek to increase productivity by designing their subsidy program in a manner that corrects for the market failure (e.g. encouraging incremental use of inputs by groups that would under-utilize inputs in the absence of the subsidy). However, caution needs to be exercised to avoid distorting the relative prices of agricultural inputs and encouraging their inefficient use. The temporary nature of the subsidy system is key: it should empower poorer farmers without making them dependent on subsidies. The program should focus on building sustainable agricultural input markets for smallholders, with the private sector as the supplier of those goods and services (ODI, 2008).

Agriculture subsidies are justifiable from an economic standpoint if they establish the foundations for a sustainable private sector-led input market. Because fertilizer is by far Indonesia's largest agriculture subsidy this report focuses mostly on better understanding this particular input subsidy, although the lessons learned equally apply to most input subsidy schemes. Thus, fertilizer subsidies can improve efficiency in the agriculture sector if they are able to:

- Develop a previously constrained or non-existent fertilizer market. That is, by offsetting high initial distribution costs until the market expands, economies of scale are realized and prices decline.
- Encourage technology adoption and diffusion by reducing the initial risk and costs of learning new technologies.
- Overcome constraints in credit markets, where farmers tend to use below optimal levels of fertilizers because of imperfect rural credit or insurance markets.
- Compensate for taxes or output price controls that make fertilizer financially unprofitable, when the removal of such taxes or price controls is not feasible.
- Generate positive environmental externalities by reducing deforestation and soil erosion.

The government should assess whether there are market failures that warrant the subsidization of inputs and whether this is the most cost-effective way of addressing the market failures. In Indonesia's case, in the area of fertilizer, after three decades of fertilizer subsidies in different forms it is debatable whether this subsidy is still necessary to develop a fertilizer market or encourage the uptake of new technologies. Arguably, smaller farmers may be credit-constrained and rural credit markets relatively undeveloped. As such, the subsidy should be addressed (in whatever form) to those farmers that need it most, rather than subsidizing the production of one of the many agricultural inputs needed by farmers. Moreover, the benefit incidence analysis shows that a large share of the benefits is going to those farmers that may not need it. The existence of market failures alone does not warrant government intervention in inputs markets. It could well be that government intervention in the form of input subsidies leads to a worse outcome than in the absence of such interventions or that a similar outcome (increased use of agricultural inputs and production) can be achieved at a lower cost. The cost-efficiency of a subsidy system often depends on the design of the program, the objectives, the targeting of the beneficiaries, and the delivery mechanism used, as well as the opportunity costs of the program, for instance, what other investments is the government foregoing in order to provide input subsidies? Box 4.2 illustrates some of the lessons learned from subsidy programs around the world.

The Ministry of Agriculture needs to have in place a comprehensive information management systems that will not only enable it to evaluate the impact of its transfer programs on productivity and farmers' welfare but also to monitor the composition of District expenditures on agriculture. A strong M& E system would allow for identification of design faults and find ways to address these faults in further implementation thereby maximizing effectiveness in bringing about the necessary increases in agriculture productivity, as well as alleviating poverty in rural areas. This capacity would also be essential if it is going to operate a matching grant program on the basis of Districts having explicit written and monitorable plans for different agricultural expenditure areas, into which central matching grants could be placed.

Box 4.2: What are the lessons learned from input subsidy programs?[27]

Clear identification and definition of program objectives. This calls for knowledge of what the subsidy seeks to achieve and the potential positive or negative interactions between objectives. Most importantly, objectives should be clear, with no room for different interpretations, while targets need to be established that allow their respective budgetary allocations to be set for short- and long-term plans.

Setting the program within an agricultural development strategy. An input subsidy program is just one of several mechanisms that work together to promote agricultural productivity. When other links are missing, the subsidies alone may not be sufficient because the market failures they attempt to correct have multi-dimensional causes. Thus, they require a multi-dimensional approach.

Targeting. The program design needs to take into account who are the target beneficiaries, what identification criteria to use, and the mechanism for the delivery of benefits, in order to minimize leakage. By improving coordination and linking the program with existing safety net initiatives, delivery costs are reduced.

Scale and costs. Program scale and costs need to be defined and limited from the early design stage. This is the area where most input subsidy schemes fail. Input subsidy programs are prone to high risks and these costs should be accounted for and quantified. There are many factors that contribute to risk, such as: fiscal instability, fraud and corruption, leakage, and uncertainty from external shocks (for example, poor weather conditions or international price changes).

Monitoring and evaluation (M&E). Information is the key to understanding where the subsidy is going and what it is achieving. With adequate monitoring of expenditure, activities, outputs and impacts, the government can tailor the program to minimize costs and risks.

Engage with the private sector. Subsidies should be used to leverage broader private sector investment and not replace this investment. Subsidies may give businesses the incentive to investment further in commercially sustainable wholesale and retail input supply chains that can reach further into remote rural areas. The exclusion of the private sector from the program's design may drive suppliers/distributors out of business because the farmers substitute private with publicly produced fertilizer. This disrupts private activity and makes the market more dependent on public suppliers.

Exit strategy. Subsidies should always be implemented on a temporary basis and provide exit options that are conceived at their design stage. These should be clearly stated before implementation.

Subsidy programs often fail to achieve their objectives in a cost-effective way. Over time, two trends have constrained input subsidy programs from realizing their full impact on agricultural productivity in many countries. First, the benefits tend to be captured by larger and wealthier farmers who do not need the subsidy in the first place. Second, subsidies have a poor track record of cost-effectiveness and, hence, introduce inefficiency in expenditures by delivering benefits at very high costs.

Input subsidies tend to perpetuate over time because they become highly sensitive issues for voters and move to the center of the political debate. As many countries have realized, it is politically costly to roll back subsidies because the beneficiaries have politically significant constituencies that will challenge reform of the system. Larger farmers are well organized, have strong political power, and lobby for legislation that protects their interests. In the case of fertilizer subsidies in Indonesia, the system benefits both consumers, and fertilizer producers and distributors. Opposition to reforms aimed at improving the fertilizer subsidy system is therefore likely to come from several fronts.

24 SOAS et al, 2008.

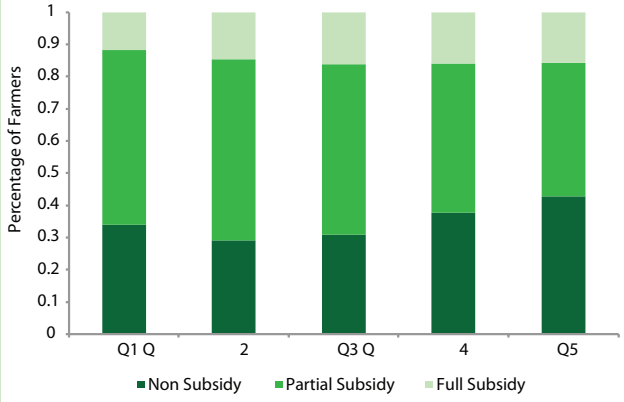
4.2. Who Benefits from Fertilizer Subsidies in Indonesia

The Ministry of Agriculture seeks two objectives with the fertilizer subsidy program. First, it seeks to increase agriculture productivity and preserve national food security and, second, it aims to enhance farmers' ability to optimize the use of fertilizer. However, there is also a sense that the program is a tool to achieve broader goals, ascribing to the program the objectives of maintaining farmers' welfare and poverty alleviation. This report finds that the fertilizer subsidy achieves its objective in a very inefficient way, with costs outweighing benefits.[28] Thus, the attainment of these other goals can be accomplished in a more cost-effective manner by addressing farmer's credit constraints rather than subsidizing production, through direct income support or cash transfers.

Using the Agricultural Census 2003 and the Rice Household Survey 2008 for Indonesia, this section analyzes the distribution of benefits from fertilizer subsidies (subsidized urea). The findings suggest that most farmers benefit from fertilizer subsidies. However, the 40 percent largest farmers capture up to 60 percent of the subsidy. Furthermore, fertilizer shortages also mean that very few farmers (fewer than 10 percent in 2007) paid the regulated price as stipulated by the MoA. The regressive nature of the fertilizer subsidies — the result of larger farms using a larger volume of fertilizer — is in line with research carried out in other countries.[29]

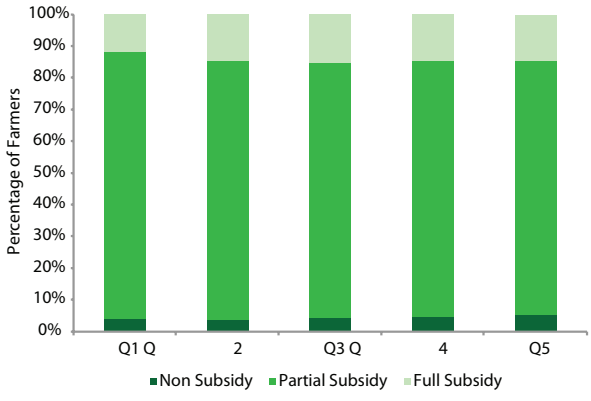
There is no evidence of targeting subsidized urea. When looking at the incidence of benefits by land-size in 2003, there were subtle differences that favored smaller farmers (those in land-size quintiles 1-3). However, while the coverage of the subsidy program increased in 2007 the targeting was ineffective and these differences disappeared (Figures 4.5 and 4.6 show that all quintiles benefited equally from the fertilizer subsidy). As the government increased spending on fertilizer subsidies, a larger number of farmers benefited. In 2003, close to 65 percent of surveyed farmers reported capturing either full or partial assistance, with this figure increasing to 96 percent by 2007.

Figure 4.5: Farmers receiving subsidized urea by quintiles of land size, 2003



Source: World Bank staff calculations.

Figure 4.6: Farmers receiving subsidized urea by quintiles of land size, 2007



Source: World Bank staff calculations.

Very few farmers are paying for fertilizer at the regulated price. The fact that most beneficiaries belong to the partial subsidy group suggests that fertilizer shortages drove prices upwards. In 2007, about 10 percent of farmers paid the regulated price, while a large majority of farmers in all quintiles paid above the regulated price for fertilizer.

28 From: World Bank 2010d. "Fertilizer Subsidies in Indonesia," Policy Note in "Indonesia Agriculture Public Expenditure Review", (forthcoming).

29 From: World Bank 2010d. "Fertilizer Subsidies in Indonesia," Policy Note in "Indonesia Agriculture Public Expenditure Review", (forthcoming).

Table 4.1: Fertilizer prices by quintiles of land size

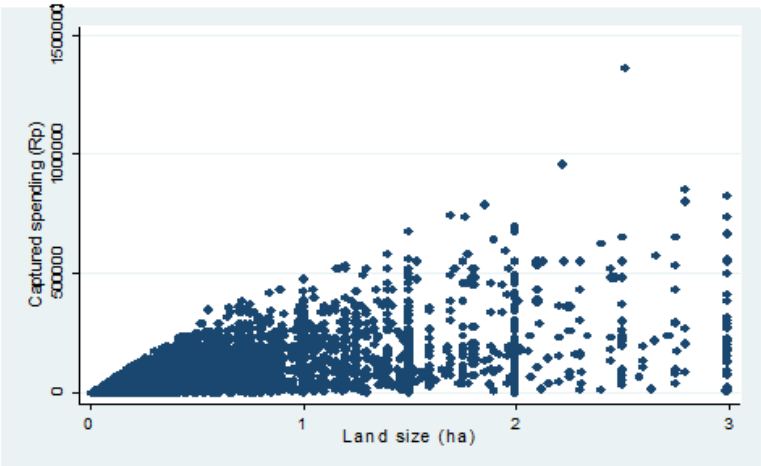
Quintile	Urea Price (Rp)	SP36 Price (Rp)	Average Land (Ha)
1	1,549	2,221	0.12
2	1,512	2,173	0.25
3	1,507	2,182	0.41
4	1,522	2,167	0.73
5	1,530	2,265	1.97
Average	1,524	2,202	0.7

Source: World Bank staff calculations.

There is evidence that, on average, farmers paid similar prices for fertilizer.[30] In 2007, farmers in the first quintile paid on average Rp 1,549 and Rp 2,221 per kg of urea and SP36, respectively, while those in quintile 5 paid on average Rp 1,530 and Rp 2,265 for these inputs. In general, farmers were charged 28 percent above the regulated urea price (HET), while a bag of SP36 was on average 45 percent more expensive than that of urea (Table 4.1).

Public spending on subsidizing urea is regressive and a large share of the benefits is captured by larger farmers.[31] These findings are corroborated by the fact that both surveys show a similar distribution of benefits, but comprise data from two different periods of the subsidy program and random samples of rice farmers. Larger farmers use greater quantities of fertilizer, which means that they absorb more public resources. In both the 2003 and 2007 surveys, the 40 percent largest farmers captured up to 60 percent of the total subsidy. Figure 4.7 illustrates the positive relationship between urea subsidy spending captured and the size of farmers' agriculture land, while Figures 4.8 and 4.9 show how these public resources were distributed across these five farmer groups.

Figure 4.7: Captured urea subsidy spending and land size, 2007



Source: World Bank staff calculations.

30 The mean difference ANOVA tests between quintiles (Bonferroni, et.al, 1969) show small, but statistically significant mean differences in urea prices amongst the land quintiles 1, 2, and 3. In the case of SP36, the mean differences were only statistically significant between quintiles 2, and 5 and 3 and 5. (See for a discussion on these tests, Abdi (2007).)

31 Large farmers does not necessarily mean large in absolute terms, since the average size even in the largest quintile is below 2 ha of land, but these farmers are large relative to the farmers in the other quintiles. These differences in land-size groups in the sample translate into significant differences in income across quintiles, where farmers in quintile 5 earn on average 7 times more gross revenues from rice than farmers in the lowest quintile. In interpreting the results of our analysis, it is important to keep in mind both the small size of most farms in the sample, as well as the large differences in average farm size and income between quintiles.

Figure 4.8: Distribution of urea subsidy spending by quintiles of land size, 2003

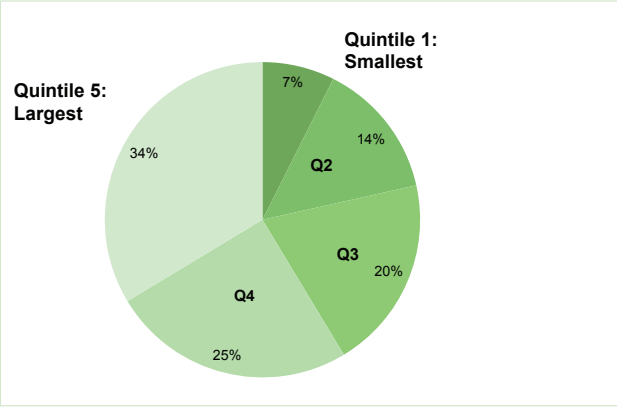
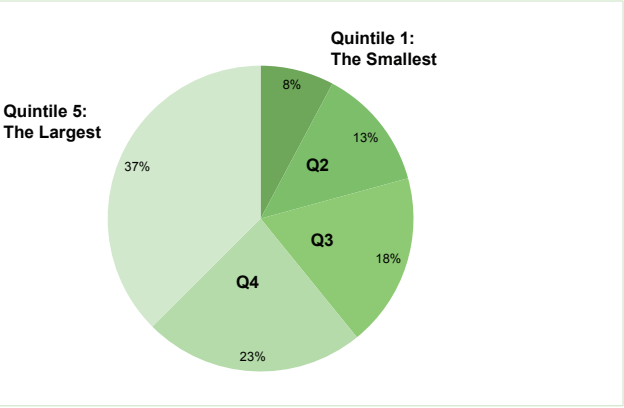


Figure 4.9: Distribution of urea subsidy spending by quintiles of land size, 2007



Source: World Bank staff calculations.

There are significant fiscal savings to be made by improving the targeting of fertilizer subsidies. Assuming a similar distribution of subsidy spending for Indonesia such as that in Figures 4.8 and 4.9, and providing the same amount of subsidies to the smallest 60 percent of farmers, the government would have saved over Rp 9 trillion from its fertilizer subsidy budget in 2008. Although a targeted subsidy is more difficult to administer than a general one, Indonesia has gained valuable experience with implementing targeted subsidy programs (e.g. the Bantuan Langsung Tunai - BLT). If the findings from this surveyed sample were extrapolated to the total population, then close to only one quarter of the government's spending on fertilizer subsidies is actually reaching farmers, meaning that the remaining three quarters are somehow absorbed by the program's distribution system. Having explored the distribution of benefits of the fertilizer subsidy, one question remains unanswered: has fertilizer usage translated into greater agriculture production in Indonesia?

4.3. The Impact of Urea Consumption on Rice Production

This section discusses results from an empirical exercise to estimate the impact of fertilizer subsidies on urea consumption and the impact of urea use on rice yields. A simple micro-model using data from the 2007 household survey explores two important questions: what is the effect of the fertilizer subsidy on urea consumption, and what impact does urea usage have on rice production?

Subsidies contribute to an increased use of urea, which in some cases has resulted in over-use with a negative impact on yields. Thus, the overall relationship between fertilizer use and rice yields is best described as an inverted U-relationship, supporting the existence of an optimum level of fertilizer use, beyond which additional consumption has an adverse effect on output. Empirical analysis carried out for this report finds a maximum level of urea use, at which the relationship with yields reverses from positive to negative which is in line with the MoA recommended use of urea per hectare in Java (200-250 kg/ha). A large number of farmers report that they use higher than the recommended levels of fertilizer. (Refer to Annex II for the model estimation, with Figure A2.1 graphically illustrating the results from the model.)

Most of fertilizer subsidies go towards urea production. A more balanced use of a blend of fertilizers to provide a range of chemicals is likely to have a greater impact on yields. Several studies exploring the productivity of rice in Indonesia have found that farming intensity in some areas has led to soil fatigue as a result of the over-use of urea fertilizer.[32]

32 Pantjar and Timmer (2008). "Indonesia Rice Production: Policies and Realities"; Adiningsih (1997).

The costs associated with the fertilizer subsidy program, both fiscal and economic, outweigh the benefits from achieving higher rice yields. To assess the benefits of fertilizer subsidies in terms of rice production, the elasticities estimated in the model help illustrate by how much urea usage would decline with a given price increase and what this would mean in terms of rice yields. (Annex II Tables A.2.1 and A.2.2) Thus, the removal of fertilizer subsidies would increase the average urea price paid by rice farmers (from an average Rp 1,524 to Rp 2,170 per kg according to the 2007 survey), while urea consumption and yields would have been around 6.3 percent lower. If this decline is translated into total rice production in 2008, then production would have been 3.8 million tons lower (from the estimated production of 60.3 million tons by BPS). At an average dried grain price of Rp 2,200/kg, the decline in production would have resulted in losses worth Rp 8.3 trillion. This is much lower than the cost of the subsidy, budgeted at Rp 15.2 trillion in 2008. As such, the government could have saved Rp 7 trillion even after accounting for the production losses.

The benefits from higher production come at a very high cost. Clearly, the benefits of fertilizer subsidies could be more widespread, with for example other food crops and plantations probably also benefiting from cheaper fertilizer. To the extent that the main policy objective of the government through this subsidy is to increase rice production, a fair simplification for our purposes is to assess benefits solely based on the main policy objective, namely the increase in rice production. This rough estimate suggests that fertilizer subsidies supported increased rice production, but did so at a very high cost.

Given the issues associated with subsidizing fertilizer and other private inputs discussed in the previous sections, the agriculture sector would be better served by a significant reallocation of resources. The government could improve the provision of public services for the agriculture sector by investing in other agricultural public goods that yield higher returns,[33] while keeping two specific objectives in mind: increasing the productivity of the sector and increasing the welfare of farmers. An array of options exists for using newly freed resources, given that fertilizer is just one of many determinants of yields and agriculture productivity that complement, but do not substitute, investments in agricultural R&D, extension services, and irrigation. The following sections suggest how to spend resources better across these three areas in order to achieve higher agricultural productivity and growth.

33 Spending on public goods is likely to have higher returns than private goods, as discussed in the policy note Agriculture Public Spending and Growth, Indonesia Public Expenditure Review, World Bank.

Chapter 5

Technical Efficiency—Improving Public Spending in Agriculture Public Goods and Services

This section analyzes public spending in areas in which the returns to government investment can have a larger positive impact on agricultural growth. Improving the use of available resources and the quality of three important agriculture public goods, namely agricultural R&D, extension services and irrigation, can have a significant positive impact on agricultural performance and boost Indonesia's productivity.

