PHILIPPINES

Rural Growth and Development
Revisited Study:
Agricultural Research,
Development and Extension

BY

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<th>Full Form</th>
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<tbody>
<tr>
<td>AFMA</td>
<td>Agriculture and Fisheries Modernization Act</td>
</tr>
<tr>
<td>AFNR</td>
<td>Agriculture, Forestry, and Natural Resources</td>
</tr>
<tr>
<td>AgGDP</td>
<td>Agricultural Gross Domestic Product</td>
</tr>
<tr>
<td>AgGVA</td>
<td>Agricultural Gross Value Added</td>
</tr>
<tr>
<td>ANR</td>
<td>Agriculture and Natural Resources</td>
</tr>
<tr>
<td>ARC</td>
<td>Agrarian Reform Community</td>
</tr>
<tr>
<td>ARI</td>
<td>Advanced Research Institute</td>
</tr>
<tr>
<td>ATI</td>
<td>Agricultural Training Institute</td>
</tr>
<tr>
<td>BAEx</td>
<td>Bureau of Agricultural Extension</td>
</tr>
<tr>
<td>BAFPS</td>
<td>Bureau of Agriculture and Fisheries Products Standards</td>
</tr>
<tr>
<td>BAI</td>
<td>Bureau of Animal Industry</td>
</tr>
<tr>
<td>BAR</td>
<td>Bureau of Agricultural Research</td>
</tr>
<tr>
<td>BARBD</td>
<td>Bureau of Agrarian Reform Beneficiaries Development</td>
</tr>
<tr>
<td>BFAR</td>
<td>Bureau of Fisheries and Aquatic Resources</td>
</tr>
<tr>
<td>BPI</td>
<td>Bureau of Plant Industry</td>
</tr>
<tr>
<td>BPRE</td>
<td>Bureau of Post-harvest Research and Development</td>
</tr>
<tr>
<td>BSWM</td>
<td>Bureau of Soils and Water Management</td>
</tr>
<tr>
<td>CARP</td>
<td>Comprehensive Agrarian Reform Program</td>
</tr>
<tr>
<td>CENRO</td>
<td>Community Environment and Natural Resources Office</td>
</tr>
<tr>
<td>CERDAF</td>
<td>Council for Extension, Research and Development for Agriculture and Fishery</td>
</tr>
<tr>
<td>CHED</td>
<td>Commission on Higher Education</td>
</tr>
<tr>
<td>CIMMYT</td>
<td>International Center for Maize and Wheat Research</td>
</tr>
<tr>
<td>CLGU</td>
<td>City Local Government Unit</td>
</tr>
<tr>
<td>COD</td>
<td>Center of Development</td>
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<tr>
<td>CODA</td>
<td>Cotton Development Authority</td>
</tr>
<tr>
<td>COE</td>
<td>Center of Excellence</td>
</tr>
<tr>
<td>CSO</td>
<td>Civil Society Organization</td>
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<tr>
<td>DA</td>
<td>Department of Agriculture</td>
</tr>
<tr>
<td>DAFEP</td>
<td>Decentralized Agriculture and Forestry Extension Project</td>
</tr>
<tr>
<td>DAR</td>
<td>Department of Agrarian Reform</td>
</tr>
<tr>
<td>DAR-MO</td>
<td>Department of Agrarian Reform - Municipal Office</td>
</tr>
<tr>
<td>DAR-PO</td>
<td>Department of Agrarian Reform - Provincial Office</td>
</tr>
<tr>
<td>DBM</td>
<td>Department of Budget Management</td>
</tr>
<tr>
<td>DENR</td>
<td>Department of Environment and Natural Resources</td>
</tr>
<tr>
<td>DILG</td>
<td>Department of Interior and Local Government</td>
</tr>
<tr>
<td>DOST</td>
<td>Department of Science and Technology</td>
</tr>
<tr>
<td>DOST-RO</td>
<td>Department of Science and Technology -Regional Office</td>
</tr>
<tr>
<td>DTI</td>
<td>Department of Trade and Industry</td>
</tr>
<tr>
<td>ERDB</td>
<td>Ecosystems Research and Development Bureau</td>
</tr>
<tr>
<td>ERDS</td>
<td>Ecosystems Research and Development Services</td>
</tr>
<tr>
<td>FDC</td>
<td>Food Development Center (NFA)</td>
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<tr>
<td>Abbreviation</td>
<td>Full Form</td>
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<td>--------------</td>
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<tr>
<td>FIDA</td>
<td>Fiber Development Authority</td>
</tr>
<tr>
<td>FITS</td>
<td>Farmers Information and Technology Services (PCARRD)</td>
</tr>
<tr>
<td>FMB</td>
<td>Forest Management Bureau (DENR)</td>
</tr>
<tr>
<td>FMS</td>
<td>Forest Management Services</td>
</tr>
<tr>
<td>FNRI</td>
<td>Food and Nutrition Research Institute</td>
</tr>
<tr>
<td>FPRDI</td>
<td>Forest Products Research and Development Institute</td>
</tr>
<tr>
<td>GBO</td>
<td>Grassroots Business Organization</td>
</tr>
<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
</tr>
<tr>
<td>GMA</td>
<td>Ginintuang Masaganang Ani</td>
</tr>
<tr>
<td>GVA</td>
<td>Gross Value Added</td>
</tr>
<tr>
<td>HCD</td>
<td>Human Capital Development</td>
</tr>
<tr>
<td>HRDC</td>
<td>Human Resources Development Center (PCARRD)</td>
</tr>
<tr>
<td>IARC</td>
<td>International Agricultural Research Center</td>
</tr>
<tr>
<td>ICT</td>
<td>Information and Communications Technology</td>
</tr>
<tr>
<td>IFPRI</td>
<td>International Food Policy Research Institute</td>
</tr>
<tr>
<td>IPM</td>
<td>Integrated Pest Management</td>
</tr>
<tr>
<td>IRA</td>
<td>Internal Revenue Allocation</td>
</tr>
<tr>
<td>IRR</td>
<td>Implementing Rules and Regulations (of a Law)</td>
</tr>
<tr>
<td>IRRI</td>
<td>International Rice Research Institute</td>
</tr>
<tr>
<td>ITDI</td>
<td>Industrial Technology Development Institute</td>
</tr>
<tr>
<td>LGU</td>
<td>Local Government Unit</td>
</tr>
<tr>
<td>MARC</td>
<td>Municipal Agrarian Reform Center</td>
</tr>
<tr>
<td>MDG</td>
<td>Millennium Development Goal</td>
</tr>
<tr>
<td>MFO</td>
<td>Major Final Output</td>
</tr>
<tr>
<td>MLGU</td>
<td>Municipal Local Government Unit</td>
</tr>
<tr>
<td>MOU</td>
<td>Memorandum of Understanding</td>
</tr>
<tr>
<td>MTPDP</td>
<td>Medium-Term Philippine Development Plan</td>
</tr>
<tr>
<td>M&amp;E</td>
<td>Monitoring and Evaluation</td>
</tr>
<tr>
<td>NARS</td>
<td>National Agricultural Research System</td>
</tr>
<tr>
<td>NAFES</td>
<td>National Agriculture and Fisheries Education System</td>
</tr>
<tr>
<td>NARRDN</td>
<td>National Agriculture and Resources Research and Development Network (PCARRD)</td>
</tr>
<tr>
<td>NARRDS</td>
<td>National Aquatic Resources Research and Development System (PCAMRD)</td>
</tr>
<tr>
<td>NAST</td>
<td>National Academy of Science and Technology</td>
</tr>
<tr>
<td>NEDA</td>
<td>National Economic Development Authority</td>
</tr>
<tr>
<td>NESAF</td>
<td>National Extension System for Agriculture and Fisheries</td>
</tr>
<tr>
<td>NFA</td>
<td>National Food Authority</td>
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<tr>
<td>NGA</td>
<td>National Government Agencies</td>
</tr>
<tr>
<td>NGO</td>
<td>Non-Government Organization</td>
</tr>
<tr>
<td>NIA</td>
<td>National Irrigation Authority</td>
</tr>
<tr>
<td>NRM</td>
<td>Natural Resources Management</td>
</tr>
<tr>
<td>NTA</td>
<td>National Tobacco Authority</td>
</tr>
<tr>
<td>PAFRDC</td>
<td>Philippine Agriculture and Fisheries Research for Development Center</td>
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<tr>
<td>PARC</td>
<td>Provincial Agrarian Reform Center</td>
</tr>
<tr>
<td>PARO</td>
<td>Provincial Agrarian Reform Office</td>
</tr>
<tr>
<td>PCA</td>
<td>Philippine Coconut Authority</td>
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I. Rationale for Investing in Agricultural Research, Development, and Extension