What makes agriculture R&D, extension services and irrigation public goods and why do they warrant public support? These three areas improve the productivity of farmers and generate positive externalities across the sector, when supplied in adequate amounts, but they are under-provided by the market because private actors cannot fully capture the returns on their investment. In the case of agricultural R&D, this generates knowledge that farmers can use to improve agricultural processes and techniques, while extension services disseminate this research and teach farmers how to implement the knowledge. Clearly, knowledge by its nature is a non-excludable good and once provided others can then copy and equally benefit from it. Therefore, there is no incentive to pay for its generation and dissemination. Consequently, this prevents the private sector or individuals from investing in key areas and the market is unable to deliver services efficiently. Similarly, irrigation expands farming opportunities and increases land productivity and farming intensity. It is a common pool good that once it has been provided farmers can then equally benefit as long as the water system is not too congested.

Combined together, these three sub-sectors are complementary and increase farmers' productivity when jointly supplied. When the public sector intervenes to provide these services more efficiently, it generates greater returns to public investment and growth than allocations towards private inputs, e.g. fertilizer subsidies, seeds, etc. In addition, governments are better suited to providing services in these areas because they can collect individual contributions, manage risk better, and capture economies of scale.

The sub-sections below discuss the context and some key issues that ensue in the provision of each of the key agricultural public goods in Indonesia, namely agricultural R&D, extension services, and irrigation, providing recommendations for improving the returns on investment for each of these public goods.

5.1. The Agriculture R&D System in Indonesia

Context

Although Indonesia has significantly increased public spending on agricultural R&D between 2001 and 2007, the level of spending is still low compared with other Asian countries. In real terms, Indonesia's public spending on agricultural R&D increased between 2001 and 2007, which is positive for an investment that yields high productivity returns for the sector. However, this increase failed to continue in 2008 and increase only slightly in 2009[34] (Figure 5.2). Public spending on agricultural R&D in Indonesia was only 0.22 percent of the agriculture

34 Public spending was calculated based on annual budget realization from three government R&D agencies and higher education institutions.

output in 2003. This was at a similar level to Laos (0.24 percent), while much lower than Malaysia (1.92 percent) and the Philippines (0.46 percent). After adding in private sector agricultural R&D investments, the ratio at which Indonesia invests in agricultural R&D[35] stands at 0.27 percent (ASTI, 2009). Countries that are strong suppliers of quality agriculture research, such as Brazil and India, invested substantially more, with ratios above 1.52 percent, respectively (Figure 5.1). Moreover, public R&D spending in Indonesia is mainly comprised of spending by the MoA through the Indonesian Agency for Agricultural Research and Development of the Ministry of Agriculture (IAARD), which constitutes 61 percent of total public agricultural R&D spending.

Figure 5.1: Public agricultural R&D spending as a share of agricultural GDP among Asian countries, 2005 (%)

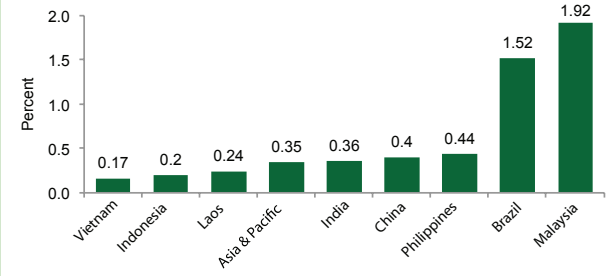
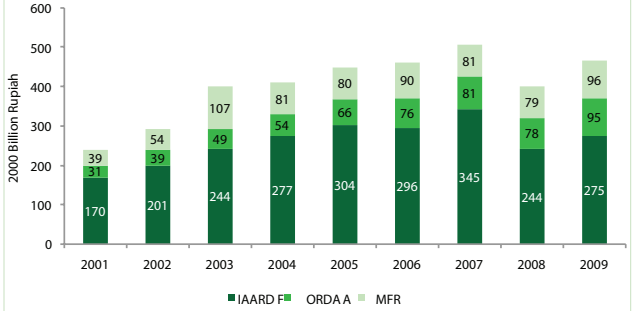


Figure 5.2: Indonesian public agricultural R&D spending, 2001-2009 (Rp billion, 2000 prices)



Source: ASTI database and World Bank staff calculations based on data from IAARD, FORDA, and AMFR.
Note: the 2009 figure is a projection.

The low level of spending is further exacerbated by an ineffective spending mixture, which emphasizes non-researcher staff salaries. The quality of agricultural R&D outputs has been undermined by a significant increase in IAARD's salaries, mostly for non-research staff, and operational and maintenance (O&M) spending. Conducting research for agriculture can be a very labor-intensive exercise and the largest spending item for research agencies is usually the salaries of its researchers. However, the composition of spending at IAARD shows that excluding "salaries" there is limited funding for conducting research projects. Personnel salaries and O&M spending comprise by far the largest share of budget at IAARD.

Five government ministries currently fund and engage in agriculture-related R&D. Although R&D is carried out by both public and private sector centers and institutes, the public sector dominates. There are three main public agricultural R&D agencies and a network of science and technology centers, including universities. First, is IAARD at the MoA which constitutes 61 percent of total public agricultural R&D spending. Second, is the Agency of Marine and Fisheries Research (AMFR) at the Ministry of Marine Affairs and Fisheries (MoMAF). Finally, there is the Forestry Research and Development (FORDA) Agency at the Ministry of Forestry (MoFo). The principal goals of public agricultural R&D in Indonesia have thus far been aimed at enhancing food security, increasing rural incomes and alleviating poverty.

Opportunities for Enhancing Indonesia's Agricultural R&D[36]

The efficient use of resources in Indonesia's agricultural R&D system could be improved by: (i) reassessing the level of spending in the medium term; (ii) adjusting spending composition to improve human resources; (iii) creating a streamlined organizational structure and improving downstream linkages to extension services; and (iv) encouraging greater collaboration with the private sector to improve quality in service delivery.

35 ARI (Agricultural Research Intensity) defined as R&D expenditure as a share of total agriculture output.
36 From: World Bank (2010). "Agriculture Research and Development," Policy Note in "Indonesia Agriculture Public Expenditure Review", (forthcoming).

(i) Reassessing the current composition of medium-term spending

Increasing the level of public allocations for agricultural R&D is a medium-term national priority. However, before focusing on investing more resources major gains could be made by spending better today. As mentioned above, Indonesia spends significantly less than its neighbors on R&D when measured as a share of agriculture GDP. Indonesia should achieve research intensity levels that are comparable with other middle-income countries. The new strategic plan (Renstra) should prioritize development expenditure (currently only 17 percent of total budget) over routine expenditure. While reinvigorating rice variety and systems research is a priority, rebalancing resources and efforts to give growing emphasis to non-rice commodities (such as cocoa, coffee) is also important.

(ii) Adjusting spending composition to improve human resources

Human resources in the agricultural R&D system will deteriorate if current recruitment trends for non-researcher staff and high attrition rates are not reversed. In IAARD, only 19 percent of the staff in 2008 was classified as researchers (Figure 5.3). The ratio of researchers to total staff has declined in recent years, as a result of recruitment of non-research staff and the loss of researchers who retired. Only AMFR improved its recruitment of technical staff after 2005 (Figure 5.4). Thus, not only did the attrition rate accelerate, but a significant number of senior scientists will be retiring soon, or have been promoted to other management positions in the MoA. Taking IAARD as an example, it is expected that over 6 percent of its researchers will retire by 2013 and these will represent 13 percent of its staff possessing PhDs at the agency.[37]

Figure 5.3: Staffing composition in IAARD, 2001-08

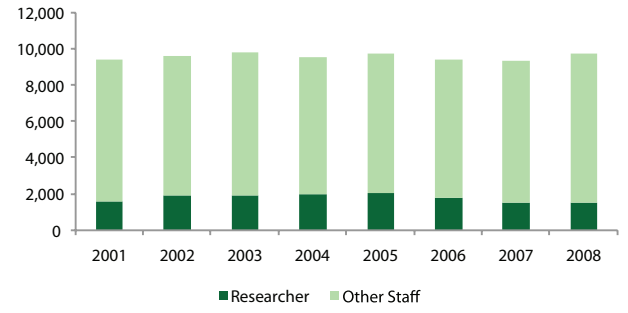
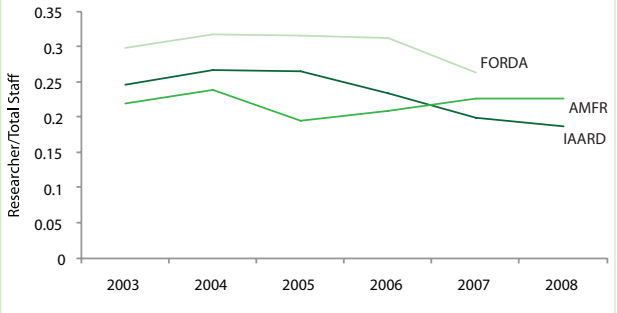


Figure 5.4: Ratio of researchers to total staff, 2003-08



Source: World Bank staff calculations, IAARD, FORDA and AMFR.

The agricultural R&D institutions need to reallocate their spending mix towards development and away from routine expenditure, investing more to develop human resources. Public investment and funding to conduct research projects in Indonesia's R&D system is still limited. Personnel salaries and O&M spending still dominate the budget of IAARD, the largest R&D institution, while recruitment has benefited mostly non–research staff. GoI should reallocate spending to provide more resources for research projects and incentives to attract qualified staff. In the longer term, IAARD needs to aggressively recruit quality researchers to reverse this trend and conduct high quality R&D. Furthermore, a strategy that gives priority to the recruitment of qualified young researchers is also needed, while at the same time encouraging existing scientists to pursue advanced degree programs by allocating greater resources to its training budget. Emphasis on the development of staff skills in agri-business and marketing, and enhancing functional skills are also important. All of these would not only boost research outputs but also enhance the quality of human resources in the R&D system.

37 The total number of staff working at IAARD in 2008 was 8,229 staff.

(iii) Creating a streamlined organizational structure, and improving downstream linkages to extension services

The fragmented structure of agricultural R&D in Indonesia between several line ministries fosters inefficiencies, hinders inter-ministerial coordination, and weakens linkages between research, extension services and ultimately farmers. The fragmented system results in duplicating functions, limited research budgets and weak linkages. Various ministries[38] establish their own R&D agencies that coordinate the R&D units within the ministries in terms of planning, financing, conducting, monitoring, and evaluating the R&D programs. This has resulted in inefficiencies in planning and the utilization of funds and human resources. Meanwhile, agricultural R&D is also providing technology development and information supply for extension services, another sub-sector that at the same time is also facing coordination problems.

The MoA is taking steps to strengthen the dissemination of technology innovation from IAARD, through the Assessment Institutes for Agricultural Technologies (AIATs). The newly introduced PUAP (Rural Agribusiness Development/Pengembangan Usaha Agribisnis Perdesaan) program seeks to address the agribusiness needs of farmers through the provision of capital grants and technical support in 10,000 poor villages and the AIATs along with the Agency for Human Resource Development (AAHRD) have been tasked with its implementation. Thus far, there has been no evaluation of the PUAP program and its effrectiveness in strengthening the dissemination of technology. Right now, IAARD has 32 AIATs at the provincial level, under the responsibility of the Center for Assessment and Development of Agricultural Technology (BBP2TP -Balai Besar Pengkajian dan Pengembangan Teknologi Pertanian) in Bogor. The 32 AIATs accounted for a significant portion of the total IAARD budget, at 26-32 percent. Although the AIATs are crucial to strengthen the linkages between R&D at the central level and extension agents in the districts, it is debatable whether each province needs such an agency. A system by which AIAT centers are positioned with agro-ecological zone specializations, serving all provinces concerned, would foster cross-province cooperation, lead to less fragmentation and reduce the potential for duplication of efforts and functions at the provincial level.

The development of a knowledge-intensive innovation system will need to be based on strategic partnerships and linkages both within and outside Indonesia to enhance access to national and global best practices, which can transform the national agricultural research agency (IAARD) into the center of research excellence it is striving for. Development of research networks and research placements (nationally and internationally) will also help to decrease the relative isolation of Indonesian agricultural science. There is also a need to develop a system for applying mature technologies developed by the research system so as to increase uptake by farmers and improve acceptance by local government institutions. This objective can be achieved through a system of national and international research- extension- farmer linkages including partnerships, consortia, and dissemination methodologies, partnership of IAARD with overseas research entities to improve productivity/ sustainability in key basic production systems supported by a system of competitive grants.

Greater coordination could be achieved through the establishment of a council system, the reallocation of resources towards tailoring research that emphasizes all agricultural needs, and the utilization of ICT for strengthening research-extension-farmers linkages. An agricultural R&D council would establish an institutional arrangement where policy-making resides in a governing council consisting of the ministers involved in agricultural R&D (agriculture, forestry, fisheries, science and technology, higher education, etc.). Furthermore, greater coordination at the central level or cross-province is also needed to ensure a more efficient role of the AIATs. International experience shows that an R&D council is an effective way to coordinate research across different sectors and institutions, and develop a system of national and international research-extension-farmer linkages that could increase the adoption rates of selected technologies. This also needs to be supported with the aim of increasing efficiency and effectiveness in generating and delivering technologies and science-based information that serve

38 The existing agricultural research and development system involves at least five ministries at central level. The Ministry of Agriculture (MoA) for crops and livestock research, the Ministry of Forestry (MoFo) for forestry and agro-forestry research, the Ministry of Marine Affairs and Fisheries (MoMAF) for marine and fisheries research, the State Ministry of Science and Technology (RISTEK), funds research through competitive grants, and the Ministry of National Education (MoNE) that coordinates university research.

all agricultural needs. There is also a strong case for using performance-based budgeting to improve the level of monitoring and increase the incentives for producing higher-quality outputs that respond to varied client needs. Another effective strategy to improve linkages includes offering a range of opportunities for extension workers and farmers' participation in joint decision-making on research themes through coordinating committees or meetings; exchanging staff between agricultural research and extension organizations, enabling personnel to work for a specified time in each other's establishment; and utilizing ICT for strengthening research extension farmer linkages (ODI, 2000, FAO (2004)). With decreasing costs of connectivity, this can be facilitated through broadband access for all researchers and extension workers to stay abreast with the latest advances and developments in their fields of expertise and experience.

Box 5.1: The Indian Council of Agricultural Research (ICAR)

The Indian Council of Agricultural Research (ICAR) is an autonomous organization under the Department of Agricultural Research and Education, Ministry of Agriculture, Government of India. The Council is the highest body responsible for coordinating, guiding and managing research and education in agriculture including horticulture, fisheries and animal sciences in the entire country. ICAR comprises 97 institutes and 45 agricultural universities, 30,000 personnel, with more than 7,000 engaged in active research, all of which make it one of the largest national agricultural systems in the world.

To cope with staff training and addressing research management issues ICAR also established a National Academy of Agricultural Research Management (NAARM). In addition to coping with the size of its organization, the technical functions of ICAR are grouped into eight subject-matter divisions, namely crop science, horticulture, fisheries, natural resource management, agricultural engineering, animal science, agricultural education, and agricultural extension, each headed by an eminent scientist as a deputy-director general.

The Indian R&D council has proven highly effective at coordinating research across different sectors and institutions. It institutionalized priority setting, helped improve the allocation of funds to priority research areas, established a competitive research funding mechanism, and made the R&D system more responsive to farmer needs by focusing on applied and adaptive research. The system has considerable technological capacity in place and gradually strengthened its focus on non-staple foods, its interaction with the private sector and its farmer focus (World Bank, 2005).

(iv) Greater collaboration with the private sector

Indonesia is an innovation-follower due to low R&D spending and limited collaboration with the private sector. In terms of performance of the innovation system based on knowledge and education, Indonesia is still one of the innovation "followers" (Spielman and Kelemework, 2009). This is not surprising given the already discussed low levels of investment on R&D. The government is already attempting to strengthen the link with the private sector, e.g. IAARD established an initiative called the Intellectual Property and Technology Transfer Management Office (IPTTMO), a semi-autonomous foundation, to link with private companies and help commercialize IAARD's innovations. This collaboration could be expanded to reach other technology developments beyond machinery innovations, animal vaccines, and feed additives that have been the main focus to date.

The government can set incentives to induce firms to invest more, deepening private investment for agricultural R&D. Through intellectual property protection, firms can be assured they may retain rights to the findings of their research, which can enable the recovery of their capital investment. Furthermore, authorities can also help overcome collective action problems by changing institutional arrangements, such as the establishment of levies, the provision of subsidies (or tax concessions) or grants that correct for market failures inherent in the creation of knowledge. These actions may serve to make private investment in R&D more appealing and generate greater interest to develop new agriculture knowledge and better farming techniques. The agricultural R&D establishment should see itself as part of a broader agricultural information system that includes linkages with extension, universities, private sector, etc. and thereby develop a system of national and international research.

5.2. Agriculture Extension Services

Context

A closer look at the provision of extension services at the sub-national level from the fieldwork suggests that meeting the national objectives set forth will require greater investment and efficiency gains from public spending. The districts are executing a large share of the extension budget as a result of decentralization, but those that have established unified extension agencies are delivering better quality services and reflecting stronger linkages between planning and budgeting. By strengthening the adoption of new technologies at the local level and increasing the knowledge-base of extension workers, the quality of service delivery could be enhanced. In addition, a closer look at selected districts shows that operational costs are under-funded and extension workers are spread thinly to cover many farmers.

Agriculture extension spending in Indonesia doubled over 2006-09 as a share of agricultural GDP. Extension services are highly decentralized and all three levels of government are executing a component of the budget, which is largely funding salaries and operational funds. This increase in spending from 0.54 to 1 percent of agriculture GDP was largely driven by decentralizing the provision of extension services to the local level and a large recruitment effort of contractor workers by the MoA, in order to pursue the goal of achieving one extension worker per village. The central government's spending for extension ranged between 10-15 percent of the MoA's total budget, equivalent to Rp 0.55-1.2 trillion in 2006-09. Furthermore, central government spending for extension services increased by 62 percent in real terms driven primarily by two big pushes in 2006 and 2009. These large increases mostly went to finance salaries (27 to 46 percent of total central extension budget), the result of the central government hiring a large number of contractors to be trained as extension workers and based at the district level. It also financed increasing transfers to cover operational costs (Belanja Operasional Pegawai/BOP) from the MoA to provinces and districts for the operational expenses of civil servant (PNS) extension workers.

Figure 5.5: Extension expenditure (Rp trillion)

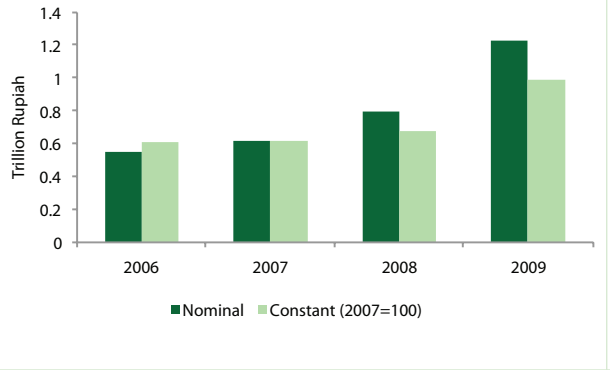
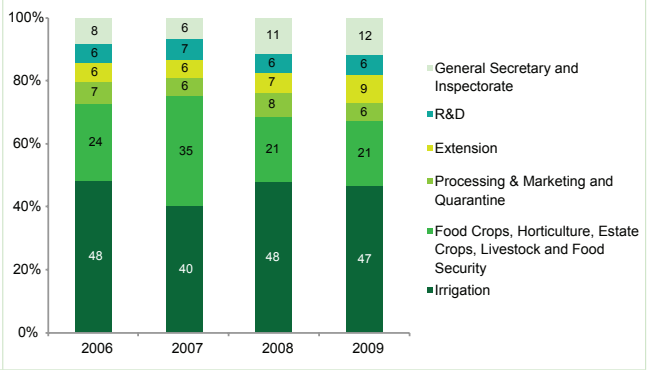


Figure 5.6: Extension expenditure as % of central agriculture spending (excluding agricultural subsidies)



Source: MoA.
Note: 1. 2006-08 figures are realized, while 2009 figure is planned. 2. Central agricultural direct spending consists of spending for agriculture, irrigation, and agricultural subsidies.

Decentralization has created a lack of clarity over funding responsibilities across different levels of government, undermining the provision of extension services. Two clear examples of this are seen in the increase in central transfers for operational expenses (BOP) and the hiring of contractors by the MoA at the district level. By trying to compensate for the lack of funding in the districts, the MoA has assumed this expense and encroached into the districts' mandate. This is setting a perverse incentive for greater under-funding of services at the local level over the upcoming years. Instead of complementing public spending, the increasing transfers are substituting sub-national spending for extension because the districts do not bear the cost and welcome this intervention. At the district level, there are two types of extension workers, the regular PNS staff, which are paid by the district

budget, and contractor workers that were recently deployed and are funded and under the mandate of the MOA. In some districts, the MoA's involvement has generated conflicting directions in the advice provided, for the agriculture priorities set by the central government sometimes differ with the planning objectives of districts.

The institutional and management changes to the agricultural extension system have led to a lack of direction and clarity of roles. The implementation of decentralization has created different interpretation of extension service delivery and led to uncertainty with regards to institutional affiliation and staff management. Most districts have moved towards a disaggregated extension scheme (non-unified extension) and others have disregarded the responsibilities to provide funding and support for extension by focusing on infrastructure, rather than human resource development projects. This is exacerbated by the common woes that agriculture extension efforts suffer worldwide, where services are greatly undermined by relatively low rural incomes, poor incentives, poor facilities, and lack of skills.

Only about half of the total number of districts in Indonesia has followed the Extension Law that mandates setting up a unified extension agency. As of November 2009, 57 percent of total districts and 73 percent of total provinces had established unified extension agencies. As of November 2009, 258 out of the 491 districts/municipalities and 24 provinces out of 33 provinces had established unified extension services.

Opportunities for Enhancing Indonesia's Extension Services Delivery[39]

The delivery of extension services in Indonesia could be strengthened in several ways, improving efficiency in the use of resources and service delivery in the short run, by: (i) reassessing the current composition of medium-term spending, (ii) improving the quality of extension services (through linkages to new technologies and better human resources and training), and (iii) better institutional arrangements, and linkages to the private sector, for extension services delivery (while emphasizing the need to unify extension services at the district level). While in the long run Indonesia should increase investment in extension services to yield higher returns and productivity gains for the sector, there are significant efficiency gains to be made with the current allocations.

(i) Reassessing the current composition of medium-term spending

At the current spending level, sub-national governments do not have sufficient resources, either in terms of staff or funds, to meet what is mandated by the Extension Law. The establishment of unified extension agencies as mandated by the Extension Law has fiscal implications. As more districts start to unify, the scope of the work plan will expand, as well as administrative costs from the greater extension services provision. While beneficial, this will create fiscal responsibilities in terms of salaries, goods and services, and administrative costs, and will require reallocating spending from those agriculture Dinas that housed extension activities previously to the newly established extension agency. While there is room for improving the efficiency of spending, additional investment is required at the local level to meet the national policy of one extension worker per village, and to provide IT solutions to strengthen linkages to new technologies. In addition, districts will require resources to retain well-performing contractors in the years ahead and to build capacity of the current staff.

Efficiency in public spending could be improved by reallocating resources away from administration towards programs focusing on training, technology enhancement, and an incentive system at the district level.[40] The MoA is beginning to develop fiscal incentives, but at the moment deconcentrated funds are devolved to the districts with few conditions. A matching grant approach can be used in a proactive manner to foster reform and, for instance, accelerate the unification of extension. By offering a matching grant, coupled with the issuance of the unification guidelines, the central government can encourage sub-national governments to prioritize and increase their share of spending for extension and to unify extension into a single Dinas as mandated by the law. Nonethe-

39 From: World Bank (2010c). "Enhancing Agriculture through Investment on Extension Services in Indonesia," Policy Note in "Indonesia Agriculture Public Expenditure Review", (forthcoming).

40 Administrative/obligatory programs consist of: office administration, personnel infrastructure, and reporting system improvement.

less, by setting fiscal incentives, the MoA needs to bring stronger management and discipline to the approach (e.g., stronger strategy foundations, identified outcome objectives, monitoring, and accountability). Moreover, a closer look at spending classified as "office administration/obligatory" in the districts could yield efficiency gains and liberate resources for functional programs that have direct impact on the provision of extension services.[41]

Greater fiscal incentives to provinces and districts would facilitate the establishment of unified extension agencies and encourage spending for extension services. By issuing technical guidance to facilitate the process of unification, and drawing on past experience of districts that have unified, the MoA can assist compliance with the law. In practice, establishing extension institutions as required by the Extension Law is not easy and subnational governments would greatly benefit from receiving support during implementation. Also, to ensure that these guidelines are put to practice, districts could be given fiscal incentives that encourage them to set up unified extension agencies. The MoA could develop a matching grant approach as a way of fostering reform to accelerate the unification of extension. By offering a matching grant to unified districts only, the central government could encourage districts to prioritize and increase their share of spending on extension.

The Transfers for Operational Costs for Extension Workers

Since 2006, the MoA has started funding a component of the extension workers' operational costs at the provincial and district levels to address the issue of limited resources for mobility and implementation of extension activities. Given that extension workers are covering many farmers and sometimes several villages, the limited funding of operations at the local level was restricting service delivery to farmers in remote areas. Operational expenses are important because they determine the mobility of extension workers and enable training activities that improve quality in service delivery. Thus, the MoA stepped in with transfers for operational costs (BOP/Belanja Operasional Pegawai) covering transportation of up to Rp 250,000 per worker per month. In 2008, the MoA transferred around Rp 85.4 billion to cover 28,465 PNS staff.

Local governments have little incentive to increase their operational budgets because they do not bear the cost of the MoA stepping in with transfers for operational expenses. In order to improve service delivery particularly at the district level, the composition of spending needs to favor an adequate budget-share for operations and transport to cover timely routine visits to farmers and villages, and the implementation of activities. Across all sampled districts operational expenditure was low and greatly constrained extension workers' mobility and implementation at the local level. Thus, these operational central transfers did not complement, but substituted operational spending across visited districts. There is an incentive to under-fund operational costs because the MoA is partially paying for them. Therefore, by establishing fiscal incentives for these transfers in the form of matching grants for operational costs, funding for operations and transportation could increase at the local level. Thus, the districts should bear a portion of the cost for the BOP transfer for operations.

41 Development programs such as: farmer's welfare, agriculture/horticulture marketing, agriculture/horticulture production, and technology application improvement.

Box 5.2: One extension worker per village[42]

It is a stated priority in the government's medium-term planning to expand extension service delivery at the district level and reach coverage of one extension worker per village. This has been the driver of the MoA's increasing resources for extension at the district level, directing greater funding for a growing number of contractors in the districts to close the gap in service delivery. The question that remains is: how much will it cost to the MoA to meet this objective?

Some back-of-the-envelope calculations show how difficult and costly this will be. By 2008, the total number of contractor workers the MoA had deployed surpassed 15,165 and, considering the 29,065 currently employed PNS staff in the districts, brought the total pool of extension workers to over 44,000. When considering that the aim is to provide one extension worker to almost 70,000 villages, this would require hiring an extra contingent of 26,000 contractors to fill in the void. This represents a massive 60 percent increase in the number of extension workers in Indonesia. Assuming that each new entrant is hired at the lowest salary level, this would entail Rp 1.1 million per month per worker including their share of the BOP transfer to cover operational expenses. This would represent a minimum[43] of Rp 0.283 trillion, or around 4.3 percent of the MoA's budget.

	2008	Minimum Salary	Minimum Operational Cost (BOP)	Total Cost
Number of villages	69,929[44]			
PNS	29,065			
Contractors	15,165	Rp 1,000,000	Rp 100,000	
Total	44,230			
Extra contractors needed	25,699			Rp 282,689,000,000

Source: World Bank staff calculations.

(ii) Improving the Quality of Extension Services

The quality of the extension services delivered depends greatly on: the linkage to new technologies and to innovative agriculture research, as well as the quality of the extension staff that disseminate the research to farmers. Therefore, to ensure that the system is delivering quality services at the local level, extension staff needs to have access to the R&D institutions that produce this knowledge and connectivity to wider hubs of agriculture research. This means that training and human resources are crucial because they ensure that there is high capacity within the extension worker pool.

Links to New Technologies and Information

Based on the sample from the field study, the quality of extension services remains poor while upstream linkages to agricultural R&D are also weak. In general, farmers and extension workers access and share the technological development, information, and crop management techniques from face-to-face consultations, magazines, newspapers, and short-message services (SMS). Research outcomes are not reaching farmers effectively and being fully disseminated at the local level. The field study finds that information and services that are given by the provincial assessment technology institutions (AIATs) are sometimes not in line with those given by extension workers. This is the result of weak coordination across agencies providing extension and R&D at all tiers of government. For example, the AIATs provide advice based on the research outputs, while extension workers give services based on the technical guidance from the MoA. Furthermore, the lack of local Internet connectivity isolates the extension agencies from technology developments and information.

42 Center of Agricultural Extension Development (AAHRD) (2008). "BPSDM Pertanian Dalam Angka".
43 This number represents the salary bracket of contracted extension workers with senior high school graduates, plus BOP transfers, over a 10 month contract.
44 Center of Agricultural Extension Development, AAHRD, (2208). General Guidelines to the Revitalization of Agricultural Extension.

The adoption of new technologies and crop-management techniques can be improved through the provision of internet connectivity and better upstream linkages to the R&D institutions and their outputs. Extension service agencies at the district level need to be provided with internet connectivity to ensure that extension workers and farmers have simple and timely access to national and international agricultural R&D centers and knowledge networks. In the Farmer Empowerment through Agricultural Technology and Information (FEATI) initiative, an early stage of introducing internet connection to farmers called e-farmers has started. This initiative aims to improve technology and information services for farmers. The MoA is also introducing cyber-extension, which seeks to provide every extension services center at the district level with a computer and internet connection. Broadband access can help to strengthen the linkage to R&D outputs, providing services based on more than just one source's guidance, and ensure workers stay abreast of the latest agriculture advances and developments in their field of expertise and experience.

The utilization of the internet by extension workers and farmers to access agricultural technology information is still very limited and at an early stage. Across visited districts, internet connections for farmers and extension workers are almost non-existing. In order to keep extension workers and farmers up to speed in terms of new agricultural developments internet connectivity is essential. This would allow extension workers to link to other sources of agricultural knowledge and advice, not only from local sources but also from international networks. For example, in Lampung province, the Lampung Fishery and Forestry Extension Coordination Agency (Bakor PPK) has launched a cyber-extension program to facilitate guidance extension for farmers via the internet. While this is an ongoing program, it is yielding interesting results in terms of providing rapid and timely extension advice.

With a medium-term perspective, introducing the use of information and technology through ICT solutions can provide just-in-time extension and technology advice and will require additional resources. The delivery of extension services through ICT solutions employing cellular phones has proven very effective in countries such as India, and for the pilot program for the province of Lampung. It has been an efficient way to deliver information on agriculture cultivation from extension officers. Farmers in the districts report that when pest problems arise there is limited access to timely advice from extension workers in the village. Hence, ICT solutions can change that and expand the coverage of the services one extension worker could provide contacting farmers through text messages. It would require, however, significant initial investment to provide connectivity to isolated rural areas. Thus, given the limited connectivity across certain islands in Indonesia it could be a more medium-term objective, after a big push to increase rural connectivity. The MoA is considering developing a cyber-extension initiative that would aim to provide internet connectivity at the local level, but this is still at an early stage.

Human Resources and Training

The MoA has directly hired about one third of all extension workers deployed in the districts, assuming responsibilities that have been decentralized. Given that these contracted extension workers are funded by the central budget (AAHRD), it creates an accountability problem and hinders smooth coordination, since these workers are directly accountable to the MoA. In some districts, this has generated conflicting advice, with contracted workers following the agriculture priorities set by the central government, which may differ from the planning objectives of the districts.

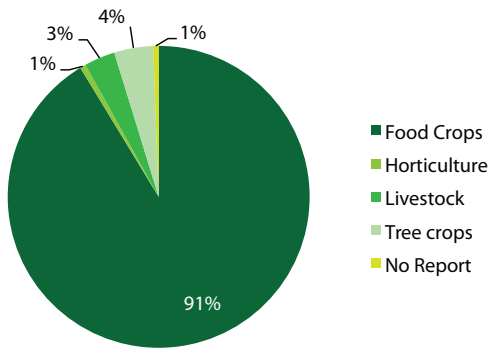
With the aim of strengthening the provision of extension services at the district level, the funding responsibility, accountability and direction of contractor extension workers should be fully transferred to the districts. The current system of dual staffing and accountability across PNS and contractor staff is undermining the ability of districts to guide and provide quality extension services. District governments should have total control over the direction of extension advice. In 2008, the central extension agency reported total spending to cover the 15,165 contracted extension workers of Rp 0.23 trillion. These resources could be transferred to the districts to better align staffing, accountability and funding arrangements. This transfer of resources and responsibilities should be combined with a strengthening of capacity at the district level, since part of the reason for the central government encroaching on district responsibilities has been the districts' inability to deliver high quality public services.

The educational attainment of most extension workers is below bachelor degree level and largely focused on expertise in food crops. Nearly 60 percent of all extension workers[45] do not hold a bachelor degree. Of the PNS extension workers, 54 percent do not hold a bachelor degree, 39 percent have bachelors and only about 1 percent hold graduate degrees. In the case of contracted workers, 70 percent do not hold bachelors and only 30 percent hold bachelors. With regard to area of expertise, in 2008, 91 percent of extension workers provided technical guidance on food crops. Consequently, estate crops were the second sub-sector and accounted for only 4 percent of extension workers' advice (Figure 5.7 and Figure 5.8).

Figure 5.7: Educational level of extension workers, 2008 ('000)

	< B. Sc.	B. Sc.	MSc	Not Defined	Total
PNS	15.6	11.4	0.3	1.8	29.0
Contracted	10.5	4.7	0	0	15.2
Total	**26.1**	**16.1**	**0.3**	**1.8**	**44.2**

Figure 5.8: Extension workers based on sub-sector, 2008 (%)



Source: AAHRD Statistics, 2008.

Extension workers in Indonesia receive little training,[46] an essential element in ensuring that farmers receive quality agriculture advice given their own low educational attainment. Since 2007, the total number of training participants decreased significantly and was half the figures reported in 2004, reduced from 12,745 to 6,237 participants over 2004-08 and by 51 to 14 percent (Table 5.2). In addition, the training figures suggest that workers mostly took courses in administrative skills (non-related to agriculture, for example managerial or computer training), followed by food crops and agribusiness. In the case of contracted extension workers, prior to deployment they only received two weeks of initial training that could hardly bring them up to speed in terms of acquiring quality agriculture knowledge to transmit to farmers. Nonetheless, the educational attainment level of the second contractor batch in 2008 was slightly higher. Within this pool, the number of graduates recruited increased from 17 to 36 percent (from 936 to 3,760), a positive move towards hiring better qualified workers.

Table 5.1: Number of training participants conducted by STTPs and BBPPs[47]

Topic/Total	2004	2005	2006	2007	2008
Administrative skills (non-agriculture)	5,925	5,958	6,817	3,269	3,269
Food crops	2,570	2,601	3,206	753	753
Estate crops	515	533	450	426	426
Livestock	1,265	1,291	1,750	923	923
Agribusiness	2,470	2,500	2,427	866	866
Total participants	12,745	12,883	14,650	6,237	6,237
Percentage of participants (%)	51.2	48.0	51.4	18.1	14.1

Source *Source:* AAHRD Statistics 2005-08.

45 There are two classifications of extension workers in Indonesia: (1) civil servants (PNS/Pegawai Negeri Sipil) extension worker which is a staff of either central or district government; and (2) contracted extension workers, which hold temporary contract with the MoA.

46 The training for extension workers is mostly conducted by several public sector institutes under AAHRD, such as STPP (Sekolah Tinggi Penyuluhan Pertanian/Agriculture Extension Academy), the provincial BBPP (Balai Besar Pelatihan Pertanian/Agriculture Training Center), and the local universities.

47 BBPP (Balai Besar Pelatihan Pertanian) is an Agricultural Training Center.

The Agency of Agricultural Human Resource Development (AAHRD) at the Central level needs to take the leadership in providing appropriate training at entry-level as well as refresher training for all extension workers as part of an overall HR development strategy for extension workers. This needs to be done in close coordination with Districts and provinces effectively utilizing the six central-level agricultural extension colleges, the sixteen provincial training centers, universities, as well as the private sector. From an efficiency point of view, it is preferable for AAHRD to expend resources in building the human resource capacity of the extension workers nationally rather than providing operational costs (BOP) that is the responsibiliity of the districts. AAHRD needs to establish sound policy guidelines for a clear career development path that is based on continual training and refresher courses for extension workers. Training curricula at the central level need to take into account a broader set of activities and techniques for upgrading their skills and diversify away from a mindset that focuses exclusively on food crops extension. Training should also be provided so that extension workers can disseminate not only crop specific techniques, curricula should also focus on non-crop related issues, such as access to credit or adding value to agricultural products, access to markets and agriculture marketing so that the extension worker is seen as a "knowledge broker" who can assist farmers with access to information and knowledge on a wide range of activities that are of interest to farmers. From a medium-term perspective, districts in consultation with AAHRD can set incentives (scholarships, performance assessments by farmers) to recruit and retain better-qualified staff. This may require a comprehensive training needs assessment prior to the development of the training program.

(iii) Better Institutional Arrangements and Linkages to the Private Sector to Improve Service Delivery

In order to accelerate the implementation of the Extension Law and improve extension services delivery, the MoA should issue the implementation guidelines for the districts to unify extension agencies. When looking across the visited districts, those that established a unified extension agency tended to better align central and sub-national priorities, reflecting stronger linkages between their planning and budgeting, and enjoyed greater coordination. Not only are unified districts providing better quality extension, but stronger linkages between planning and budgeting have translated into higher disbursement ratios and synchronization across programs. Furthermore, the districts with unified agencies are more accountable for resources because they aim to monitor and evaluate activities and track results better. In non-unified districts, such as Kupang, Lamongan, extension planning is carried out within the Dinas Agriculture and because spending is blurred within other programs there is limited reporting. Although unifying extension has been mandated by law, the regulation leaves discretion over the decision to the district head (bupati), resulting in a significant number of districts still not being unified. Non-unifying extension has undermined the provision of services and the MoA can assist districts in complying with the law by giving them guidance on the process of implementation and providing appropriate incentives. Ensuring that districts unify their extension services will improve the quality of those services.

Programs[48] that focus on enhancing the performance of extension services highlight that the private sector has been a strong cooperator as it sees the value of working with groups of farmers in delivering agricultural information. It is along these lines that a new approach towards agricultural extension provision is increasingly being adopted worldwide. These programs shed some light on the importance of linking farmers, government and private sector extension services, particularly in the area of improving access to markets and adding value. The private sector is delivering extension services in some districts through demonstration plots, and the promotion of pesticides or seeds to farmers, and local authorities could take greater advantage of this work and build on these efforts.

Reaching out to the private sector could improve the quality of extension services at the local level, enabling greater efficiency in spending by reducing duplication and creating synergies. As corroborated by the World Bank field study, extension services provided by private firms are of high quality and have a positive impact on service delivery, mostly though demonstration plots and information and training for fertilizers, hybrid seeds and pesticides. In districts with high private extension presence, a partnership arrangement should be encouraged that can reduce the duplication of activities and better link valuable private sector knowledge to farmers and extension workers. This would liberate resources to provide extension services in areas of limited interest and private sector

48 For example programs supported by World Bank projects in the agriculture sector in Indonesia such as DAFEP and FEATI.

engagement. In districts with little private presence, private sector participation could be encouraged through the provision of funding/competitive grants or the outsourcing of certain activities. In both cases, the local extension agency can play a greater role in guiding and supervising quality of these private services.

5.3. Investing in Indonesia's Irrigation Systems

Context

Investing to provide an effective irrigation system will yield high returns in terms of agriculture productivity. Not only is irrigation an important input to agricultural production, but it is also directly linked to improving farmers' welfare by expanding the agriculture opportunities of many poor farmers. The World Development Report 2008 estimates that economic returns for investments in effective water systems are on average 15-20 percent around the world, excluding the social gains they entail. Along these lines, Hussein and Wijerathna (2004) conducted an analysis of household data in 2001-02 to find that irrigation had a significant impact in reducing poverty in Indonesia. Because the quality of water systems directly impacts the quality of outputs and agriculture productivity, it is important for the public sector to invest in supplying adequate amounts of this input to farmers.