A. Investment in Agricultural Research and Development

Investment in agricultural research and development (R&D) has been one of the major sources of growth in agricultural productivity in the past. It is likewise important in achieving future development priorities such as poverty reduction and natural resources conservation. Agricultural productivity growth has been based mainly on the application of technology and science-based information generated by national agricultural R&D systems.

Hundreds of studies in developing countries have consistently shown that R&D investments generated high payoffs, with rates of return averaging over 40%, and an average rate of return of 50% in Asia (Byerlee and Alex 2003). Alston et al. (1998) surveyed 294 studies of the rates of return to agricultural research and showed that the estimated annual rates of return averaged 73%. Rice research in India and Indonesia has 65% rate of return (Ponce 2002). Such a high return would suggest that agricultural research is an unusually profitable development investment opportunity. But despite such evidence of high returns, agricultural R&D funding continues to decline in many developing countries.

Many products of agricultural R&D are public goods that the private sector has no incentive to produce. In most developing countries, the public sector funds most agricultural R&D. The targets are usually small-scale farmers and fishers who are not organized and cannot afford to finance their own research activities. With limited opportunities to appropriate profits from new technologies needed by small-scale producers, private companies do not have incentives to invest in R&D. But private research often relies on knowledge provided by publicly funded R&D.

Research investment can also provide important direct and indirect impacts on rural poverty. Byerlee and Alex (2003) cited some examples of direct impact such as increase in micronutrient contents of food by commercial farmers, and increase value-addition and high-value crops/livestock and technologies to reduce production risks in small farms. Some indirect impacts are: promote labor-intensive, high-value industries (cut flowers), and increase productivity to reduce food prices in commercial farms; and develop labor-intensive production systems to generate employment in small farms. Agricultural research can benefit poor farmers who adopt improved technologies by increasing their incomes or reducing production and marketing risks (i.e., breeding for pest resistance). Research can also improve management of natural resources, which the poor depend for their livelihood.

Studies using equation-modeling framework by the International Food Policy Research Institute (IFPRI) in China (Fan, Zhang and Zhang 2001) and India (Fan, Hazell and Thorat 1999) showed that investments in agricultural research, infrastructure, and education provided the highest productivity and poverty reduction effects (Table 1). In India, the study showed that government investment in agricultural R&D had the highest contribution to productivity and growth (6.98%), followed by roads (3.03%). In China, the highest productivity returns were also from agricultural R&D (7.97%), followed by education (6.68%), and roads (4.91%).

The authors also showed that in India, the most effective rural poverty reduction investments were roads (0.87%), followed by agricultural R&D (0.48%). In China, the most important contributors to poverty reduction (in terms of number of poor reduced per 10,000 yuan) was education (8.80),
followed by agricultural R&D (6.79), and then roads (3.22). Translated into the US dollar, the cost of
removing one person from poverty was about $180 in India and $380 in China.

Table 1. Effects on productivity and poverty of additional government expenditures.

<table>
<thead>
<tr>
<th>INVESTMENT</th>
<th>INDIA Marginal Impact of Additional Rs 100 B at 1953 Prices (%)</th>
<th>Number of poor reduced per Rs billion</th>
<th>CHINA Returns to Agricultural Production (Yuan/ Yuan Invested), %</th>
<th>No. of poor reduced per 10,000 Yuan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agricultural R&amp;D</td>
<td>0.48</td>
<td>6.98</td>
<td>91.4</td>
<td>9.59</td>
</tr>
<tr>
<td>Irrigation</td>
<td>-0.04</td>
<td>0.56</td>
<td>7.40</td>
<td>1.88</td>
</tr>
<tr>
<td>Roads</td>
<td>0.87</td>
<td>3.03</td>
<td>165.0</td>
<td>2.12</td>
</tr>
<tr>
<td>Education</td>
<td>0.17</td>
<td>0.43</td>
<td>31.7</td>
<td>3.71</td>
</tr>
<tr>
<td>Electricity</td>
<td>0.02</td>
<td>0.02</td>
<td>2.90</td>
<td>0.54</td>
</tr>
<tr>
<td>Rural Telephone</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1.19</td>
</tr>
<tr>
<td>Soil and Water</td>
<td>0.04</td>
<td>0.00</td>
<td>6.70</td>
<td>--</td>
</tr>
<tr>
<td>Rural Development</td>
<td>-0.15</td>
<td>n.a.</td>
<td>27.8</td>
<td>--</td>
</tr>
<tr>
<td>Health</td>
<td>-0.02</td>
<td>n.a.</td>
<td>4.00</td>
<td>--</td>
</tr>
</tbody>
</table>


The World Bank (2003) determined that gross domestic product (GDP) growth is needed in low-income countries to cut poverty in half by 2015 to meet the Millennium Development Goal (MDG). It showed that about 24% of low-income countries’ GDP is agricultural; hence, agriculture must grow at about 3.4% per annum to achieve the overall growth and poverty reduction objective. Such level of growth is critical because agriculture is also a source of food security; and a safety net for the poor. There has been global success in food production. In 1970-2000, dramatic shifts in food production and have outpaced population growth as indicated in Figure 1. High-yielding varieties of wheat and rice swept across much of Asia during the 1970s and 1980s, easing fears of imminent famine (Rosegrant et al. 2001).

![Figure 1. Population and global food production indices, 1996-1998.](Source: FAOSTAT in Rosegrant et al. 2001)
In spite of the positive impact of science-based technological changes in agriculture, farmers in the world’s poorest countries are still untouched by yield increases (Figure 2). The crop yield gap has been reduced by the adoption of improved technologies, which has been critical in enhancing agricultural growth. Because new agricultural land will be scarce, increasing cereal production will require increasing productivity, that is, getting greater cereal yields from a given hectare of land (Rosegrant et al. 2001). But yield growth rates in nearly all regions have been slowing down since the 1980s.

![Figure 2. Cereal yield growth rates by region, 1967-2020.](image)

**Figure 2. Cereal yield growth rates by region, 1967-2020.**
Sources: FAOSTAT In: IFRI 2001

**B. Investment in Agricultural Extension and Information Systems**

Technology and information from extension and information services influence farming decisions by most men and women farmers and fishers, and other rural dwellers. Agricultural knowledge, technology, and skills will be more important as development strategy shifts from extensification to sustainable intensification of agriculture.

Past returns to investment in extension have been high, although extension services have been criticized for low efficiency and equity in service provision. Rates of return on extension investments in developing countries have generally ranged from 5% to more than 50% (Evenson 1997). A meta-study of 289 studies of economic returns to agricultural research and extension found median rates of return of 58% for extension investments, 49% for research investments, and 36% for investments in research and extension combined (Alston et al. 2000). But the authors noted that rates of return were highly variable.

Public extension expenditures grew rapidly in the 1970s and were estimated at about US$6 billion globally in 1988 (Swanson, Farmer and Bahal 1990). Since then, there may have been substantial decreases in expenditures due to structural adjustment programs, public sector retrenchment, and reallocation of expenditures. However, the authors indicate that extension funding may have remained high, up to 2% of agricultural gross domestic product (AgGDP).
C. Philippine Agriculture and Fisheries RDE Modernization Strategy

Research, development, and extension (RDE) could provide critical inputs for the modernization of Philippine agriculture and ensure that Philippine commodities and products are competitive in the global and domestic markets. There are two significant milestones that influenced RDE in the country in the past decade: (1) the devolution of agricultural extension in 1991, and (2) the passage of the Agriculture and Fisheries Modernization Act (AFMA) in 1997.

1. Devolution of Agricultural Extension Services

The passage of the Local Government Code (Republic Act 7167), in 1991, transferred the actual delivery of agriculture and fisheries extension services to farmers, fishers, and agribusiness entrepreneurs from the Department of Agriculture (DA) to the decentralized local government units (LGUs). It also abolished DA’s Bureau of Agricultural Extension (BAEx).

2. AFMA: The Role of Agricultural RDE

The passage of the AFMA (Republic Act 8345) was a significant milestone in redirecting RDE funding and programs in the Philippines. AFMA aims to modernize Philippine agriculture and fisheries and recognize the critical role of RDE. The AFMA Implementing Rules and Regulations (IRR) defined the scope and coverage of agriculture and fisheries RDE services to include: technology generation, training, farm or business advisory, technology demonstration, and information and communication support. It also specified that the government should provide RDE budget equivalent to 10% of gross value added in agriculture (AgGVA), with 4% for biotechnology. Allocation for agricultural extension was envisioned to be 10% of the total AFMA budget.

The implementation of the many goals of AFMA, especially reorientation and revamping of public sector support, has not taken place. The first year proposed AFMA budget was ₱20 billion, but this amount has not been released. The actual releases averaged from ₱12 billion to ₱15 billion over the past six years. Further, AFMA implementation has been on selective basis (Sarmiento 2003). Failure to provide the required fund allocations was critical, but this was not the only problem. A number of key institutional reforms have not been undertaken.

A 2003 report of the Presidential Adviser on Agriculture and Fisheries Modernization showed substantial initial accomplishments in implementing the RDE reforms. Further assessment of the implementation status of RDE in AFMA was carried out by del Rosario, Consolacion, and Quinones (2003), as part of the preparation for the World Bank-assisted Diversified Farm Income and Market Development Project that has recently become effective. They determined that although there have been initial outputs, there is no significant impact so far.

3. Medium-Term Philippine Development Plan for 2004-2010

The Medium-Term Philippine Development Plan (MTPDP) for 2004-2010 (NEDA 2004) is in its second year of implementation. A review of the previous MTPDP (2001-2003) indicated that the agriculture sector grew 3-5% annually, and that most of the key agriculture and fishery production targets were exceeded. However, comparative yield, production cost, and prices of agricultural commodities were hardly apace with its Asian neighbors. Major reasons cited are higher cost of farm inputs and poor access of farmers to recommended packages of technology.
The programs and policy reform targets of MTPDP for 2004-2010 related to agricultural RDE and science and technology (S&T) are:

**Agribusiness** (Chapter 2):

1. Intensify S&T application in Philippine farms by transforming RDE institutions into market-sensitive and demand-driven change agents; national government to focus on capacity building of LGUs to deliver extension services.
2. Fully implement AFMA provision to consolidate and rationalize the agriculture and natural resources (ANR) RDE system for eventual unification of the system by 2010.