The benefits of irrigation are evident in higher rice yields per hectare and cropping intensity for provinces with more irrigated land. The provinces with more irrigated land in-Java also have better quality soil so they reflect greater productivity in terms of rice yields per hectare than other provinces. As Figure 5.9 illustrates, those provinces with greater coverage of irrigated land produced higher rice yields in 2008. To a large extent, this is because irrigation is one of the main inputs for rice production and Javanese provinces are not only better irrigated but have stronger institutions, for example Water User Associations (WUAs), and farmers with greater access to inputs, such as fertilizer, quality labor, etc. Other contributing factors to the higher productivity on Java are soil characteristics and smaller plot sizes, which tend to be worked more intensively. In provinces with greater coverage of irrigated land, farmers harvest paddies more intensively and land is more productive in terms of annual rice yields per hectare. While topography across islands plays an important role, the number of seasons a paddy can be harvested during one year is determined to a great extent by the coverage of water systems and soil fertility.

Figure 5.9: Rice yields per ha and wet land, 2008

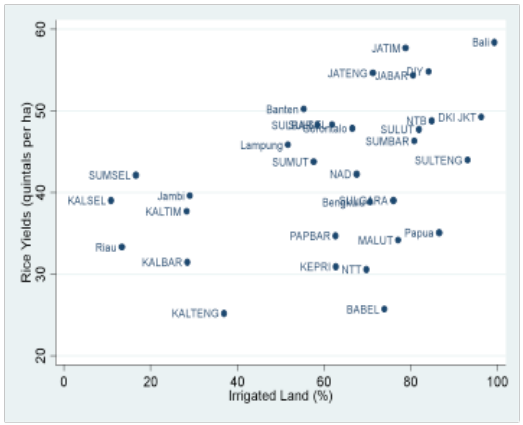
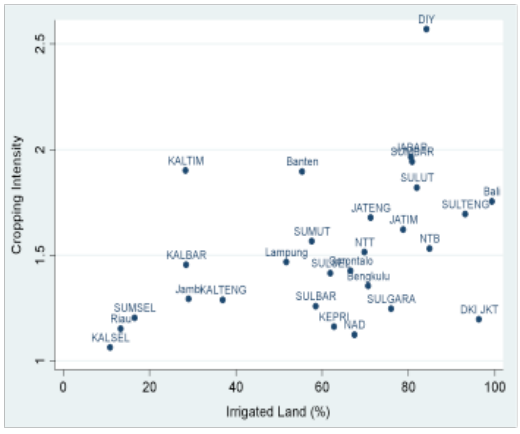


Figure 5.10: Rice-cropping intensity and irrigated land, 2007[49]



Source: MPW.
Note: 1 quintal = 0.1 tons
Irrigated Land (%) = Irrigated land/Total paddy wetland.
Cropping intensity = Total harvested paddy area/Total paddy wetland.
Total paddy wetland (*sawah*) = irrigated land (semi, technical, and simple irrigation) + non-irrigated land (rain-fed); *sawah irigasi* + *sawah non-irigasi*.

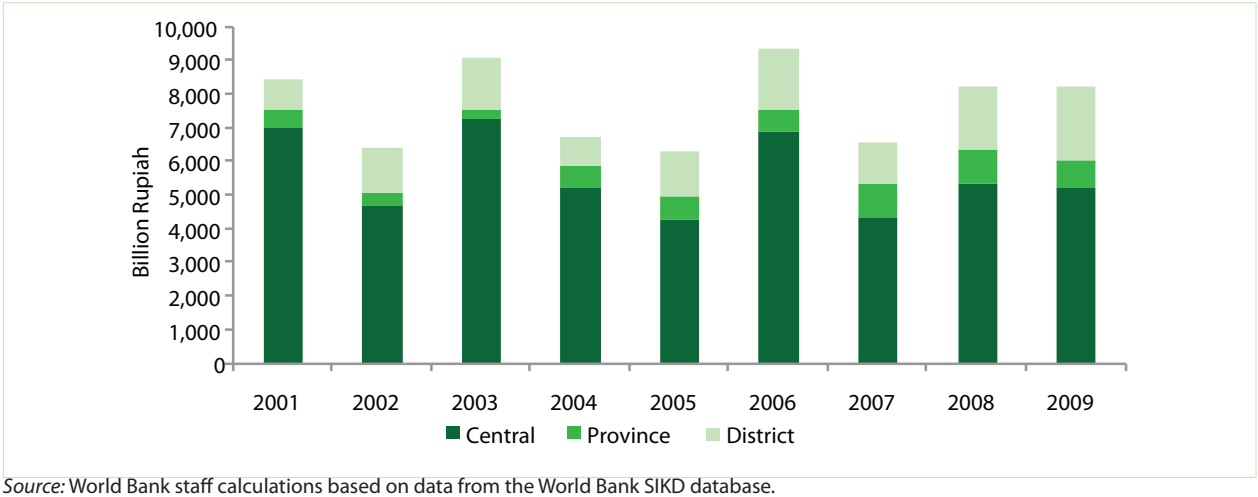
49 Irrigated land excludes rain-fed irrigation.

Since the start of decentralization, the responsibility for operating the main irrigation network is shared across all three levels of government according to the size of the command area and cross-boundary occurrence. The central government is responsible for the bulk of the water supply in strategic basins and irrigation systems larger than 3,000 hectares or cross provincial systems. The provincial government has jurisdiction over the management of irrigation systems with a command area of between 1,000 and 3,000 hectares and across district systems. Finally, the district level manages irrigation systems smaller than 1,000 hectares. The tertiary units are the full responsibility of the farmers through their WUAs and the Water User Association Federations (WUAFs), which are composed of several WUAs, and are partners in O&M of the primary and secondary canals of the central, provincial, and district schemes.[50]

Each government level is responsible for the O&M of the network under its authority. Rehabilitation and investment is primarily financed from the central government budget and transfers to the regions (Special Allocation Fund, or DAK). At the central level, the DG Water Resources at the MoPW funds O&M of its systems through the national budget (APBN) and utilizes the Tugas Pembantuan transfers to the provincial irrigation services for O&M implementation. At the provincial level, the Dinas Water Resources/Irrigation funds O&M of its systems through the provincial budget (APBD-P) and the deconcentration fund, which is not exclusively earmarked for irrigation. At the district level, the O&M budget comes from the district budget (APBD). The O&M in all systems is jointly executed with the WUAs/WUAFs. The WUAs/WUAFs can bear the full responsibility for the O&M in the tertiary systems and partial responsibility for the main and secondary systems, according to mutual agreement with the responsible irrigation service. Thus, this may include a small budget from the DG Water Resources for the WUAFs, as well as from the province and district to conduct maintenance activities and carry out this mandate.

The increase in agriculture spending of the past decade has not benefited irrigation. Irrigation spending decreased in real terms since 2006, a trend that reversed only in 2009. Consequently, the contribution from the central government to irrigation decreased after 2006, as spending at the provincial and district levels was growing, because more resources where transferred to the regions in the form of earmarked transfers for capital spending on irrigation (DAK transfers) to support local governments in the rehabilitation of, and investment in, water systems that had become their responsibility after decentralization.

Figure 5.11: Irrigation spending at various government levels, 2001-09 (Rp billion, 2007 prices)



Source: World Bank staff calculations based on data from the World Bank SIKD database.

50 Since the Law on Water Resources No.7/2004, Indonesia has adopted a system of participatory irrigation management, which involves farmers through water user associations (WUA) in planning, design, construction and O&M activities. The WUAs are credited with driving the recent improvements in the management of irrigation systems and supporting the increase in rice production in 2008 and 2009. But despite these improvements in O&M, much of the network is still in need of large-scale rehabilitation and investment, which can only be undertaken by the public sector.

At the sub-national level, districts and provinces are executing a large share of the irrigation budget as a result of decentralization. In 2006-08, the share of the agriculture budget that sub-national governments (both provinces and districts) allocated for water systems grew from 29 to 38 percent. Consequently, period figures also show spikes in spending for the years when Indonesia significantly increased the budget across all sectors during the big push for decentralization in 2001 and 2006. In addition, the provincial role in irrigation spending became more prominent and budget allocations at this level of government increased significantly after 2001.

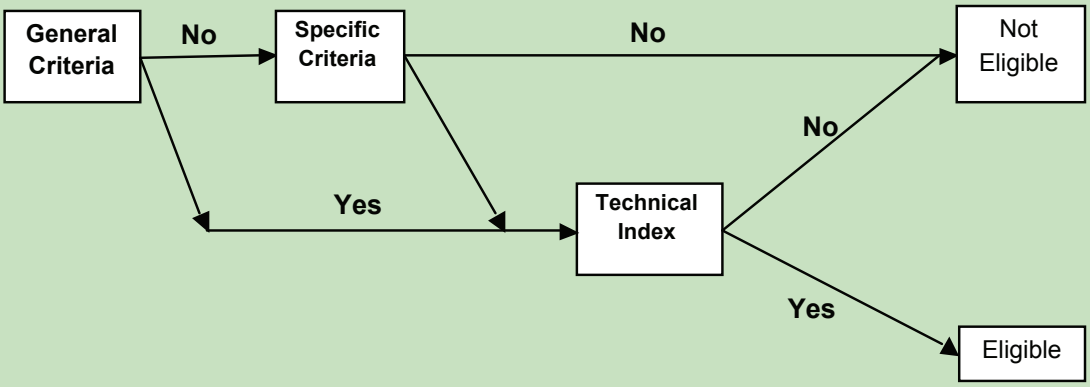
The DAK transfers for irrigation are earmarked to provincial and district governments for capital expenditure, to deepen investment in rehabilitation and expand irrigation coverage, and cannot be used for O&M activities. A closer look at the irrigation DAK by district shows a positive relationship between the coverage of irrigated land and the size of DAK allocation. As the formula intends, those districts with more irrigated land received larger resources in 2008 (Box 5.3). However, the DAK formula only takes into account "damage" and rehabilitation needs, but does not consider coverage needs. The technical index only assigns resources if the district has a higher percentage of irrigated land and punishes those in greater need of expanding coverage. Nonetheless, some districts with little or no irrigated land managed to capture DAK through criteria in the formula, such as reduced fiscal capacity and the exceptions to certain regions, such as "specific criteria" in the case of districts in Papua.

Box 5.3: The allocation formula for irrigation DAK in 2008

The allocation of DAK for irrigation in 2008 was based on a formula that gives districts three opportunities to be eligible for funding. First, the formula makes eligible those districts with fiscal capacity below the country's national average. Those districts that fail to meet the threshold then try for eligibility through exceptions according to region specific characteristics, such as remoteness, post-disaster areas and important tourism destinations. Finally, those districts that remain ineligible have a final opportunity to receive DAK if they rank high on a technical index that takes into account both high coverage of irrigated land and a highly damaged water network. In 2009, the DAK formula was revised so that at the final stage the technical index is given greater weight.

Technical Index = 40% Irrigated Land + 40% Network Damage + 10% District Size + 10% Population

Decision tree for DAK for irrigation, 2008



Once eligibility is determined, DAK transfers are allocated to favor districts ranking lower in the fiscal capacity index (first step). The MoF then decides the size of the transfer on a case-by-case basis, giving different weights to the regions and based on data and indices provided by the MoPW.

Source: MoF.

Opportunities for Enhancing Indonesia's Irrigation Systems[51]

Indonesia's irrigation systems could be strengthened in several ways, improving efficiency in the use of resources and service delivery in the short run, by: (i) reassessing the current level of spending, (ii) increasing the coverage of water systems, (iii) reversing the deterioration of the water network, and (iv) setting incentives for district governments to invest in service delivery. In the long run, Indonesia should increase investment in irrigation, yielding high returns and productivity gains for the sector.

(i) Reassessing the Current Level of Spending

Given the high returns to investing in water systems, the quasi-public-good nature of the investment, and Indonesia's water needs, irrigation requires greater resources to develop an adequate and timely supply of water to rural areas all year round. While there are efficiency gains to improving current spending patterns, greater investment is needed to address Indonesia's irrigation needs. Sub-national governments are responsible for a large share of the irrigation budget as a result of decentralization, but greater investment would expand coverage and meet rehabilitation, and O&M needs in the regions. Across islands in Indonesia investment needs differ: many provinces off-Java require new investment to increase the coverage of irrigated land, while Javanese provinces need to invest resources to rehabilitate a deteriorating irrigation network. In Java, the emergence of a more commercial type of agriculture, more market driven and needing technically more sophisticated water control systems, should result in greater private sector involvement in irrigation financing.

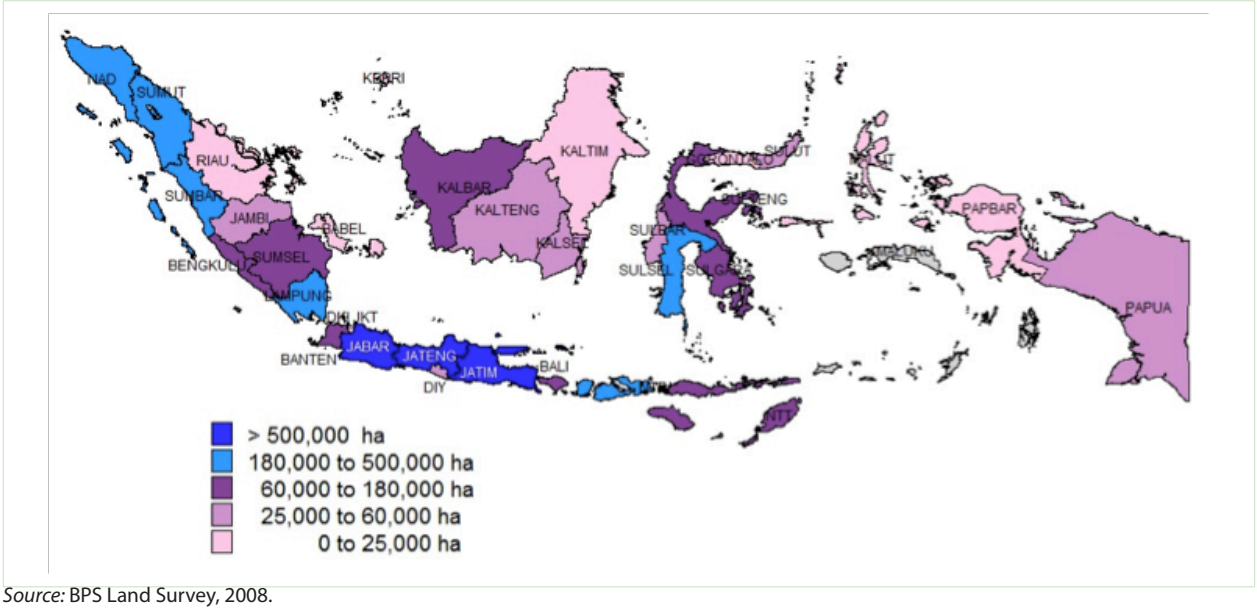
Any increase in resources should address two issues. First, there is low coverage of water systems off-Java and this will require deepening investment by the central government to increase the supply of simple irrigation. Local governments do not have the capacity to conduct these investments, nor do the water-user associations that participate in managing the irrigation network. In addition, DAK allocations for irrigation are insufficient for increasing coverage in most provinces and districts. Second, the network is deteriorating because provinces and districts are under-spending on the O&M of the schemes under their jurisdiction. As discussed below, this is the result of both lack of incentives created by decentralization and low funding. Reversing this trend will require heavy investment in rehabilitation by the central government. However, higher spending for rehabilitation is only one part of the story, and setting incentives for spending on O&M at the local level will also play an important role.

(ii) Increasing the Coverage of Water Systems

A closer look at irrigation coverage across islands in Indonesia reveals striking differences. While some provinces have low levels of irrigated agricultural land, the island of Java has the most irrigated land at 76 percent compared with off-Java, which averaged 49 percent (in 2008). Most Javanese provinces have extensive irrigation coverage, such as West Java, Central Java, and East Java, all at over 700,000 hectares each. Of the non-Javanese provinces, North Sumatra (275,000 ha) and South Sulawesi (351,600 ha) stand out as highly irrigated areas (Figure 5.12).

51 From: World Bank (2010). "Investing in Indonesia's Irrigation Systems," Policy Note in "Indonesia Agriculture Public Expenditure Review", (forthcoming).

Figure 5.12: Irrigated land by province, 2008 (ha)



Source: BPS Land Survey, 2008.
Note: BPS definition of irrigated land differs from FAOSTAT,
Irrigated land = semi, technical, and simple irrigation (sawah irigasi), excludes rain fed (sawah non irigasi -BPS).

The coverage of irrigated land in many off-Java provinces is low and in many provinces of Sumatra and Kalimantan the percentage of irrigated land is less than 30 percent. This greatly constrains farmers' agriculture opportunities in these areas. Thus, expanding coverage in poorly irrigated areas should be a spending priority and will have direct impact on farmers' welfare off-Java. Farmers in many of these provinces have below national average income levels and investing in simple irrigation systems would boost agriculture and rural development with a direct impact on poverty.

Investing in quality irrigation systems in-Java will yield high returns to public investment in terms of agricultural productivity. As the figures on network quality illustrate, reversing the deterioration of the irrigation system is more pressing in-Java and for smaller schemes of less than 3,000 hectares. Given that most Javanese provinces are among the largest rice producers, deepening investment to upgrade the network will yield the highest return in terms of rice yields.

(iii) Reversing the Deterioration of the Water Network

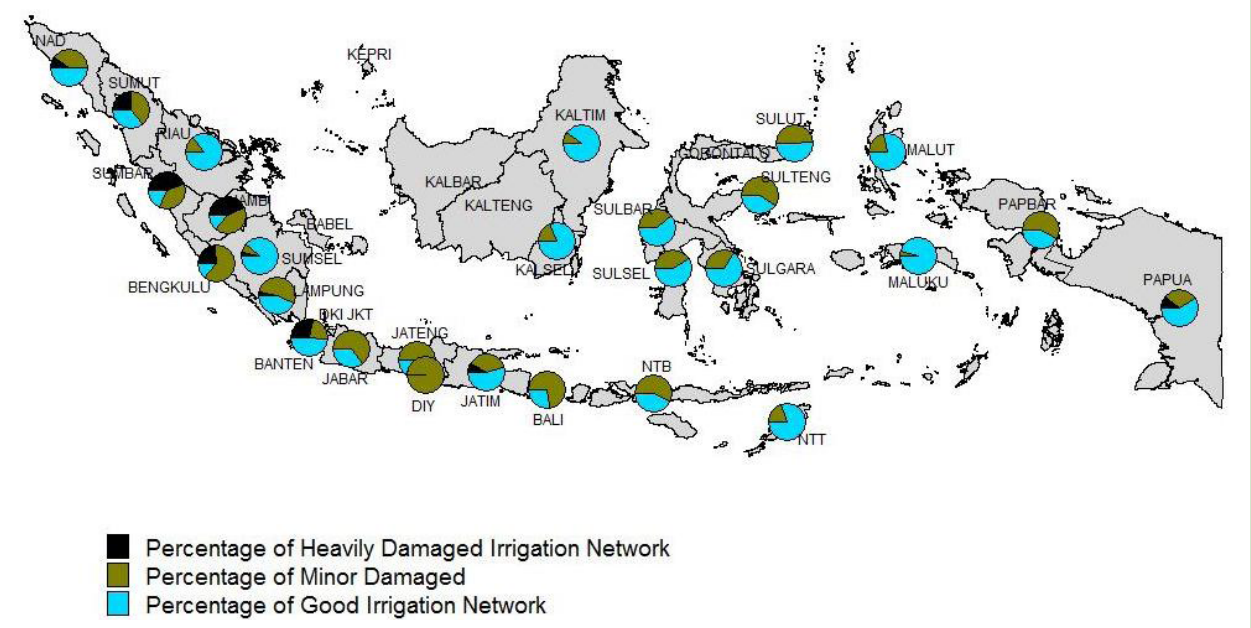
In recent years, the quality of the irrigation network in Indonesia has deteriorated significantly. Data from the MoPW and local governments that report the condition of their networks suggest that about 18 percent of the irrigation system, from a total 7.4 million hectares, is in need of rehabilitation (RPJM 2010-14).[52] The damage is more acute across the largest rice-producing provinces where more than half of the smaller water systems are damaged. At the sub-national level, districts are under-investing in O&M, a trend that will need to be reversed if the deterioration of smaller water systems is to be remedied.