**Mobilizing Knowledge and S&T** (Chapter 18)

1. Adopt S&T policies focused on making the Philippine National Innovation System work.
2. Accelerate knowledge creation and transfer to upgrade technologies and increase productivity.
3. Improve competitiveness of the country’s human capital.

### II. Approach and Methodology for the Study

The current study started with a quick review of relevant literature in agricultural RDE, both local and foreign, to get a broader perspective and identify lessons learned that are appropriate in the Philippines. This was followed by discussion with managers/leaders of key government offices involved in RDE to identify/verify the key constraints and issues in the implementation progress of various government reforms in RDE. This discussion also provided opportunity to identify possible solutions and key actions to enhance implementation during the MTPDP period (2004-2010).

Due to time constraint, there have been limited consultations with stakeholders, such as representatives of private sector companies, private sector alliances, non-government organizations (NGOs), rural producer organizations (RPOs), and client groups. The recommendations and suggested actions were based on an analysis of the implementation progress and constraints identified in current public RDE programs and agriculture-related development programs. Current literature was reviewed and discussions were done with key government officials and individual senior Filipino RDE specialists. E-consultations were also done with some international specialists in RDE and in agriculture and rural development-related topics. An attempt was made to follow-up the initial consultations with government officials to get feedback on the findings and proposed actions to be taken to improve RDE implementation.

### III. Asian Regional Agricultural Research

The green revolution had a significant impact on Asian agriculture. It came about by the introduction of semi-dwarf varieties of rice and wheat in the mid-1960s. Research outputs from International Agricultural Research Centers (IARCs), such as the International Rice Research Institute (IRRI) and the International Center for Maize and Wheat Research (CIMMYT), contributed significantly to the spread of the new crop varieties. The Philippines and other
Asian countries benefited from these research outputs. The widespread adoption by farmers of these “miracle grains” raised yields greatly. The improved grain cultivars and other various research-led technological changes have translated into production increases. Modern varieties offered the alternative of raising yields so that more food could be produced in existing crop lands. The widespread adoption and large impact of new agricultural technologies would suggest that agricultural research is a profitable activity.

In 2003, the SEAMEO Regional Center for Graduate Study and Research in Agriculture (SEARCA) analyzed the productivity of 17 crops from 1990-2000 in six Asian countries. The result showed productivity gaps across most commodities, showing a deterioration of the competitiveness of the Philippines in agriculture. Table 2 shows a comparison of the productivity of four major crops, two cereal crops for food security (rice and maize), and two high-value crops for export (banana and pineapple). The data shows large productivity gap even in 2000 between the Philippines and its Asian neighbors except in pineapple.

The rice yield in the Philippines, although higher than Thailand’s, was three-fourths of the average among Asian developing countries, seven-tenths of Indonesia’s and Vietnam’s, and about half of China’s. Thailand has higher rice hectare per capita and is a net rice exporter, while the Philippines is a net rice importer. The Philippines had the lowest maize yield among the Asian countries in 2000, about half of Thailand’s and the average for Asian developing countries. The commodity where the Philippines was a yield leader in the region was in pineapple. The Philippines remains competitive mainly in corporate-based fruits such as banana and pineapple.

Table 2. Yield per hectare of four commodities (rice, maize, banana, and pineapple) in the Asian Region, 1990-2000.

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<tr>
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<tbody>
<tr>
<td>Yield (mt/ha)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Yield (mt/ha)</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Philippines</td>
<td>2.98</td>
<td>2.80</td>
<td>3.07</td>
<td></td>
<td>Philippines</td>
<td>1.27</td>
<td>1.52</td>
<td>1.80</td>
<td></td>
</tr>
<tr>
<td>Asia Developing</td>
<td>3.57</td>
<td>3.70</td>
<td>3.92</td>
<td></td>
<td>Asia Developing</td>
<td>3.31</td>
<td>3.61</td>
<td>3.58</td>
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</tr>
<tr>
<td>World</td>
<td>3.53</td>
<td>3.66</td>
<td>3.88</td>
<td></td>
<td>World</td>
<td>3.68</td>
<td>3.79</td>
<td>4.30</td>
<td></td>
</tr>
<tr>
<td>China</td>
<td>5.72</td>
<td>6.02</td>
<td>6.26</td>
<td></td>
<td>China</td>
<td>4.53</td>
<td>4.92</td>
<td>4.60</td>
<td></td>
</tr>
<tr>
<td>Indonesia</td>
<td>4.30</td>
<td>4.35</td>
<td>4.41</td>
<td></td>
<td>Indonesia</td>
<td>2.13</td>
<td>2.26</td>
<td>2.75</td>
<td></td>
</tr>
<tr>
<td>Malaysia</td>
<td>2.77</td>
<td>3.16</td>
<td>3.17</td>
<td></td>
<td>Malaysia</td>
<td>1.75</td>
<td>1.87</td>
<td>2.41</td>
<td></td>
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<tr>
<td>Thailand</td>
<td>1.96</td>
<td>2.42</td>
<td>2.62</td>
<td></td>
<td>Thailand</td>
<td>2.41</td>
<td>3.29</td>
<td>3.64</td>
<td></td>
</tr>
<tr>
<td>Vietnam</td>
<td>3.18</td>
<td>3.69</td>
<td>4.24</td>
<td></td>
<td>Vietnam</td>
<td>1.55</td>
<td>2.11</td>
<td>2.75</td>
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<tr>
<td>Yield (mt/ha)</td>
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<td></td>
<td>Yield (mt/ha)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Philippines</td>
<td>3.70</td>
<td>10.87</td>
<td>12.86</td>
<td></td>
<td>Philippines</td>
<td>19.39</td>
<td>21.03</td>
<td>35.07</td>
<td></td>
</tr>
<tr>
<td>Asia Developing</td>
<td>14.76</td>
<td>15.99</td>
<td>19.07</td>
<td></td>
<td>Asia Developing</td>
<td>17.73</td>
<td>17.49</td>
<td>19.29</td>
<td></td>
</tr>
<tr>
<td>World</td>
<td>13.89</td>
<td>14.76</td>
<td>16.30</td>
<td></td>
<td>World</td>
<td>18.12</td>
<td>18.05</td>
<td>18.43</td>
<td></td>
</tr>
<tr>
<td>China</td>
<td>14.02</td>
<td>16.65</td>
<td>19.90</td>
<td></td>
<td>China</td>
<td>26.72</td>
<td>27.15</td>
<td>27.95</td>
<td></td>
</tr>
<tr>
<td>Indonesia</td>
<td>18.20</td>
<td>13.58</td>
<td>13.15</td>
<td></td>
<td>Indonesia</td>
<td>7.96</td>
<td>11.97</td>
<td>7.50</td>
<td></td>
</tr>
<tr>
<td>Malaysia</td>
<td>17.78</td>
<td>17.43</td>
<td>17.74</td>
<td></td>
<td>Malaysia</td>
<td>23.47</td>
<td>23.18</td>
<td>18.57</td>
<td></td>
</tr>
<tr>
<td>Thailand</td>
<td>12.22</td>
<td>12.96</td>
<td>12.84</td>
<td></td>
<td>Thailand</td>
<td>25.03</td>
<td>23.07</td>
<td>23.51</td>
<td></td>
</tr>
<tr>
<td>Vietnam</td>
<td>13.84</td>
<td>13.98</td>
<td>11.41</td>
<td></td>
<td>Vietnam</td>
<td>12.03</td>
<td>7.02</td>
<td>7.98</td>
<td></td>
</tr>
</tbody>
</table>