Water systems under central government authority are in better shape than the smaller schemes under provincial and district management. According to the MoPW's DG Irrigation, the larger systems have a smaller share of "heavily damaged" network and were mostly classified as having "minor damage" in 2009. The greatest deterioration in the irrigation network was recorded across Sumatra and Java. Thus, the provinces of North Sumatra, Jambi,

52 There are differences in the figures for irrigated land reported in the RPJM 2010-14 and the MoPW vs. the figures from BPS. The BPS Land Utilization Survey 2008 reports total irrigated land in Indonesia at 8.0 million hectares, while the RPJM and MoPW report 7.4 million hectares of irrigated land.

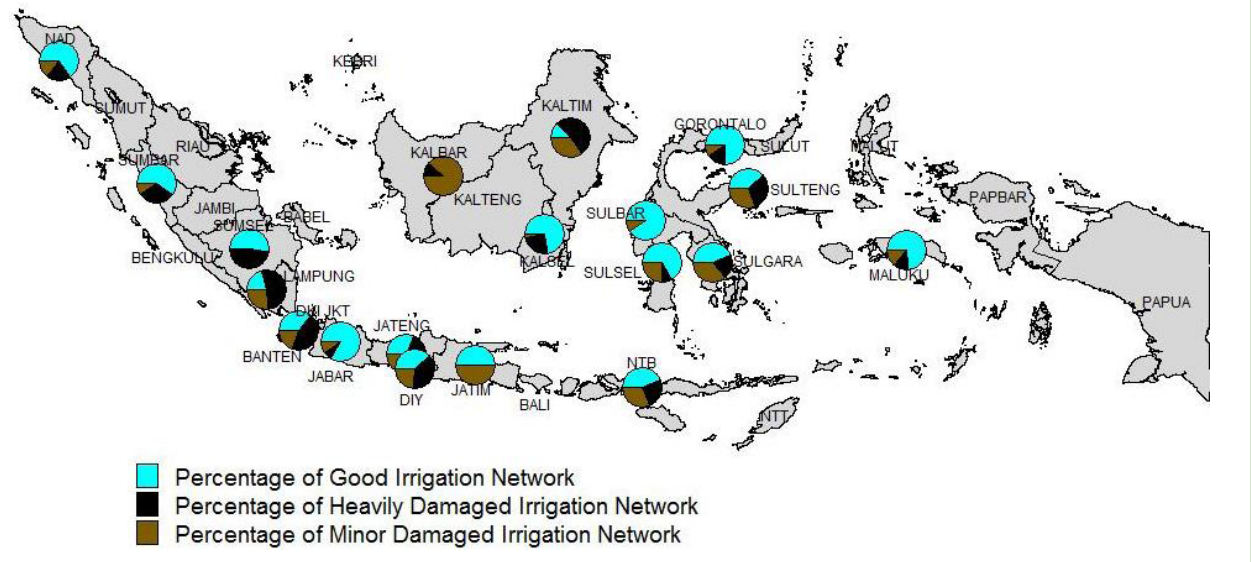
Bengkulu and West Sumatra, and Central Java and Yogyakarta report the greatest deterioration, with 85 percent or more of damaged network area. In contrast, West Sulawesi, South Sulawesi, South Sumatra, Riau and NTT have above 80 percent of their larger systems in good condition. Some other provinces, such as East Kalimantan and Maluku, where there is little irrigated land above 3,000 hectares, also report canals in good condition given that they were recently built (Figure 5.13).

Figure 5.13: Physical condition of central government systems (> 3,000 ha), 2009



Source: MoPW.

Figure 5.14: Physical condition of provincial and district systems (< 3,000 ha), 2007



Source: MoPW, 2007.

The largest deterioration is reported across provincial and district authority schemes (those less than 3,000 ha), but there was great variation in 2007. This suggests that reversing the deterioration of the irrigation system is more pressing in-Java and for smaller schemes of less than 3,000 hectares. While it is worth noting that deterioration figures tend to be over-estimated because districts have an incentive to over-report damage to qualify for rehabilitation spending, many provinces in Sumatra and Java have heavily damaged networks (Figure 5.14). Of those local governments that reported damage to the MoPW, the provinces of West Kalimantan (87 percent), Lampung (79 percent), Banten (63 percent) and Central Java (68 percent) had "heavily damaged" water systems.[53] In contrast, other provinces showed water systems in "good condition", as in the case of West Java (82 percent), West Sulawesi (90 percent), Gorontalo (75 percent) and South Kalimantan (71 percent) for 2007. Interestingly, West Sumatra, West Java and Aceh reported heavy damage only for the larger canals, but not for the smaller schemes, while in East Kalimantan the opposite was the case. In general, the variations suggest that some local governments are able to maintain their networks under the current arrangements more effectively than others (as in the case of West Sulawesi).

Increasing transfers from the MoPW for rehabilitation of canals is substituting rather than complementing the spending share for O&M by the provinces and districts. Thus, local governments are anticipating rehabilitation funds by redirecting the O&M budget for schemes under their authority to other activities. This is one of the reasons why the quality of the network has deteriorated in recent years, requiring the current level of investment for rehabilitation, as corroborated by the fieldwork conducted by this study in selected provinces and districts. Increasing DAK transfers and the rehabilitation budget have created an incentive for districts to under-spend on O&M and await a rehabilitation "bail-out" by the central government.

In the short term, rehabilitation resources and capacity from the central government need to be directed to reverse this deteriorating trend. As irrigation is a main input for rice production and agriculture, failing to maintain a good quality network will take a heavy toll on agricultural productivity. It is particularly important for rice production because heavy damage is widely reported across the largest rice producing provinces. Therefore, the MoPW should continue to heavily invest in rehabilitation to ensure some of these deteriorated networks are brought up to adequate standards. However, greater funding for rehabilitation is only part of the solution; incentives also need to be in place so that sub-national governments adequately fund O&M activities and will not find themselves in the same situation several years down the line.

Rehabilitation investment in-Java should aim to upgrade and modernize existing water systems from simple to semi or fully technical irrigation schemes in the medium term. Upgrading the water network from simple to more technical irrigation will ensure better water supply to a larger number of farmers all year round. It will allow some regions and those farmers at the lower end of the network who currently face water constraints to increase their yields and the number of harvested seasons. However, this will require greater technical capacity from WUAs and more resources for O&M, as semi/technical systems are more expensive to maintain. Nonetheless, this is an investment that will yield high returns and directly impact agricultural productivity by increasing cropping intensity. Upgrading the network in heavily populated areas in Java will also directly impact farmers' welfare and boost rural development.

(iv) Setting Incentives for District Governments to Invest in Service Delivery

In the long run, in order to address the deteriorating quality of the irrigation network, provinces and districts need to allocate more resources towards O&M and assume a portion of the rehabilitation cost (according to local fiscal capacity). Local governments have little incentive to adequately invest or even increase their O&M budgets because they do not bear the cost of the central government's rehabilitation grants. Therefore, the cost of rehabilitating the provincial and district networks should be shared between the central government and the

53 West Kalimantan reports a highly damaged network, but size of the network is very small, at less than 8,700 ha.

provinces and districts according to fiscal capacity. This would create an incentive to maintain the network because it is significantly cheaper to fund regular maintenance operations than to support rehabilitation projects. Only when the composition of spending at the district level favors a budget-share for O&M that can cover timely routine maintenance activities will the network require less rehabilitation spending.

Box 5.4: Lessons learned from the award for the best Water-User Associations

Indonesia is a leader in participatory irrigation and its Water-User Associations (WUAs) are largely credited with improvements in the management of the irrigation network. These farmer groups are increasingly assuming O&M tasks over large parts of the water system and contribute financially and in-kind to the operational costs.

Since 2005, the MoPW has given a recognition award to the best performing WUA and WUAF. This has not only created an incentive for farmers groups to do a better job in their O&M of the tertiary systems, but it has shown that there are certain characteristics that inherently make some associations more successful than others. The award is based on performance based on three criteria: (i) good organization and managerial skills, (ii) technical capacity and ability to effectively perform O&M activities, and (iii) funding. In 2009, the winners of the best WUA award received the award for the first time and were from villages in Bali, NTB and Yogyakarta (DIY). For the WUAF category, the federations operating in Central Java, Yogjakarta and East Java won awards.[54]

Award winners tend to be better organized than other farmer groups because they share three different factors. First, winners tend to come from districts where there is a strong commitment from the district head towards participatory irrigation. This is because these farmer groups have a say in the planning and administrative decisions of the irrigation network and are better supported with budget allocations to carry out their mandate. The Dinas in these districts also tend to have stronger WUA empowerment programs and see the WUAs/WUAFs as effective counterparts in providing irrigation services to the community. Second, winning WUAs/WUAFs have strong leadership and tend to be headed by a highly respected local community figure. As a result, they are better organized and enjoy greater ownership and community support. Finally, winners tend to come from regions were water supply is more limited. Interestingly, water scarcity creates an incentive for farmers to be more directly involved in the WUAs, to participate in the decisions to allocate the water supply and to be more involved in O&M activities. Thus, water scarcity raises the costs of failing to provide water to farmers. This also coincides with regions that have higher income, above the national average, and were farmers have more capacity. Therefore, WUAs/WUAFs in many districts in Java and Sumatra facing water shortages tend to rank higher in the criteria for this award.

Source: MoPW.

54 The winners for the WUA award in 2009 were: 1. Subak Munggu Tegallantang from Kecamatan Mengwi, Kabupaten Badung, Bali, 2. Moge Rukun from Kecamatan Gunungsari, Kabupaten Lombok Barat, and NTB, 3. Sido Mulyo from Kecamatan Turi, Kabupaten Sleman, and Yogjakarta. The WUAF winners were: 1. Tirto Sar from Kecamatan Matesih, Kabupaten Karanganyar, Central Java, 2. Pengasih Barat from Kecamatan Temon, Kabupaten Kulon Progo, and Yogjakarta, 3. Tirto Panguripan, Kecamatan Gondang, Kabupaten Mojokerto, and East Java.

Chapter 6

Conclusions and Policy Recommendations

Spending on agriculture has increased significantly in Indonesia over the past decade. This trend reverses the low public investment in the sector visible during the 1990s, which was largely behind the sector's relatively poor performance. However, a large share of this increase is being allocated to subsidizing private inputs, which raises concerns over the effectiveness of public spending and how it will drive increases in productivity over the coming years.

In order to improve the effectiveness of spending, the Government of Indonesia should consider reallocating public spending from subsidizing private inputs (fertilizer, seeds, and grants to farmers and farmers' groups) towards providing agricultural public goods, particularly R&D, extension services and irrigation. Going forward, it is important to allocate resources according to a strategy that maximizes spending effectiveness and that can translate into increasing growth for the agriculture sector, while also paying attention to the welfare of farmers.

Fertilizer subsidies are consuming a significant share of the budget allocated for agriculture, and their impact on productivity is at best unclear. Fertilizer subsidies have increased exponentially during the past few years, and they benefit primarily those farmers who have larger farms and are wealthier. Although the subsidies have a positive impact on urea consumption and yields, they do so at a very high cost and many farmers are over-using urea. There is no rationale for continuing to subsidize fertilizer production and distribution. Instead, support to farmers so they can purchase an optimum combination of inputs is likely to yield greater results. A targeted cash transfer program for the poor, where Indonesia already has valuable experience, could address credit constraints of farmers without distorting input prices. Although targeting assistance can be administratively challenging, Indonesia has gained valuable experience in this type of programs in the recent past.

A strong monitoring and evaluation system is necessary, in particular for the large share of public spending executed in the form of transfers to farmers and farmers' groups (social aid). It is important to assess the overall impact of these programs on agricultural productivity and farmers' welfare. There is a role that social aid spending can play by funding participatory projects at the local level. However, at the level of 40 percent of the budget of the MoA this leaves little room for investment in other public goods, such as irrigation, extension services and agricultural R&D. Evaluation of these programs, in a way similar to other countries, would allow for identification of design faults and find ways to address these faults in further implementation.

Increasing the level of public spending for agricultural R&D is a medium-term priority. However, before focusing on investing more resources major gains could be made by spending better today.

In R&D, GoI should reassess the spending composition between development, routine expenditures and salaries for research staff over non-research staff. Human resources in the agricultural R&D system will deteriorate if current recruitment trends for non-researcher staff and high attrition rates are not reversed. Currently, there is limited funding to conduct research projects in Indonesia's R&D system. Personnel salary and operations and maintenance spending dominate the budget at IAARD, the largest R&D institution, while recruitment has benefitted non–research staff. Given the accelerated attrition rates of researchers, there is a risk that the capacity of R&D

institutes can erode in the near future, if current recruitment does not favor young qualified scientists. Because capital expenditures are being crowded out by salaries and operations and maintenance, agencies should review whether their current spending composition is undermining both the quality and quantity of R&D, and whether it is appropriate for the advancement of innovation.

Creating a streamlined organizational structure and improving downstream linkages to extension services will directly strengthen its output. Thus, greater coordination for agriculture R&D could be achieved through the establishment of a council system, the reallocation of resources towards tailoring research that emphasizes all agricultural needs, and the utilization of ICT for strengthening research-extension-farmers linkages. An agricultural R&D council can establish an institutional arrangement where policy-making resides in a governing council consisting of the ministers involved in agricultural R&D (agriculture, forestry, fisheries, science and technology, higher education, etc.). There is also a strong case for using performance-based budgeting to improve the level of monitoring and increase the incentives for producing higher-quality outputs that respond to varied client needs. Another effective strategy to improve linkages is to offer opportunities for extension workers and farmers' participation in joint decision-making on research themes. Thus, for instance, through coordinating committees or meetings or by exchanging staff between agricultural research and extension organizations, enabling personnel to work for a specified time in each other's establishment. Finally, with decreasing costs of connectivity, ICT can be facilitated through broadband access for all researchers and extension workers to stay abreast with the latest advances and developments in their fields of expertise and experience.

Greater collaboration with the private sector will improve quality in service delivery. This could be achieved by setting incentives to induce firms to invest more, deepening private investment for agricultural R&D. Through intellectual property protection, firms can be assured they may retain rights to the findings of their research, which can enable the recovery of their capital investment. Furthermore, authorities can also help overcome collective action problems by changing institutional arrangements, such as the establishment of levies, the provision of subsidies (or tax concessions) or grants. These actions may serve to make private investment in R&D more appealing and generate greater interest to develop new agriculture knowledge and better farming techniques. The agricultural R&D establishment should see itself as part of a broader agricultural information system that includes linkages with extension, universities, private sector, etc. and thereby develop a system of national and international research.

The delivery of extension services in Indonesia can be made more efficient along with measures to improve the quality of service delivery and changes in the current institutional arrangements.

Greater fiscal incentives to provinces and districts would facilitate the establishment of unified extension agencies and encourage spending for the extension services. The MoA is beginning to develop fiscal incentives, but at the moment deconcentrated funds are devolved to the districts with few conditions. A matching grant approach can be used in a proactive manner to foster reform and, for instance, accelerate the unification of extension. By offering co-financing, the central government can encourage sub-national governments to prioritize and increase their share of spending for extension and to unify extension into a single Dinas as mandated by the law. Such a scheme, however, will necessitate the development of strong management information systems capacity in MoA to enable it to monitor the composition of District expenditure on agriculture. MoA will need to engage with Districts on the basis of Districts having explicit written and monitorable plans for different agricultural expenditure areas, into which central matching grants could be placed.

Local governments have little incentive to increase their extension operational budgets because they do not bear the cost of the MoA stepping in with transfers for operational expenses. Thus, the districts should cover a portion of the cost of the BOP transfer for operations. Across all sampled districts operational spending was low and greatly constrained extension workers' mobility and implementation at the local level. There is an incentive to underfund operational costs because the MoA is partially paying for them. Therefore, by establishing fiscal incentives for these transfers, in the form of matching grants for operational costs, funding for operations and transportation could increase at the local level.

The quality of extension services could be improved with stronger linkages to new technologies. Extension agencies at the district level need to provide internet connectivity to extension workers, in order to ensure that they have access to national and international agriculture R&D centers and knowledge networks. With decreasing costs of connectivity, broadband access can strengthen the linkage to R&D and ensure workers stay abreast of the latest agricultural advances and development in their fields of expertise and experience. This will ensure that the local extension agencies are kept up to date with the latest developments in agricultural technologies.

As a way of improving the quality of services delivered, the Agency of Agricultural Human Resource Development (AAHRD) at the Central level needs to take the leadership in providing appropriate training at entry-level as well as refresher training for all extension workers as part of an overall HR development strategy for extension workers. This needs to be done in close coordination with Districts and provinces effectively utilizing the six central-level agricultural extension colleges, the sixteen provincial training centers, universities, as well as the private sector. From an efficiency point of view, it is preferable for AAHRD to expend resources in building the human resource capacity of the extension workers nationally rather than providing operational costs (BOP) that is the responsibiliity of the districts. AAHRD needs to establish sound policy guidelines for a clear career development path that is based on continual training and refresher courses for extension workers. Training curricula at the central level need to take into account a broader set of activities and techniques for upgrading their skills and diversify away from a mindset that focuses exclusively on food crops extension. Training should also be provided so that extension workers can disseminate not only crop specific techniques, curricula should also focus on non-crop related issues, such as access to credit or adding value to agricultural products, access to markets and agriculture marketing. From a medium-term perspective, districts in consultation with AAHRD can set incentives (scholarships, performance assessments by farmers) to recruit and retain better-qualified staff.

With the aim of strengthening the provision of extension services at the district level, the funding responsibility, accountability and direction of contractor extension workers should be fully transferred to the districts. The MoA has directly hired about one third of all extension workers deployed in the districts, assuming responsibilities that have been decentralized. Given that these contracted extension workers are funded by the central budget, it creates an accountability problem and hinders smooth coordination, since these workers are directly accountable to the MoA. In some districts, this has generated conflicting advice, with contracted workers following the agriculture priorities set by the central government, which may differ from the planning objectives of the districts. Resources for extension workers should be transferred to the districts to better align staffing, accountability and funding arrangements. This transfer of resources and responsibilities should be combined with a strengthening of capacity at the district level, since part of the reason for the central government encroaching on district responsibilities has been the districts' inability to deliver high quality public services.

Given the high returns to investing in water systems, the quasi-public good nature of the investment, the deteriorating quality of the network, and Indonesia's water needs, this sub-sector requires greater resources to develop an adequate and timely water supply all year round to rural areas. While there can be efficiency gains from improving current spending patterns, greater investment is needed to address the country's needs.

Across islands in Indonesia the investment needs are different. Provinces in-Java need to invest resources to rehabilitate a deteriorating irrigation network. Investing in quality irrigation systems in-Java will yield large returns to public investment in terms of agriculture productivity. As the figures on the network quality illustrate, the needs to reverse the deterioration of the irrigation system are more pressing in-Java and for smaller schemes of less than 3,000 hectares. As agriculture production in Java becomes more commercially oriented, there should also be a greater role for private sector investment in technically more sophisticated water control systems.

Provinces off-Java require new investment to increase the coverage of irrigated land. The coverage of irrigated land in many off-Java provinces is low. Thus, expanding coverage in low irrigated areas should be a spending priority and will have direct impact on farmers' welfare off-Java. Farmers in many of these provinces are below the country's average income level and investing in simple irrigation systems in these areas will boost agriculture and rural development with a direct impact on poverty.

The cost of rehabilitating the provincial and district networks should be shared between the central government and the provinces and districts according to fiscal capacity. In order for provinces and districts to have an incentive to properly maintain the networks and to avoid the need for further rehabilitation transfers in the future, they need to partially bear the cost of the rehabilitation. This could be shared through a matching grant approach, where the size of the central rehabilitation spending could be determined by a contribution for O&M funding from the provincial or district governments. Only when the composition of spending at the district level favors a budget-share for O&M that can cover timely routine maintenance activities will the network require less rehabilitation spending.