There has been significant increase in public agricultural research expenditures in Asia, from 17% in 1976 to 31% in 1995, while other regions declined or remained the same (Figure 3). The increase and sustained funding in the 20-year period indicate greater support to R&D by the governments in the Asian region; and their awareness of the impact of technological innovations to agricultural productivity.
Table 3 shows a comparison of the public research investment and agricultural research intensity ratio (RIR) in seven Asian countries in 1995. R&D intensity ratio means R&D expenditures as percentage of AgGVA, or a measure of the level of R&D investment by a country. Thailand (0.69%) and Malaysia (0.58%) have the highest RIR among the Asian countries. The Philippines (0.23%) has second to the lowest RIR compared to other Asian countries. Considering that Thailand has a lower population than the Philippines, the per capita R&D expenditures in Thailand is even much higher. The persistent under-investment of R&D has contributed partly to the lag in agricultural productivity in the Philippines compared to its Asian neighbors.

Table 3. Public research investment and research intensity in Asia, 1995.

<table>
<thead>
<tr>
<th>COUNTRY</th>
<th>AGRICULTURE VALUE ADDED (US$ million)</th>
<th>PUBLIC R&amp;D (US$ million)*</th>
<th>PUBLIC R&amp;D INTENSITY**</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>146,506</td>
<td>479.5</td>
<td>0.327</td>
</tr>
<tr>
<td>India</td>
<td>93,984</td>
<td>347.9</td>
<td>0.370</td>
</tr>
<tr>
<td>Indonesia</td>
<td>33,673</td>
<td>81.0</td>
<td>0.241</td>
</tr>
<tr>
<td>Malaysia</td>
<td>11,090</td>
<td>64.0</td>
<td>0.577</td>
</tr>
<tr>
<td>Pakistan</td>
<td>1,769</td>
<td>25.0</td>
<td>0.159</td>
</tr>
<tr>
<td>Philippines</td>
<td>16,320</td>
<td>37.5</td>
<td>0.230</td>
</tr>
<tr>
<td>Thailand</td>
<td>18,376</td>
<td>127.0</td>
<td>0.691</td>
</tr>
</tbody>
</table>

Note: Data from Pray and Fuglie 2001
*Calculated using official exchange rates
**R&D Intensity equals R&D expenditure as percentage of AgGVA

Proposed Actions:

(i) International collaboration and fund leveraging: Continue active collaboration with IARCs, Advanced Research Institutions (ARIs), and Asian National Agricultural Research System (NARS) to facilitate the flow of new technologies and information from global and regional R&D
initiatives to the Philippines; Philippine Council for Agriculture, Forestry and Natural Resources Research and Development (PCARRD), Philippine Council for Aquatic and Marine Resources Research and Development (PCAMRD), Bureau of Agricultural Research (BAR), and Ecosystems Research and Development Bureau (ERDB) to provide coordination.

(ii) Develop joint RDE projects with IARCs, IARIs, and Asian NARS to generate and/or leverage funding from multi-lateral and bilateral donors, and international partners; PCARRD, PCAMRD, BAR, and ERDB to lead in fund generation efforts.

### IV. Private Agricultural Research

#### A. Asian Private Agricultural Research

A consensus has been arrived at that technology will be required to provide the major source of growth in Asian agriculture in the 21st century (Pray and Fuglie 2001). They questioned whether the gap caused by decline in public financing of agricultural research could be filled by private research and technology transfer. Using 1995 data, they noted that the highest percentage of private research expenditures compared to the total R&D budget were in the Philippines (22%) and Malaysia (21%), doubling the Asian average of 11% (Table 4). China is on the extreme, with only 3% of its research carried out by the private sector.

Relative to the size of its agricultural economy, China’s investment in private research is small (less than 0.01% of AgGDP). In Thailand and Malaysia, private companies spent about 0.1% of AgGDP. Between 1985-1987 and 1995-1998, private R&D grew in real terms in the seven countries studied by Pray and Fuglie (2001). They noted that in India, Pakistan, Indonesia, and China, private research funding more than doubled in 10 years and concluded that at this rate, private research will not fill the gap needed to support rapid growth in demand for agricultural products.

Private companies fund research to expand markets for their products and to enhance company profits. Most private research was carried out by the agricultural chemical industry, followed by agricultural processing, and plantation industries. The contribution of foreign companies to private research in all countries was important, accounting for most of the growth in private research in Asia, but this was variable. For example in China, almost all private research was by joint venture between foreign and local companies, while in Malaysia, there was little research by private companies.