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Annex I. Agriculture Public Expenditure (Rp billion)

Table A1.1: Agriculture Public Expenditure in Indonesia

	2001	2002	2003	2004	2005	2006	2007	2008	2009
1. Agriculture:	3,425	4,608	5,947	5,206	5,746	9,253	13,120	15,378	16,134
- Central (includes Extension Services)	1,032	1,679	2,780	2,153	2,179	4,193	5,581	6,610	6,559
- Sub national	2,393	2,930	3,167	3,053	3,567	5,060	7,539	8,768	9,575
2. Irrigation:	4,785	3,866	5,765	4,641	4,969	8,414	6,540	9,763	10,191
- Central	3,971	2,815	4,595	3,602	3,355	6,201	4,342	6,363	6,478
- Sub national	813	1,051	1,170	1,038	1,614	2,213	2,198	3,400	3,713
3. Research and Development (Central only)	195	243	311	383	481	535	694	581	686
4. Subsidies:	3,518	4,742	6,085	6,175	9,071	8,651	13,371	29,398	34,489
- Fertilizer	0	49	794	1,171	2,527	3,166	6,261	15,184	18,532
- Other (seeds, Raskin)	3,518	4,693	5,291	5,003	6,543	5,486	7,111	14,214	15,957
Total National Agriculture Spending	**11,922**	**13,460**	**18,108**	**16,405**	**20,267**	**26,854**	**33,726**	**55,119**	**61,501**
National Agriculture Spending as % of National Spending	**3%**	**4%**	**4%**	**4%**	**4%**	**4%**	**4%**	**6%**	**5%**
National Agriculture Spending as % of GDP	**1%**	**1%**	**1%**	**1%**	**1%**	**1%**	**1%**	**1%**	**1%**
Central Agriculture Spending as % of Agri-GDP	**1%**	**1%**	**1%**	**1%**	**1%**	**2%**	**3%**	**3%**	**4%**
Sub National Agriculture Spending as % of Agri-GDP	**1%**	**2%**	**2%**	**2%**	**2%**	**2%**	**4%**	**4%**	**5%**
National Agriculture Spending as % of Agriculture GDP	**7%**	**7%**	**10%**	**8%**	**10%**	**13%**	**16%**	**24%**	**34%**
GDP	1,646,322	1,821,833	2,013,675	2,295,826	2,774,281	3,339,480	3,957,404	4,705,980	4,162,627
Agri GDP	175,241	181,485	188,506	193,134	197,959	204,297	211,358	227,170	179,603

Agriculture public expenditure (% of total agriculture spending)

Item	2001	2002	2003	2004	2005	2006	2007	2008	2009
1. Agriculture:	29%	34%	33%	32%	28%	34%	39%	28%	26%
- Central (includes Extension Services)	9%	12%	15%	13%	11%	16%	17%	12%	11%
- Sub national	20%	22%	17%	19%	18%	19%	22%	16%	16%
2. Irrigation:	40%	29%	32%	28%	25%	31%	19%	18%	17%
- Central	33%	21%	25%	22%	17%	23%	13%	12%	11%
- Sub national	7%	8%	6%	6%	8%	8%	7%	6%	6%
3. Research and Development (Central only)	2%	2%	2%	2%	2%	2%	2%	1%	1%
4. Subsidies:	30%	35%	34%	38%	45%	32%	40%	53%	56%
- Fertilizer	0%	0%	4%	7%	12%	12%	19%	28%	30%
- Other (seeds, Raskin)	30%	35%	29%	30%	32%	20%	21%	26%	26%
Total National Agriculture Spending	100%	100%	100%	100%	100%	100%	100%	100%	100%

Source: MoF, LKPP and SIKD, from various years and MoA.

Annex II. Estimation of relationship between fertilizer and rice yields

A simple micro-model using data from the 2007 household survey explores two important questions: What is the effect of the fertilizer subsidy on urea consumption, and what impact does urea usage have on rice production? The model proposed allows for diminishing returns to the use of fertilizer (by including a quadratic term for urea used), implying that there is an optimal point for urea usage beyond which yields start to decline. The quantity of urea consumed depends on: the price of urea, the price of other fertilizers (which are proxied with the price of SP36), the price of rice, and the price of rice seeds. In turn, the impact of urea on rice yields is dependent on: the quantity of urea used, the consumption of other inputs (land, labor, irrigation), and controls for soil quality (a dummy variable for Java-Bali) and human capital (in this case, the years of education and the age of the head of the household). The model to be estimated is summarized below:

$$\ln rice\_yield = a + b_1 \ln urea\_used + b_2 \ln urea\_usedsq + b_3 \ln land\_size_i + b_4 \ln labor\_cost + b_5 irrigation + b_6 educ + b_7 age + b_8 Java\&Bali + e \quad (1)$$

where *urea_used* is the fitted value of the regression:

$$ln\ urea\_used = a + b_1\ lnprice\_urea + b_2\ ln\ price\_SP + b_3\ ln\ price\_seeds + b_4\ lnprice\_rice + b_5\ ln\ land\_size_i + b_6\ ln\ labor\_cost + b_7 irrigation + b_8 educ + b_9 age + b_{10} Java\&Bali + n \quad (2)$$

And *urea_usedsq* is the fitted value of the regression:

$$ln\ urea\_usedsq = a + b_1\ lnprice\_urea + b_2\ ln\ price\_SP + b_3\ ln\ price\_seeds + b_4\ lnprice\_rice + b_5\ ln\ land\_size_i + b_6\ ln\ labor\_cost + b_7 irrigation + b_8 educ + b_9 age + b_{10} Java\&Bali + z \quad (3)$$

Variable Definitions[55]*:*

rice_yield is the quantity of rice (kg/ha)

urea_used is the quantity of urea used (kg/ha)

urea_usedsq is the square term of *urea used*

land_size is the size of the cultivated rice field (ha)

labor_cost is the total cost of labor ($/ha)[56]

irrigation is a dummy variable (1 for irrigated land)

price_urea is the price of urea

price_SP is the price of SP36 fertilizer

price_seeds is the price of the most commonly used rice seeds -superior ($/kg)

price_rice is the dried grain price of rice at which the farmer sold the last harvest.[57]

educ is the years of education of the head of the household

55 A word of caution is necessary when interpreting the results. This model focuses on understanding the relationship between fertilizer use and rice yields. A model to better understand the factors determining rice production is a far more complex undertaking which requires additional information unavailable at this stage, such as the quality of rice seeds, irrigation and soil.

56 Labor costs: The number of workers multiplied by their reported salary. For those non-wage workers, the average salary for men and women is assumed for the estimation. An alternate specification used labor inputs measured in man days per hectare and showed similar results.

57 The rice price influences the quantity of urea used by providing farmers with the means and incentives to buy fertilizer. Although the dried grain price at which farmer's sell their output rice (the information provided in the survey) may differ from the price farmers faced when buying inputs (not provided by the survey), both prices will be strongly correlated. Therefore, this model uses this post-harvest information from the survey as a proxy for the rice price.

age is the age of the household

Java&Bali is a dummy variable (1 for provinces in Java and Bali)

e, v, *and z* are error terms

There are some challenges in estimating this model, primarily the inability to take into account how farmers' incomes may drive both rice yields and urea use. Estimating the relationship presents a potential endogeneity problem. This is because urea used will most likely be correlated with the error term in the yields equation because of omitted variable bias.[58] Those omitted variables that have an impact on yields, but were not included in the regression, either observable or unobservable effects, will be captured in the error term. Farmers' incomes will most likely impact yields, but in the absence of a measure of wealth in the survey, it cannot be captured in the yields equation (1) explained below. Thus, income is a driver of yields if richer farmers have different production levels than poorer farmers as a result of being less credit constrained, risk averse, or having access to better farming techniques. On the other hand, income will determine how much urea farmers can buy and, for poorer farmers, spending on inputs accounts for a much higher share of their resources. Therefore, omitted variable bias can drive the relationship between urea usage and the error term when income is not accounted for in the yields equation. Other omitted variables that can impact yields include: the quality of irrigation, private capital, and effort or ability to grow rice.

To address this endogeneity problem, the model is estimated using an instrumental variable (IV) through a two-stage least square regression (2SLS). The 2SLS estimator calculates the fitted values of the urea regression (2) and the fitted values of urea used squared (3) to use as IV's and indirectly capture the impact on the yields regression (1). In the first stage regression, it breaks urea used (and urea used squared) into 2 components, a "problematic one" correlated with the error term and a "non-problematic" exogenous component. Then, it takes the exogenous parts of urea used (and urea used squared) to capture the effect on the rice yields. There are two conditions to meet in order for this estimator to be valid: (i) instrument relevance, where the correlation between urea fitted and urea used is different from 0; and (ii) instrument exogeneity, where the correlation between urea fitted and the error term (e) is 0. Both these conditions are met by the model in this section.[59]

The results below suggest there is a positive impact on rice yields when using urea at adequate levels, but there is a threshold that, if exceeded, the relationship reverses and fertilizer starts having a negative impact (Table A2.1). Figure A2.1 illustrates graphically the results from Table A2.1 and shows how beyond a certain point increasing the use of fertilizer has an adverse effect on yields.

58 The results of the Durbin-Wu-Hausman test for endogeneity confirm that urea used is correlated with the error term in the yields equation (1), (Stock and Watson 2003).

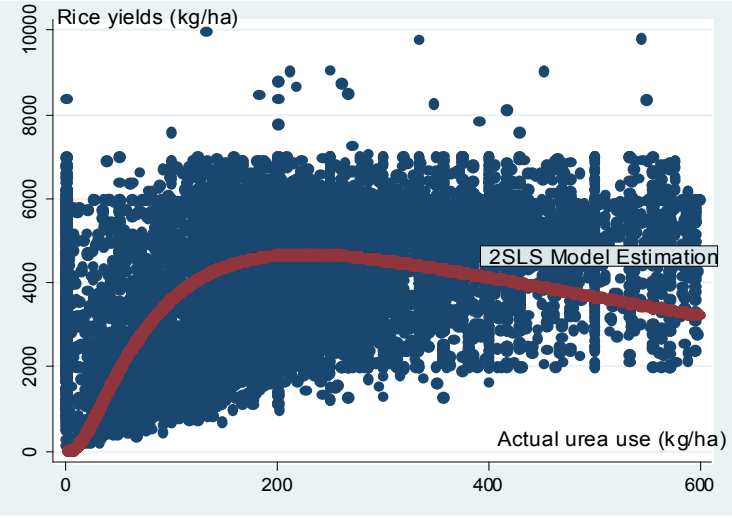
59 Instrument exogeneity in the model was tested with the overidentifying restrictions test and failed to reject the null hypothesis of exogeneity. The instruments used and results presented in this section meet the condition of exogeneity and are statistically valid. (Stock and Watson, 2003).

Table A2.1: Estimation results (2SLS second stage regression) in 2007

Dependent variable: Rice yields	Overall	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5
	(1)	(2)	(3)	(4)	(5)	(6)
Urea use	4.2098	0.4997	0.4269	0.3091	0.3506	0.1552
	(2.26)*	(7.54)**	(6.43)**	(4.28)**	(4.77)**	(2.31)*
Urea use squared	-0.3882					
	(-2.08)*					
Land size	-0.0959	-0.0685	-0.0472	-0.1029	-0.1383	-0.2004
	(-5.86)**	(-3.27)**	(-2.25)*	(-4.56)**	(-4.90)**	(-7.59)**
Labor cost	0.0431	0.0561	0.0540	0.0740	0.0958	0.0760
	(3.08)**	(5.50)**	(4.84)**	(5.84)**	(6.84)**	(7.24)**
Dummy irrigation	0.0339	0.0216	0.0089	0.0383	0.0403	0.1017
	(2.76)**	(1.18)	(0.53)	(2.03)*	(1.74)+	(3.25)**
Education	-0.0006	0.0034	0.0042	0.0026	-0.0012	0.0003
	(-0.32)	(1.32)	(1.64)	(1.01)	(-0.42)	(0.09)
Age	-0.001	-0.0007	0.0013	-0.0019	-0.0006	-0.0014
	(-1.82)+	(-1.04)	(0.34)	(-2.43)*	(-0.68)	(-1.22)
Dummy for Java-Bali	-0.0937	-0.1625	-0.1384	-0.096	-0.1148	-0.0021
	(-4.49)**	(-4.39)**	(-4.69)**	(-2.86)**	(-3.28)**	(-0.06)
Constant	-2.3646	5.8908	6.0816	7.1419	6.9928	8.5999
	(-0.52)	(17.11)**	(15.57)**	(15.84)**	(13.80)**	(17.43)**
R-squared	.	.	0.09	0.25	0.32	0.30

z statistics in parentheses.
+ significant at 10%; * significant at 5%; ** significant at 1%. ll variables are estimated in natural logarithm

Figure A2.1: Urea and rice yields in 2007 - 2SLS model estimation



The impact of fertilizer use on yields is not uniform, and smaller in magnitude and significance for larger farms off-Java. When looking at the relationship between fertilizer use and yields by quintile, a linear model seems to fit the relationship better (the urea squared term is not significant), which differs from the non-linear relationship found for the overall sample. The fact that the relationship is different when breaking down the sample by land size suggests that smaller farmers have a different production function than larger farmers. Also, the analysis by plot size

captures geographical differences in rice farming that could lead to different production functions; for example, in Java, farms are not only smaller or sowed more intensively, but soil quality is better and farmers have higher years of schooling.

At the quintile level, estimating the model linearly shows that a 1 percent increase in urea use increases yields by 0.31-0.49 percent on Java and 0.16 percent mostly off-Java. Within Java-Bali, quintiles 1-4 show differences in the impact of urea use on yields and a much larger effect on the yields of smaller farms. Similarly, the urea consumption of the bigger farms in quintile 5, mostly off-Java farms, reflect the lowest boost in yields for the sample. This suggests that other deteminants (land size, irrigation, labor) are more significant drivers of yields than fertilizer for the larger producers, and it is not surprising that, since they are less credit constrained and have access to better information, other determinants are better able to explain their variation in rice yields.

Most control variables behave as expected: land size is negatively associated with yields, while agricultural inputs (labor and irrigation) are positively associated. Land size is negatively associated with rice yields, as anticipated given that smaller plots are farmed more intensively. The dummy for Java-Bali, which is introduced to proxy for different soil qualities, shows that on-Java more urea is consumed compared with off-Java (a positive and significant effect). Nonetheless, one would expect to find a positive relationship between the dummy for Java-Bali and yields, to reflect the better soil quality in these islands. As such, the significant and negative relationship in most quintiles is surprising (with the exception of quintile 5 where it is inconclusive),[60] and signals that the dummy may not be such a good proxy or the fact that other variables in the model (irrigation, fertilizer) are already explaining much of the impact from soil quality. Increased labor (including non-wage labor or unpaid family members) is also positively associated with higher rice yields, and this is particularly true in larger farms (quintiles 4 and 5), where the effect is greater in magnitude and significance. As expected the findings show that the effect on rice yields from using diverse inputs varied between small and larger farmers.[61]

Further research is required to capture the relationship between irrigation and rice yields. While the impact from the dummy for irrigation is positive and significant (and greater in magnitude for the larger farmers), the survey data did not allow capturing factors such as: maintenance, the quality of the irrigation network or the extent to which existing infrastructure is operational, which are the true drivers of the relationship with yields. Therefore, further research may shed light on the impact of these factors in determining rice production.[62]

Not surprisingly, the urea price is negatively associated with urea use, although there are significant differences by farm size (Table A2.2). The consumption of urea in the smallest farmers (quintile 1) is the least affected by the urea price. However, urea consumption of the largest farmers mostly off-Java (quintile 5) is highly sensitive to changes in fertilizer subsidies, as well as quintile 2 farmers that are mostly composed of Javanese farmers.

60 The fact that the dummy for Java-Bali is not significant in the quintile 5 suggests that for these larger farms, which are mostly located off-Java, soil quality is not a driver of yields and that soil characteristics are more homogenous.

61 One production input that could be controlled for is capital inputs. There is limited information from both surveys to control for investments that farmers may be doing in their fields.

62 There may be measurement error in the irrigation variable. The surveys show that about 50 percent of all rice farmers grow rice in irrigated fields (sawah), both in Java and outside Java. This is much lower than widespread perceptions and data published by BPS, which show that over 90 percent of rice produced in Indonesia is grown in irrigated fields.

Table A2.2: Estimation results (2SLS first stage regression) in 2007

*Dependent variable: Urea use and Urea use squared *)*	Overall (Urea use)	Overall (Urea use squared)	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5
	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Urea price	-0.4123	-4.0166	-0.2568	-0.4949	-0.3980	-0.2981	-0.5096
	(-11.30)**	(-11.19)**	(-3.76)**	(-6.29)**	(-5.12)**	(-3.58)**	(-5.40)**
SP price	-0.1901	-1.9744	-0.2587	-0.1535	-0.1614	-0.2699	-0.1745
	(-6.19)**	(-6.53)**	(-4.23)**	(-2.47)*	(-2.35)*	(-3.64)**	(-2.30)*
Seeds price	0.1343	1.301	0.109	0.0329	0.0992	0.1638	0.1924
	(7.40)**	(7.29)**	(-3.37)**	(0.86)	(2.43)*	(3.86)**	(4.07)**
Rice price	-0.2353	-2.4983	-0.3366	-0.0842	-0.1614	-0.2989	-0.3564
	(-4.74)**	(-5.12)**	(-3.83)**	(-0.83)	(-1.53)	(-2.49)*	(-2.59)**
Land size	-0.2834	-2.7681	-0.0231	-0.1166	-0.1993	-0.3188	-0.3497
	(-33.72)**	(-33.48)**	(-0.84)	(3.43)**	(-6.24)**	(-10.84)**	(-15.35)**
Labor cost	0.0846	0.7801	0.0223	0.0586	0.0865	0.1294	0.0938
	(12.91)**	(12.09)**	(1.52)	(3.54)**	(4.84)**	(7.83)**	(7.60)**
Dummy irrigation	0.0947	0.9417	0.0632	-0.0026	0.0458	0.1016	0.2276
	(6.99)**	(7.06)**	(2.49)*	(-0.10)	(1.55)	(3.13)**	(6.13)**
Education	-0.0005	-0.0003	0.0029	-0.0048	0.0023	-0.0016	0.0039
	(0.25)	(-0.02)	(0.77)	(-1.21)	(0.55)	(-0.38)	(0.86)
Age	0.0005	0.0036	0.0014	-0.0007	0.001	0.0009	0.0000
	(0.81)	(0.62)	(1.34)	(-0.63)	-0.75	-0.66	(-0.02)
Dummy Java-Bali	0.2976	2.9552	0.258	0.2696	0.2842	0.2595	0.3043
	(17.74)**	(17.90)**	(6.07)**	(7.53)**	(7.63)**	(7.02)**	(7.43)**
Constant	11.9444	96.2634	10.8608	11.0279	10.6926	11.9695	13.4387
	(26.10)**	(21.38)**	(12.40)**	(11.25)**	(10.79)**	(10.90)**	(10.99)**
R-squared	0.27	0.27	0.13	0.12	0.13	0.18	0.26

t statistics in parentheses
+ significant at 10%; * significant at 5%; ** significant at 1%
All variables are estimated in natural logarithm
*) Dependent variable of estimation at quintile level is urea use

The model estimates the threshold at which the relationship between urea used and yields reverses at 226 (kg/ha) and in line with the recommended amounts by the MoA at 200-250 (kg/ha). However, it is important to note that the maximum of a 2SLS quadratic estimation is sensitive to omitted variable bias. The model supports the thesis that overusing urea will have an adverse impact on rice production. Many farmers in the survey report using two and three times the recommended urea levels. The overuse of urea in Indonesia, particularly when compared with some of its regional peers, and its negative impact on soil quality, are well documented.[63] This is mostly the result of distorted factor prices and is more prominent in smaller farmers. Figure 4.7 in Section 4, illustrates graphically the results from Table A2.2 and shows how beyond a certain point increasing the use of fertilizer has an adverse effect on yields.

63 Several studies conducted by agriculture research institutes in Indonesia document the negative effects of overusing urea on yields and soil quality. Pantjar and Timmer (2008) document the link between soil degradation and urea overuse and land farming intensity in Indonesia. In the same line, Supriono (2000) explored the impact of urea use on soy bean growth in Central Java and found that using urea at 100 kg/ha had a positive effect on increasing soy plant height, pod numbers per plant, and seed yields per plant, but that high levels or urea stifled plant enzymes and decreased soy bean yields and growth. Furthermore, Aribawa, et. Al., (2006) looked at the effect of urea usage and other organic fertilizer on the soil composition and the growth of long beans in Bali. They found that using urea, as the sole fertilizer, decreased the nitrogen elements and the acidity of the soil and recommended using a blend (urea and organic fertilizer) to maintain the high growth of long beans in Bali.