<table>
<thead>
<tr>
<th>COUNTRY</th>
<th>PRIVATE R&amp;D* (US$ million)</th>
<th>PUBLIC R&amp;D (US$ million)</th>
<th>% OF TOTAL R&amp;D</th>
<th>PRIVATE R&amp;D INTENSITY**</th>
<th>PUBLIC R&amp;D INTENSITY**</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>16.0</td>
<td>479.5</td>
<td>3</td>
<td>0.009</td>
<td>0.327</td>
</tr>
<tr>
<td>India</td>
<td>55.5</td>
<td>347.9</td>
<td>14</td>
<td>0.059</td>
<td>0.370</td>
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<tr>
<td>Indonesia</td>
<td>6.1</td>
<td>81.0</td>
<td>12</td>
<td>0.018</td>
<td>0.241</td>
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<tr>
<td>Malaysia</td>
<td>16.6</td>
<td>64.0</td>
<td>21</td>
<td>0.150</td>
<td>0.577</td>
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<tr>
<td>Pakistan</td>
<td>5.7</td>
<td>25.0</td>
<td>19</td>
<td>0.036</td>
<td>0.159</td>
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<tr>
<td>Philippines</td>
<td>10.5</td>
<td>37.5</td>
<td>22</td>
<td>0.064</td>
<td>0.230</td>
</tr>
<tr>
<td>Thailand</td>
<td>17.4</td>
<td>127.0</td>
<td>12</td>
<td>0.095</td>
<td>0.691</td>
</tr>
<tr>
<td>TOTAL</td>
<td>127.8</td>
<td>1,125.3</td>
<td>11</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Data from Pray and Fuglie 2001

*Calculated using official exchange rates

**R&D Intensity equals R&D as percentage of AgGVA
B. Philippine Private Agricultural Research

Most private agricultural research is on developing and supplying improved inputs to farmers. Examples are high-yielding crop varieties or animal breeds, more effective agrochemicals, better farm machinery, etc. The aim of these technical innovations is to increase productivity by lowering the average cost of production. The industries that had attracted the largest investments in private research had large markets; a way of capturing benefits from new technologies, and the possibility of producing innovations without major investments. In the Philippines, these conditions are true for fruits and vegetable plantations, pesticides, hybrid seeds, and poultry and pig production. Most private firms that carry out research in the country are multinational firms.

1. Funding for Private Agricultural Research

Philippine private companies spent about US$10.5 million on private research in 1995 (Table 5). This is 22% of the total agricultural research in the Philippines. Relative to the size of agriculture, it is a small amount, about 0.06% of AgGDP. There was no increase in the research expenditure as percentage of AgGDP in 10 years, from 1985-1995, was at 0.06%. During this period, the focus of private research shifted from plant breeding in 1985 to plantations in 1995. Private research increased by 60% in real US dollars, with almost all the growth in the rapidly growing livestock and plantation industries. The largest private research expenditure was by fruit plantations, providing the highest growth in private research.

Table 5. Philippine private agricultural research expenditures, 1985 and 1995.

<table>
<thead>
<tr>
<th>RESEARCH EXPENDITURE</th>
<th>1985</th>
<th>1995</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1,000</td>
<td>1,000</td>
</tr>
<tr>
<td>Agricultural machinery</td>
<td>305</td>
<td>Unknown, but small</td>
</tr>
<tr>
<td>Agricultural chemicals</td>
<td>1,657</td>
<td>2,562</td>
</tr>
<tr>
<td>Livestock</td>
<td>708</td>
<td>1,480</td>
</tr>
<tr>
<td>Plant breeding</td>
<td>2,242</td>
<td>1,800</td>
</tr>
<tr>
<td>Plantations</td>
<td>1,610</td>
<td>4,680</td>
</tr>
<tr>
<td>Total private research</td>
<td>6,522</td>
<td>10,522</td>
</tr>
<tr>
<td>Public research expenditure</td>
<td>n.a.</td>
<td>37,000</td>
</tr>
<tr>
<td>Private research as a percentage of total research</td>
<td>n.a.</td>
<td>22%</td>
</tr>
<tr>
<td>AgGDP</td>
<td>11,054,000</td>
<td>16,319,000</td>
</tr>
<tr>
<td>Private research as percentage of AgGDP</td>
<td>0.059%</td>
<td>0.064%</td>
</tr>
</tbody>
</table>

n.a. indicates not available
Note: The peso-dollar exchange rate was P26.29.

A successful example of private research funding is that of the Philippine Sugar Institute (Philsurin), a private research institution, funded through a lien of P2/kg on all sugar produced. More than 50% of Philsurin’s expenditures support extension activities such as propagation of plantlets and distribution of new high-yielding varieties to sugar producers. Only about 25% of the expenditures are for R&D
(₱12.9 million in 1999-2000). The combined efforts of Philsurin and the Sugar Regulatory Administration (SRA) contributed to the recent increases in sugar production in the country.

2. Impact of Private Agricultural Research

Pray (2001) cited three impacts of private research that benefited the Philippines. Plantation research on crop management package by Twin Rivers, a local private R&D center, allowed the Philippines to produce and export bananas (Cavendish variety). Complementary research by foreign companies (Dole and Del Monte) to reduce cost of production (soil nutrition, pest management), provided local companies with additional information, allowing local companies to compete with multinational firms.

Two pesticides from American Cyanamid, a corn herbicide marketed in Europe in 1996 and an insecticide against diamondback moth, resulted from agricultural chemical research in the Philippines. The applied research, which supported the registration of these new pesticides, led to a greater number of pesticides available in the country. An impact study carried out by Antle and Pingali (1995) showed that insecticides and herbicides increased rice productivity in the Philippines, but cited the harmful effects of insecticides to farmers’ health.

Plant breeding research resulted to introduction of yellow corn hybrids, which in part increased the average corn yield, from 1.1 mt/ha in 1985 to 1.5 mt/ha in 1995, with increasing use of hybrids by farmers. Improved vegetables also increased the yields of some vegetables. The current effort to promote hybrid rice is expected to have impact on rice yields and production. Private seed companies are involved in hybrid rice seed production and distribution.

In the Philippines, until late 1990s, processors and exporters also owned banana and pineapple plantations. These firms benefited from plantation management research through lower costs on their large plantations. Recent land reform policies may force fruit processing and export companies to buy fruits from smallholders. The seed industry depended on hybrids to be able to appropriate the benefits from research. The hybrid breeding activity was mainly on corn, vegetables, and rice. The Intellectual Property Code of the Philippines (Republic Act 8293) was passed in 1997, but it excluded plant varieties and plant breeders’ rights. In 2002, the Philippine Plant Variety Protection Act (Republic Act 9168) was passed providing rights to breeders for the varieties that they developed. The implementation of these laws would create an enabling environment to increase private investment in agricultural research (see Policy Reform Section).

There is high technological opportunity in biotechnology research, which was stimulated by billions of dollars of international research. In the Philippines, there is increasing interest in private research in biotechnology, although IRRI and the Philippine Rice Research Institute (PhilRice) have active research on rice biotechnology. The Biotechnology Coalition of the Philippines, made up of private and public institutions involved in biotechnology research, is active in biotechnology promotion. Mostly, international private companies are interested to introduce insect- and herbicide-resistant corn. Implementation of the bio-safety rules and regulations and establishment of a Biosafety Committee in 1990 would stimulate field-testing of biotechnology products in the country.

Clearly, the intellectual property rights regime (i.e., legal provisions, administrative processes for filing patents, etc.) can help spur greater private sector involvement and investment in R&D. The regulatory role of the government is equally important (i.e., setting standards and certification requirements which would significantly affect private seed producers). The World Bank-assisted Diversified Farm Income and Market Development Project would strengthen DA’s Safety and Quality Assurance Systems. This will include: (i) institutional and physical strengthening of the Bureau of Agriculture and Fisheries
Products Standards (BAFPS); (ii) strengthening laboratory capacity and facilities to meet exports and imports standards requirements; and (ii) streamlining of quarantine and inspection processes.

3. Public-Private Sector Partnerships

Because the Philippine RDE system is overwhelming the public sector and the linkage to the private sector remains weak, there is limited experience in formal partnerships with private firms in joint planning, funding, and implementation of RDE activities. Most of the experience in the RDE system is working with small- and medium-scale enterprises (SMEs) that make up about 99% of the entire industry. The Department of Science and Technology’s (DOST) Industrial Technology Development Institute (ITDI) has R&D and technology transfer programs to upgrade the technologies of SMEs to improve food products and packaging, and their technical knowledge and skills of their collaborating firms or processors’ association (ITDI 2002).

a. The Industry Incubator Model. This model to enhance partnership between the public and private sectors, was developed in the Philippines through a United States Agency for International Development (USAID)-funded Peanut Collaborative Research Support Program initiated in 1999. The University of Georgia collaborated with the Food Development Center of the National Food Authority (FDC/NFA) and the University of the Philippines Diliman (UPD) on food product development and laboratory analyses, including transfer of peanut processes and technology (i.e., sorting technology to produce aflatoxin-free peanut products). The Industry Incubator Model resulted from the early collaboration with two private firms: Newborn Foods Inc. that produces about 70% of the peanut butter in the market; and Marigold Commodities Corporation that produces food sauces, including peanut-based sauces exported to the U.S. and other countries.

Lustre (2005) described the components of the model: (i) initial surveys on industry practices and quality of products in the market, (ii) identification of collaborators (covered by memorandum of agreement [MOA] indicating the responsibilities of partners, (iii) product development in the laboratory and pilot scale (FDC/NFA and UPD), (iv) commercial production in private companies’ plants, development of guidelines for good manufacturing practices, and (v) training of plant managers and employees. There has been some significant impacts of the public-private partnerships that benefited consumers, the participating private companies, and the R&D institutions in terms of increased production of domestic and export products, and considerable capacity building (Lustre et al. 2004). The Industry Incubator Model would facilitate public-private sector collaboration in other industry clusters and provide a mechanism to ensure market-pull of RDE projects.

b. Joint Venture Arrangements. SEARCA (2003) describes two examples of government and private sector partnerships to share financing and returns of R&D. The first type of partnership involves both research and development, a good example being the Australian Rural Research and Development Corporation (RRDC) scheme. The second type is where the government (and academe) undertakes research while the private sector undertakes technology development, testing of the products widely, and undertakes market development. A good example is the Cooperative research and Development Agreement (CRADA) scheme in the U.S. Details of these schemes are described in Annex 1.

Proposed Actions: 2005

(i) Partnerships/participation: Carry out public-private sector consultations to identify priority areas for collaboration and ways to strengthen public-private sector partnerships in RDE (i.e., using the
Industry Incubator Model, ITDI’s SME technical services); BAR, PCARRD, PCAMRD, and ERDB to coordinate; private sector to cost-share consultations.

(ii) Use industry cluster approach in RDE strategic planning and priority setting to ensure market-orientation of RDE and active participation of the private sector; train researchers and extension staff on new strategic approaches/models and business-oriented RDE; PCARRD and PCAMRD to provide guidance.

(iii) Ensure participation of the private sector in RDE through joint planning and priority setting (i.e, using the Industry Incubator Model), co-financing (cost-sharing, joint ventures), implementation (private contracting), and monitoring and evaluation of RDE projects; BAR, PCARRD, PCAMRD, and ERDB to provide coordination from government.

(iv) Ensure that DA and DOST build staff capacity and lead in the implementation of laws/legal instruments that would create an enabling environment to increase private investment in R&D (i.e., Philippine Plant Variety Protection Act, Intellectual Property Code of the Philippines, Biosafety Rules and Regulations, etc.); refer to Policy Reform Section.

V. The Philippine Public Agriculture, Fisheries, and Natural Resources R&D System

The Philippine National RDE System covers the agriculture, fisheries, forestry, and natural resources sectors. It involves six government departments. This analysis of the contribution of RDE to agricultural growth mainly covers four key interrelated areas where weaknesses of the public sector RDE system occur. They are: (i) the need to shift to demand-driven and market-oriented RDE; (ii) the highly complex, disperse, and duplicating institutional arrangements and weak research-extension linkage; (iii) serious under-investment in RDE and poor transparency and accountability to clients; and (iv) the large human capital that needs to be reoriented to fit the shift towards market-oriented and demand-driven RDE.