The analysis in this section supports the notion that urea usage has a positive impact on yields, with the exception of the larger farms, but it still leaves some questions unanswered. It does not answer whether the costs at which this improvement in yields is achieved outweigh the benefits. Neither does it discuss whether alternative public spending (on irrigation, improved R&D or extension services) may actually have a larger impact on productivity than the subsidization of fertilizer.

Annex III. Empirical Estimation and Methodology: The Impact of Public Spending on Agriculture GDP

Table A3.1: Variable Description

	Variable	Source
y	Agriculture GDP per capita	Statistical Yearbook of Indonesia
	Fertilizer subsidies	Statistical Yearbook of Indonesia 1980-2008, Presidential Address to the Republic of Indonesia 1793, 1978, 1983, and LKPP 2004-2008
	Agriculture and irrigation spending	Statistical Yearbook of Indonesia 1980-2008, Presidential Address to the Republic of Indonesia 1793, 1978, 1983, and LKPP 2004-2008
ATR	Tax revenues to agriculture GDP	Statistical Yearbook of Indonesia 1980-2008, Presidential Address to the Republic of Indonesia 1793, 1978, 1983, and LKPP 2004-2008
APE	Total agriculture public expenditures to agriculture GDP	Statistical Yearbook of Indonesia 1980-2008, Presidential Address to the Republic of Indonesia 1793, 1978, 1983, and LKPP 2004-2008
l	Agriculture labor force	Statistical Yearbook of Indonesia
la	Arable land	FAOSTAT
GD	Index of global demand for agriculture exports	FAOSTAT
	Population	World Bank WDI, 2008

The basic model is as follows:

$$\Delta \ln y_t = b_0 + b_1 \Delta \ln y2_t + b_2 \Delta APE_{t-1} + b_3 \Delta ATR_{t-1} + b_4 \Delta \ln l_t + b_5 \Delta \ln la_t + b_6 \Delta \ln GD_t + b_7 Dummy98 + \varepsilon_t$$

where:

t is the year

y is the rate of growth of agriculture GDP per capita

Fiscal variables:

APE is the ratio of total agriculture public expenditures to agriculture GDP

ATR is a ratio of 3% of total tax revenues to agriculture GDP

Control variables:

y2 is the rate of growth of non-agriculture GDP per capita

l is the agriculture labor force (in thousands)

la is the arable land, as an asset of the farmers (ha)

GD is an index of global demand for agriculture exports, total world demand for agriculture, crops, livestock, primary, and processed exports, in billions of US$.
Dummy98 is a dummy, 1 for the 1998 financial crisis

is an error term,

And b_0,b_1, b_2, b_3, b_4, b_5, b_6, and b_7 are the coefficients assigned to the independent variables.

Estimation

The model was estimated with time series data for 1976-06 in first difference using OLS and a one-year lag of the fiscal variables. This is because fiscal variables impact agriculture GDP growth with a lag, as today's output is dependant on last year's net public spending. However, the control variables enter the specification contemporaneously, reflecting the assumption that their impact occurs within the same fiscal year.

All variables enter the specification in first difference ensuring that they are stationary and that the model is stable overtime. As can be seen from the Augmented Dickey Fuller tests for stationarity (Table A3.3. below), the control variables where non-stationary in levels as well as the log of non-agriculture GDP, but all were stationary in first differences. On the other hand, the fiscal variables and the log of agriculture GDP per capita are stationarity in both levels and first difference.

Table A3.2: Impact of Agriculture Public Spending on Per Capita Agriculture Growth

Dependent Variable: Agriculture GDP Growth	OLS(1)	OLS(2)	OLS(3)	GMM(1)	GMM(2)	GMM(3)
Constant	-0.03	-0.03	-0.04	-0.01	-0.06	-0.06
	(-1.64)	(-1.21)	(-1.97)+	(-0.38)	(-2.43)*	(-2.87)**
D(APE (-1))	0.46			5.90		
	(0.56)			(2.29)*		
D(Agriculture and Irrigation Public Spending(-1))		2.36	2.72		8.20	4.68
		(2.17)*	(2.41)*		(3.07)**	(2.90)**
D(Fertilizer Subsidies Spending(-1))		-5.14	-6.38		-33.31	-15.62
		(-1.83)+	(-2.24)*		(-4.41)**	(-3.92)**
D(Log non agri-GDP per capita, US Dollar)	0.89	0.84	0.93	0.15	0.97	0.83
	(6.04)**	(7.52)**	(12.28)**	(0.51)	4.31	(6.10)**
D(Log Agriculture Labor)	0.79	0.52	0.30	3.52	-0.03	-1.62
	(2.44)*	(1.34)	(0.72)	(2.23)*	(-0.05)	(-2.61)*
D(Log Arable Land)	-0.37	-0.0005	-0.16	-1.88	0.99	0.82
	(-0.61)	0.000	(-0.30)	(-2.05)+	(1.30)	(1.56)
D(ATR (-1))			-6.65			-24.93
			(-1.43)			(-3.53)**
D(Log GD)			0.0000			-0.0002
			(-1.25)			(-3.22)**
Dummy98	-0.19	-0.19		-1.46	0.36	
	(-1.18)	(-1.23)		(-3.11)**	(0.89)	
Observations	29	29	29	27	27	27
R-squared	0.89	0.92	0.90	0.38	0.59	0.79
Durbin Watson Stat.	2.41	2.60	2.80	1.47	2.57	2.22

t statistics in parentheses
+ significant at 10%; * significant at 5%; ** significant at 1%

Table A3.3: Augmented Dickey Fuller Tests and Stationarity

Variable	Interpolated Dickey-Fuller Test Critical Value: 1% = -3.716; 5% = -2.986; 10% = 2.624 Test Statistic variable in levels Z(t)	Unit Root Process	Test Statistic variable in first difference Z(t)	Unit Root Process
(1)	(2)	(3)	(4)	(5)
Total Agriculture Public Spending (t-1)	-3.391	I(0)	-8.082	I(0)
Agriculture and Irrigation Public Spending to Agriculture GDP (t-1)	-3.482	I(0)	-7.623	I(0)
Fertilizer Subsidy Spending to Agriculture GDP (t-1))	-2.667	I(0)	-8.458	I(0)
Growth of Agriculture GDP per Capita (US Dollar, log)	-3.380	I(0)	-7.008	I(0)
Growth of Non Agriculture GDP per Capita (US Dollar, log)	-1.519	I(1)	-6.361	I(0)
Arable Land (log)	-0.404	I(1)	-3.674	I(0)
Labor force in the agriculture sector (log)	-1.788	I(1)	-5.725	I(0)
Agriculture private machinery input (log)	0.130	I(1)	-3.515	I(0)
Agriculture tax revenue (log)	-0.158	I(1)	-5.082	I(0)
Index of global demand for agriculture export (log)	-1.899	I(1)	-3.592	I(0)

Robustness: Estimating with the General Method of Moments (GMM)

We look at the impact of public spending on agriculture growth with the GMM to conclude that the results are not dependant on the choice of model specification (hence, as reported in Table A3.2. GMM(1), (2), and (3)) . Our findings are generally consistent across specifications and changes to the econometric technique, and in line with the findings from the literature exploring the impact of public spending on growth. However, there are some interesting points to highlight from these empirical estimations.

To control for possible endogeneity between the public spending components and other right hand side variables, the (GMM) regression technique includes instrumental variables that are the lagged values of the regressors, it creates a dynamic setting that can capture endogeneity.[64] Thus, it uses as instruments the second and third lags of Agriculture and Irrigation Public Spending, Fertilizer Subsidy Spending, ATR and residuals, as well as the first and second lags of growth rate GD, non agriculture GDP per capita, and the first and second lags of Arable land, and Labor force in the agriculture sector.

The results indicate that most fiscal variables have a statistically significant effect on the growth rate of agriculture GDP per capita, while the impact is more statistically significant within the GMM setting. Thus, the positive and statistically significant effect on the agri-GDP per capita growth rate comes from agriculture and irrigation spending. This can be seen across the estimations in Table A.3.2., but OLS(3) and GMM(3) are particularly interesting, for they capture the composition effect while considering the impact of taxation and the global demand for agriculture. By contrast, fertilizer subsidy spending has a negative effect on the growth rate of agriculture GDP per capita like in the OLS results.

As in OLS, the growth rate of non agriculture GDP has a positive and highly significant impact implying that spillovers effects from the other sectors are complementary and contribute to growth. With the exception of GMM(1), the effect from the time dummy variable for 1998 is not significant and negative, but serves to control for any disturbances to growth that could be attributed to economy's contraction following the Asian financial crisis.

64 Durbin Wu Hausman test is used to determine endogeneity problem. The test result is rejecting the null hypothesis that the "regressors are exogenous".

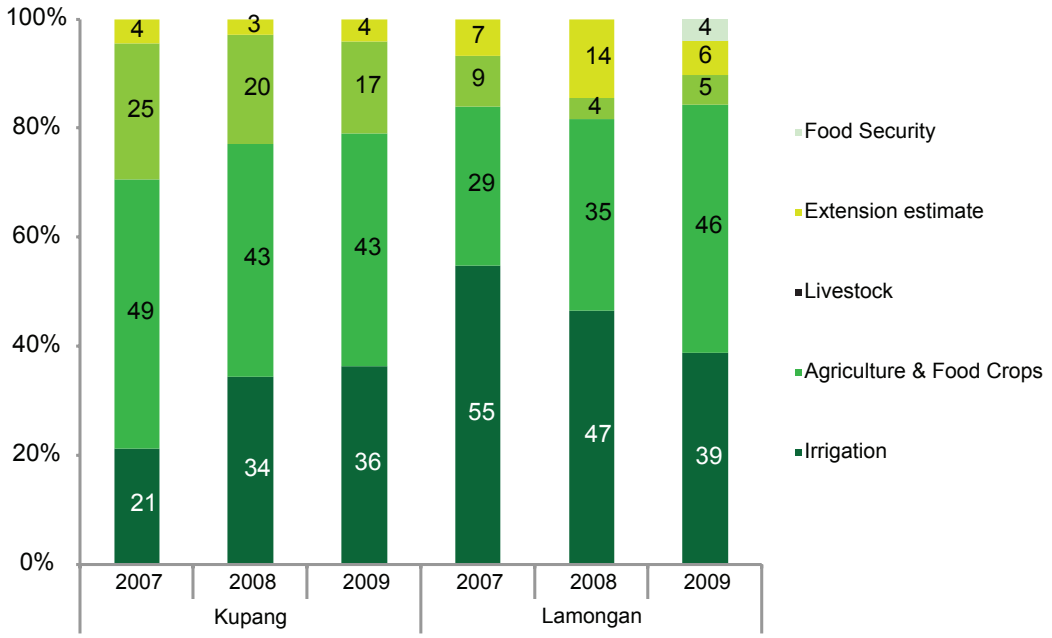
There are also some differences between the OLS and GMM results worth mentioning. Total agriculture spending (combining development spending and subsidies) is only significant in the GMM setting. The agricultural tax variable is negatively associated using OLS and it becomes statistically significant in the dynamic setting of the GMM technique (GMM(3)). Also, the impact from the change in world demand for agricultural products is negative and significant in the GMM results, suggesting a lack of response of agriculture production in Indonesia to changes in global demand.

Annex IV: Findings from the Agriculture Public Expenditure Review Fieldwork

Extension Services

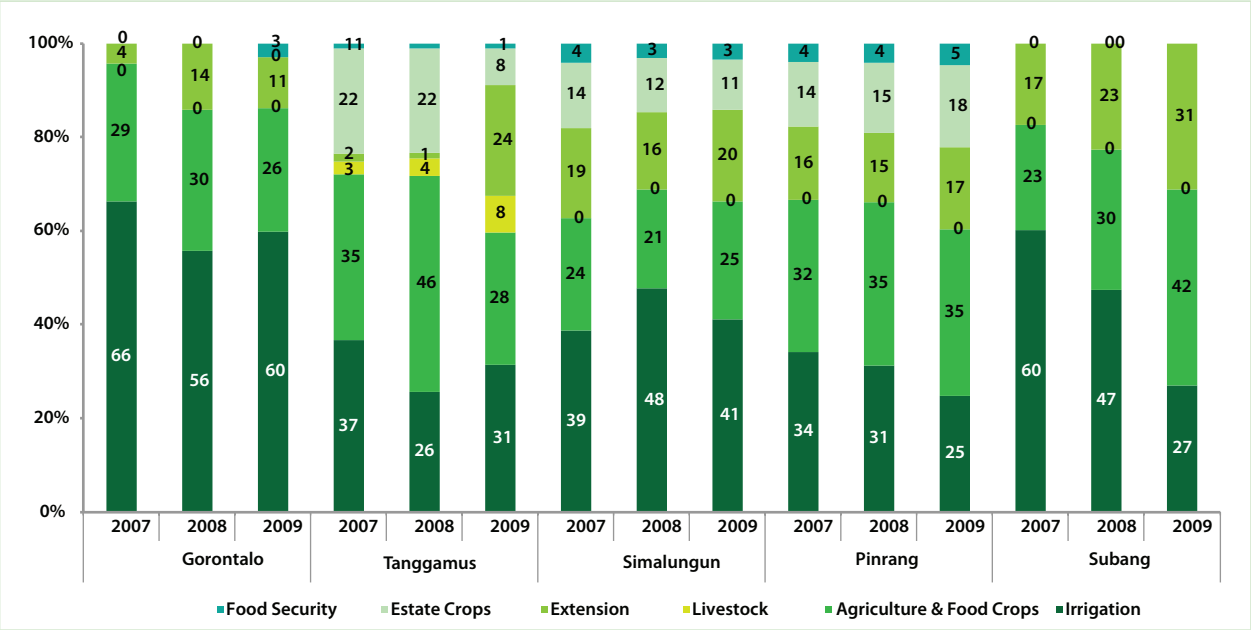
The extension spending in the sample of seven districts varied from around 4 to 24 percent of total agriculture spending. Interestingly, in the districts that had a unified extension agency the level of spending was higher and increased in the past 3 years. In contrast, in those non- unified districts spending was much lower and either stagnant or decreasing. The findings from the field study across five districts with unified extension agencies show that spending for extension ranged from 4 to 31 percent of the total district's public agricultural budget, while the range was much narrower and between 2 to 14 percent for non- unified districts.[65] (Figures A4.1 and A4.2) However, in general when looking across district agencies executing agriculture activities the extension services received amongst the lowest budget share across Dinas, which captures the low budget priority local governments give to the provision of extension services in relation to other agriculture subsectors, such as irrigation, livestock, and food crops. Interestingly, the qualitative information from the survey reveals that having a unified extension agency was helpful in leading sub- national governments prioritize extension activities through their Strategic and Working Plans and resource allocations.

Figure A4.1: Extension spending in non-unified districts, 2007-09



65 Agriculture extension spending in non-unified districts is estimated by capturing spending for extension activities across relevant Dinas, mostly from the Dinas Agriculture. Total agriculture spending consists of the total budget of the Dinas executing agriculture activities, and the irrigation component from the Dinas of Water Resources/Public Works.

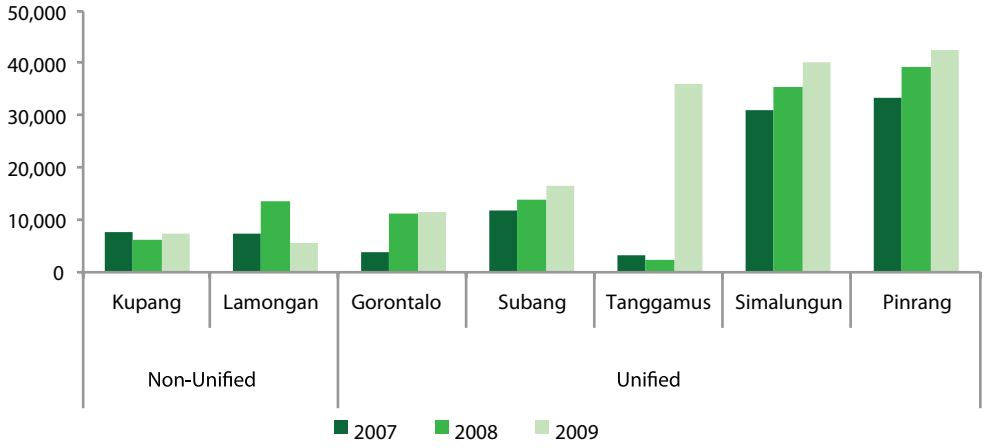
Figure A4.2: Extension spending in unified districts, 2007-09



Source: World Bank staff calculations based on World Bank APER field visit, Direct Spending October 2009.

The extension spending per farmer in those districts with unified extension was higher and showed an increasing trend during 2007-09, compared with spending in non- unified districts. The extension spending per farmer (a ratio of total public extension expenditure to total national spending) was calculated and amongst seven visited districts, in five districts extension spending per farmer was significantly higher than in the case of non- unified extension agencies (Figure A4.3). Furthermore, not only was spending per farmer higher, but the increasing trend was common across the unified districts over the last three years. On the contrary, in Kupang and Lamongan, two districts where there is no unified extension agency, extension spending per farmer was below Rp 15,000 per farmer and is decreasing over the same period.

Figure A4.3: Extension spending per farmer in seven districts, 2007-09



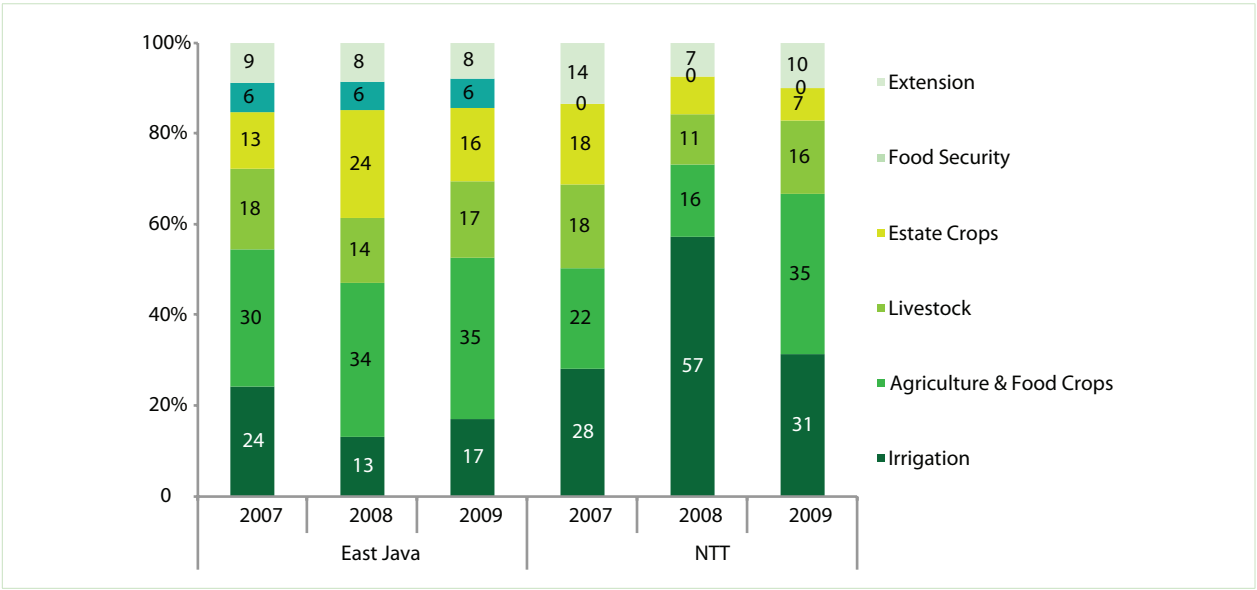
Source: World Bankstaff estimate based on and data from the Wordl Bank APER field visit, October 2009. Direct Spending. Number of farmers is based on data from district BPS and SAKERNAS (number of active labor in agriculture sector, 2006-08).
Note: 1). In districts where unified extension agency is not established yet, extension spending is taken from extension activities of Agriculture Dinas; 2). In Gorontalo and Tanggamus, unified extension agency was established in 2008, the extension spending in 2007 is an estimate calculated from extension activities of Agriculture Dinas in 2007.

Administrative programs dominate extension spending at the district level, leaving little budget to activities supporting service delivery. The extension budget was dominated by allocations for office administration, apparatus, facilities and infrastructure, and development of a financial and reporting system. In some districts, the administrative component was remarkably higher compared to functional program, the case of Subang (42 percent to administrative programs and 45 percent functional respectively), while in Gorontalo, the newly unified agency allocated 65 of the total agency spending for administrative programs. Furthermore, spending for extension in the case study districts by economic classification dominates with spending for salaries, followed by goods and services.

Irrigation

The share of irrigation spending compared to allocations in other agriculture Dinas in both provinces decreased in recent years but, irrigation received greater priority in the budget in NTT than in East Java. For East Java in 2009, the biggest allocation went to the Dinas Agriculture at 35 percent, followed by the Dinas Livestock, the irrigation component of the Dinas Public Works both at 17 percent, and Estate crops at 16 percent of the province's resources for agriculture. The irrigation spending in 2009 accounted for a much smaller share of the budget than in 2007 at 24 percent.[66] Similarly, in NTT the irrigation spending at the Dinas Public Works stood at 31 percent of the budget; a share which only lower than the Dinas Agriculture at 35 percent. Over the last three years, the allocations for irrigation as a percent of the agriculture spending declined considerably in both provinces. Thus, in East Java the decrease was from 24 to 17 percent (2007-09) and in NTT from 57 to 31 percent (2008-09) (Figure A4.4).

Figure A4.4: Agriculture spending across Dinas in selected provinces, 2007-09 (%)

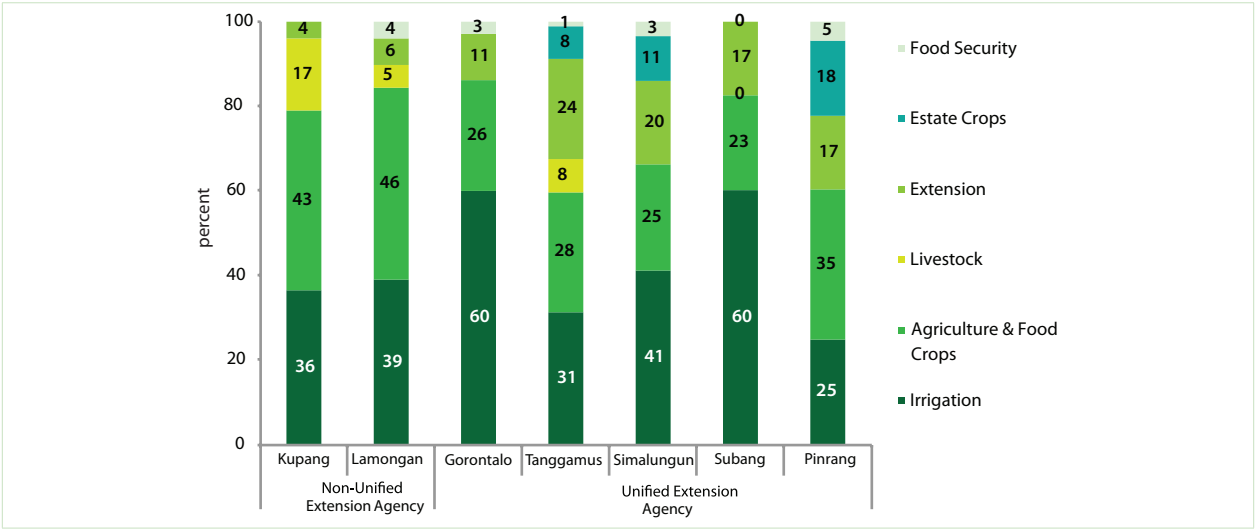


Source: World Bank staff calculations, APBD 2007-09.

In most of the surveyed districts, irrigation was a budget priority for agricultural spending, with an increasing trend in the last three years. While allocations for irrigation varied significantly, across visited districts the irrigation component of the Dinas Public Works/Water Resources received at least one third of the total agriculture spending. Thus, in Gorontalo and Subang it accounted for almost two thirds and Pinrang was the exception. Interestingly, Subang which is one of the most important rice producing districts in West Java, along with Gorontalo, allocated the largest share of the budget of any agriculture agency at 60 percent, followed by the Dinas Agriculture and extension services (17 percent). Irrigation spending was higher across districts with high coverage of irrigated land, the case of Simalungun, Subang, and Gorontalo (Figure A4.5).

66 Total agriculture spending in a district/ province comprises the combined budget of those agencies executing spending related to agriculture.

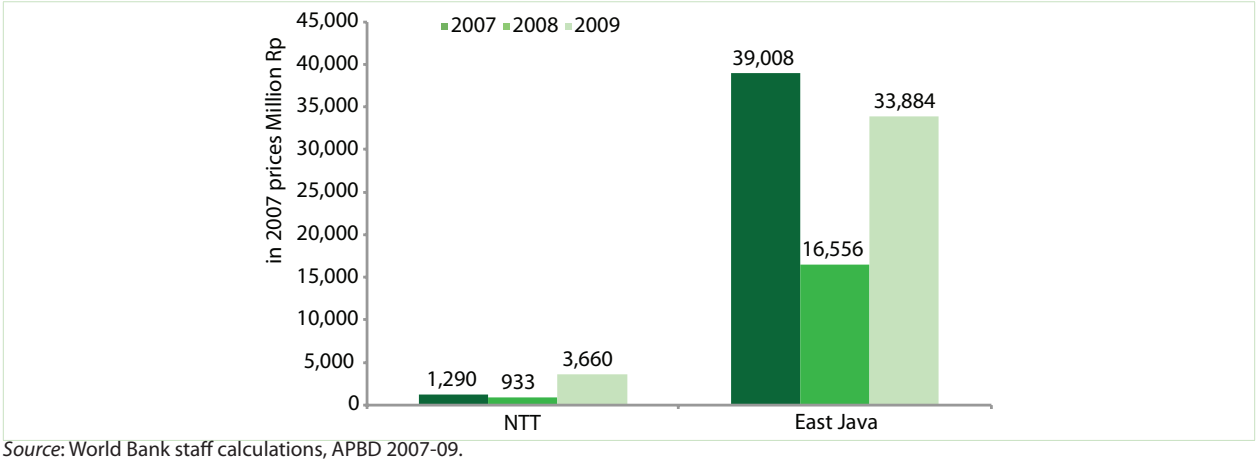
Figure A4.5: Agriculture spending across Dinas in selected districts, 2009



Source: World Bank staff calculations, APBD 2007-09.

A closer look at the budget for O&M for the provincial authority network, it shows a great variability across years that undermines proper maintenance.[67] It was a positive move that both provincial governments reversed in 2009 what had been a significant budget dip in O&M funding in 2008. The budget for O&M across time is a highly rigid expenditure and there is little room for such variability in spending during a short period of time (three years). Therefore, such variance in O&M spending (particularly in 2008) undermines the ability of authorities to properly maintain the provincial network, and 2008 would seem like a difficult year to carry out proper O&M activities in both provinces.

Figure A4.6 : O&M for the secondary network



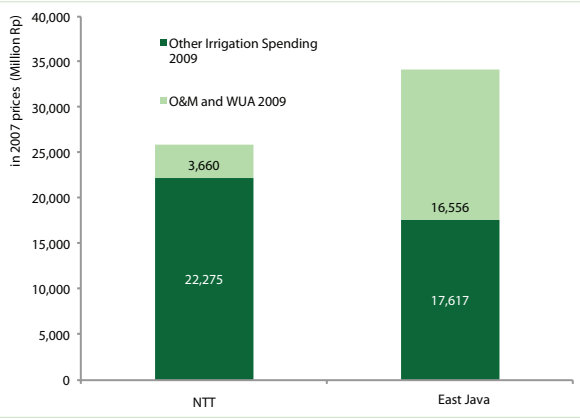
Source: World Bank staff calculations, APBD 2007-09.

However, data from these two provinces suggest that spending on irrigation did not reflect the provinces' needs. In East Java, the allocation for O&M in 2009 was small given the size of the provincial network under its command. Even when considering spending to empower WUAs and the maintenance expenses of the Dinas of Public Works, East Java allocated Rp 33.9 billion and NTT Rp 3.7 billion in 2009 (2007 prices). However, this translated into Rp 103,000 per ha in East Java and into Rp 78,000 in NTT for a much smaller network. These figures are along the lines of the estimations for O&M spending under the WISMP project, which calculates spending at 124,000 per ha for

67 At the provincial and district level spending for O&M comprises: direct spending salaries (and a share of indirect spending salaries), good & services, and spending for water user associations.

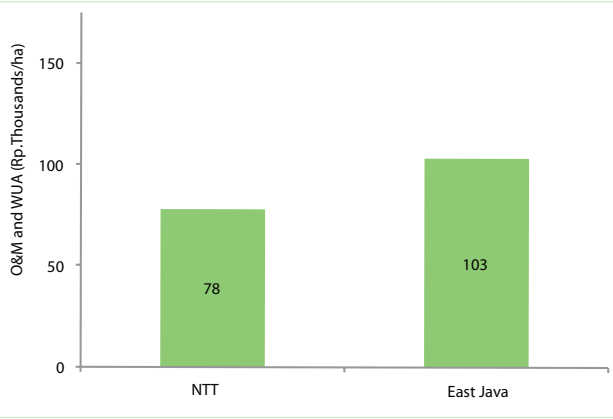
East Java and 60,000 for NTT.[68] While it is difficult to determine an appropriate level of O&M spending, the WISMP estimates suggest maintenance for provincial schemes should oscillate between Rp 150,000 per ha and above. Thus, when put in context spending in these two provinces was still below appropriate levels and when considering the funding needs in East Java, the size of its network, and its current deterioration, this level of funding is low to conduct necessary O&M activities.

Figure A4.7 : O&M spending for the secondary network, 2009 *



Source: World Bank staff calculations, APBD 2007-09.

Figure A4.8: O&M spending per ha *

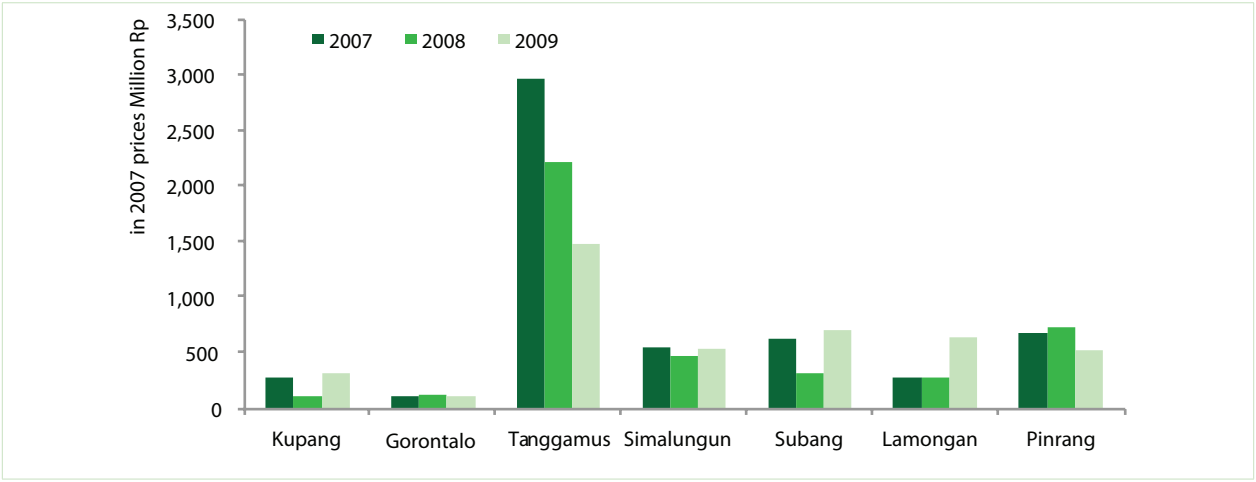


Source: World Bank staff calculations, APBD 2007-09, MPW Decree No. 390/Kpts/M/2007
Note: * East Java, 2008, NTT 2009.

In 2007-09, the budget for O&M for district authority schemes increased in real terms in four of the seven sampled districts, with the exception of Pinrang, Gorontalo and Tanggamus. In Subang, Lamongan, and Kupang, the increase was significant in 2009. The largest decrease in O&M spending was seen in Tanggamus where O&M was reduced by half in real terms over these three years. Also, Simalungun, Subang and Kupang, like the provincial governments, reported a big dip in O&M spending for 2008 that reversed the following year. This wide variance in these three districts across a three-year period and for a highly inflexible expense would have made difficult the execution of operation and maintenance activities for 2008. In general, there was great variation across all districts and over time in spending for O&M.

68 WISMP, Water Resources Irrigation Management Program. Source: Panduan Penilaian Kinerja Kabupaten, WISMP, Directorate Irrigation, MoPW, 2010.

Figure A4.9: O&M spending for district authority schemes

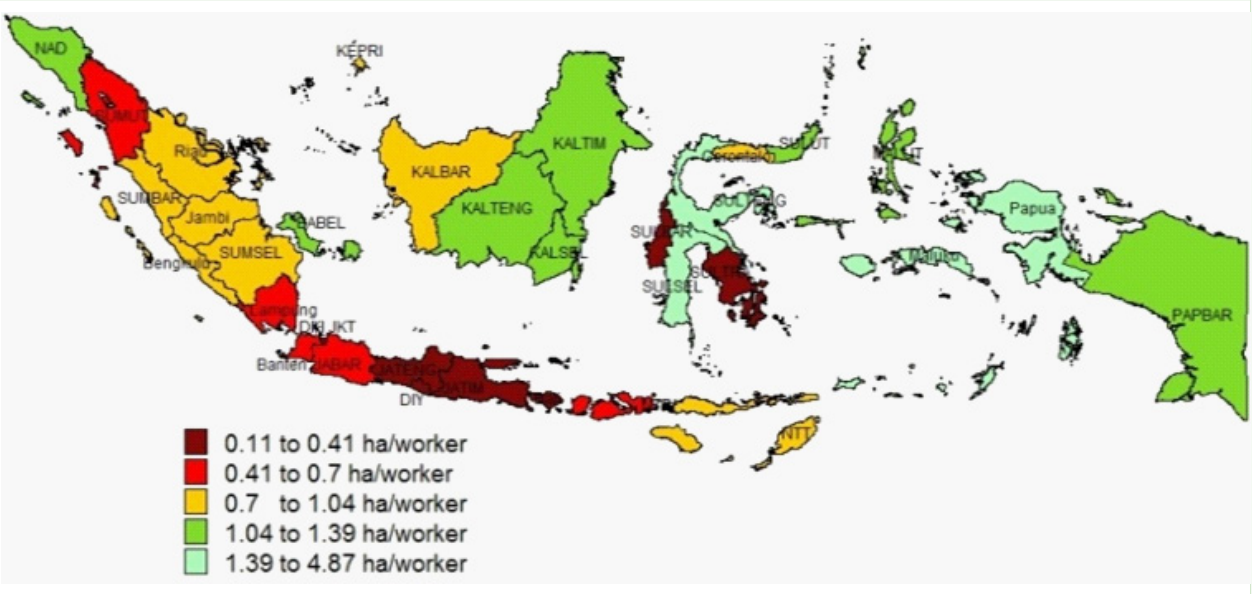


Source: World Bank staff calculations, APBD 2007-09.

Annex V: Land Use, Productivity and Irrigation Coverage

The provinces in Java, Bali, and some areas of Sulawesi are the most densely farmed areas, reflecting less than 0.4 ha of arable land per farmer, as well as the most productive land. These account for many of the important rice producing provinces and illustrate the small-holder nature of agriculture production in Indonesia. These regions are known to be important agriculture centers and entail highly populated rural areas (Figure A5.1). Therefore, it is not surprising that here land is more productive, reflecting the highest output per ha of arable land at above Rp 32 million outside Java and surpassing Rp 60 million within Java, as was also the case in Riau and North Sumatra (Figure A5.1).

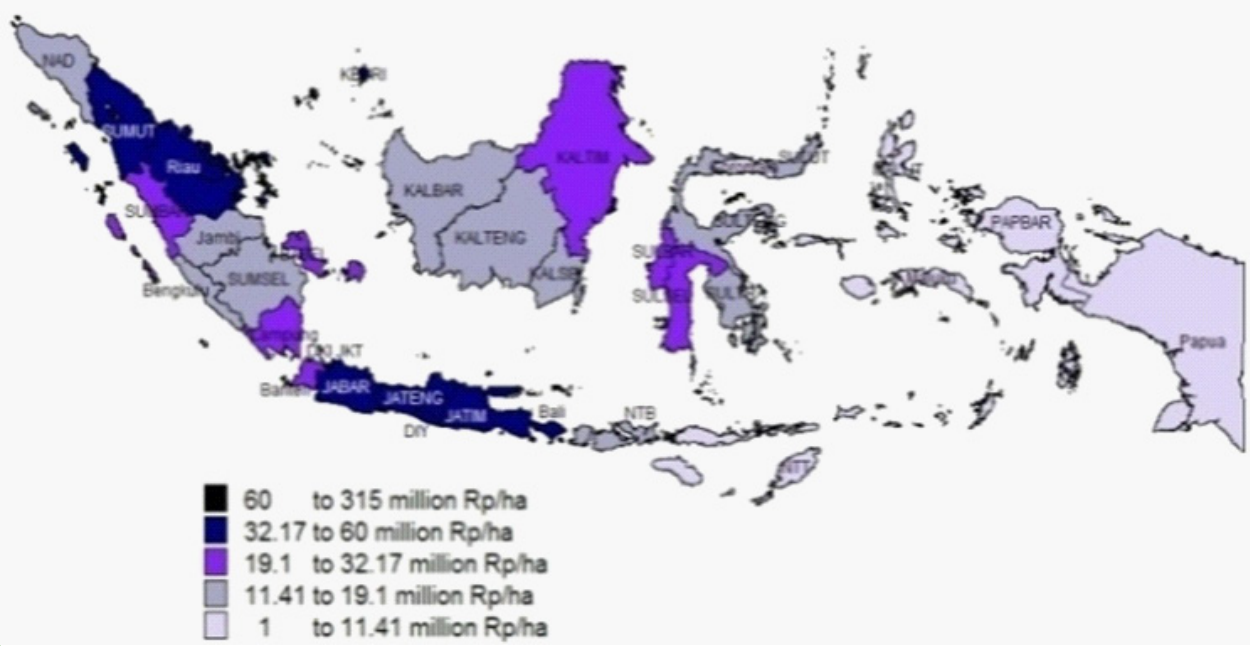
Figure A5.1: Arable land per worker * (ha), 2008



Source: BPS.
*Worker = agriculture employment including forestry, hunting, fisheries.[69]

69 In 2008, total agriculture employment in the FAOSTAT database was 47,894,000 while the BPS figures 42,689,635 people.

Figure A5.2 : Agriculture output per hectare of arable land (million Rp/ha), 2008



Irrigation

According to data from FAO, irrigation coverage in Indonesia is low, particularly outside of Java and Bali, covering just slightly above 20 percent of arable land; much lower than China (40 percent), India (36 percent), and Vietnam (47 percent) as described in Table A.5.1 below. Much of irrigation in Indonesia went to traditional crops (rice), of which 82 percent is grown under irrigation[70]. Across Indonesian regions, Java and Bali have the highest irrigation coverage with over 50 percent of irrigated land (paddy land). However, the total size of irrigated area has not increased much over the past years, averaging 1 percent growth after 2005.

Table A5.1: Irrigation as percentage of arable land (2000-07)

Countries/Year	2000	2001	2002	2003	2004	2005	2006	2007
Indonesia	21.6	22.3	22.4	20.1	18.2	20.5	20.5	20.5
Malaysia	19.9	20.3	20.3	20.3	20.3	20.3	20.3	20.3
Philippines	30.8	31.1	31.4	31.6	31.0	28.0	27.7	28.0
Thailand	29.7	32.0	32.4	32.8	32.8	32.8	32.8	32.8
Vietnam	48.4	45.1	45.5	45.6	46.4	47.2	47.3	47.2
India	32.6	35.4	34.2	35.0	35.0	36.0	36.1	36.1
China	37.4	41.2	42.0	42.0	41.5	40.2	39.7	39.6

Source: FAOSTAT.

70 World Bank (2009).

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