A. RDE Outputs, Impact, and Success Story

1. R&D Breakthroughs and Impact

Past estimates of rates of return to R&D in the Philippines are few and only in some commodities. The estimates are high for rice research of about 75% in the 1970s and more than 100% for poultry in the 1980s (David 1995). More recently, BAR (2000) had estimated adoption rate of new technologies of about 25%. This low adoption rate indicates a gap between technology generation and dissemination. Some causes cited by BAR in the study are: (i) incompatibility of technology with the farmers’ circumstances, (ii) weak extension, (iii) inadequate support services including credit, (iv) and low market demand. Despite aggressive promotion efforts by the government, many technologies did not reach commercialization stage. For example, attempts to commercialize Sinta papaya and Laguna duck were hindered by inadequate supply of planting materials and animal stocks, respectively (PCARRD 2001).

The documents reviewed, such as PCARRD’s R&D Status and Directions (2000 and Beyond) for specific commodities and the PCARRD’s R&D Milestones publications, show a large number of R&D outputs that are ready for commercialization. In 2004, an External Program Management Review Panel reviewed 204 BAR-funded projects and identified 56 ‘matured’ technologies, 26 of which are ready for commercialization by DA. Brief descriptions of ‘matured’ technologies identified by PCARRD,
PCAMRD, BAR, and PhilRice in 2003-2004 are in Annex 2. Some examples of outputs include technologies like hybrids and improved crop varieties and livestock breeds; improved processes and techniques; improved production and post-harvest management practices like integrated pest management (IPM), post-harvest and processing technologies, and new information to improve R&D management, advocacy, and policy making.

Taking rice research impact as an example, Annex Figure 1 shows rice production trends from 1910-2000, showing the effect of technological innovations promoted by past government rice programs. The milestones represent peaks and dips in the evolution of the Philippine rice farming systems and their effect on rice production, cultivated rice area, and rice yields vis-à-vis population growth, technological changes, relevant laws, policies, programs, and institutions behind each milestone.

The yield per hectare and volume of rice produced continued to increase during the 90-year period, with the sharpest increases in both yield and volume resulting from the technologies (i.e., new rice varieties) implemented under the Rice Masagana 99 Program in the 1970s (del Rosario and Agarrado 2004). The creation of PhilRice and widespread introduction of rice IPM technologies and training farmers by using Farmers’ Field School methodologies in the 1980s, sustained these increases. These interventions are RDE-related and technology-based. Both rice yield and volume increases were well above population growth. Trend in rice production in 1970-1997 using the modern vs. traditional varieties in irrigated areas showed both yield and production volume of modern varieties were well above those of traditional varieties, indicating positive impact of rice technologies (del Rosario and Agarrado 2004). The analysis also showed a similar trend in rice yield and production in rainfed areas, although at lower intensities.

PhilRice has developed new rice technologies that are already adopted widely by farmers. An example is the use of locally-developed rice hybrids (Mestizo hybrids) planted in over 120,000 hectares by about 200,000 farmers in 2004. The adoption rate of farmers in 2004 was 7.4% in irrigated areas (8.4% for the wet season) comparing well with China’s 9.0% adoption rate three years after program inception (PhilRice 2005). The rice hybrid seed industry showed significant development with 33 farmer seed growers’ cooperatives producing 60% of the seed requirement of the program. Two other rice technologies include: (1) the use of Minus-one element technique, a reliable, low-cost, and easy alternative for testing nutrient deficiency in rice, and (2) production of carbonized rice hull that has multi-uses such as organic fertilizer and soil conditioner, base-material for making microbial inoculants, charcoal for fuel, active ingredient for pesticide making, etc. (PhilRice 2002 and 2003) It has also export potential.

2. Tilapia Farming in the Philippines: A Success Story

The Philippines has become one of the world’s largest producers of tilapia, both as cheap source of protein for local consumers and a potential export product. Fisheries R&D have allowed the development of commercial tilapia production. Guerrero (1994) described how the sex-reversal technology was adapted to the Nile tilapia in the 1970s and breeding technology of Nile tilapia and use of floating cages with feeding in the 1980s. Public researchers have worked closely with private sector firms in the commercial application of these technologies.

Successful piloting and commercial fingerling production by private sector firms (San Miguel Corporation and Meralco Foundation) encouraged other companies to commercially produce tilapia. This resulted to sharp increases in tilapia production in the late 1980s up to today and the basis for expansion of the fish fillet exports of the Philippines. A strong private sector interest and government support for research, extension, and training of beneficiaries have ensured continuing positive growth
of the industry. Recent developments are showing the usefulness of R&D efforts. The Philippines has the world’s only tilapia gene bank. New tilapia hybrids have been produced, such as EXCEL tilapia and saline tilapia, which would increase the economic value of tilapia and would likely push the export drive further. Clearly, the success of tilapia farming could be attributed to the match of available improved tilapia breed and appropriate production technologies, market demand, and the interest of private companies to fill this demand; and strong government support for R&D and extension including active promotion to smallholder fishers.

3. RDE Impact Assessments

R&D institutions have failed to do assessment of the impact of R&D in a systematic manner. Hence, it’s difficult to quantify the overall contribution of new technologies to agricultural growth using field data. In 2004, BAR has allocated budget for impact studies; but the results are not yet available. PCARRD had carried out studies on the return of investment in selected commodities (rice, maize, and sugarcane) in the past; but there is a need to do more. Results of impact assessment of key commodities would be useful for R&D priority setting, planning, policy-making, and increased funding advocacy. A nationwide system of monitoring R&D projects, budgets, and outputs is already being done by PCARRD and PCAMRD, and more recently by BAR and ERDB, with separate databases in these institutions. But impact evaluation has to be institutionalized as part of the monitoring and evaluation (M&E) system. The information could justify increased overall allocation for R&D and a shift in funding to key commodities/products that have the highest market potential and competitiveness.

Proposed Actions: 2005

(i) Impact assessments: Carry out impact assessment studies of the adoption of technological innovations in key commodities, especially those of high market potential; BAR, PCARRD, and PCAMRD to fund and provide overall coordination and analysis.

(ii) Change proposal preparation process to include, in addition to technical and agro-ecosystems considerations, socioeconomic benchmark, and impact parameters in the design of major R&D programs and projects; integrate funding for impact assessments in regular agency RDE budget; BAR, PCARRD, PCAMRD, and ERDB to provide coordination and guidance.

(iii) Staff training: Train economists, sociologists, and staff in key RDE institutions on impact evaluation methodologies; train scientists/researchers on improved project design to consider socioeconomic aspects; BAR, Agricultural Training Institute (ATI), PCARRD, PCAMRD, and ERDB to provide coordination and funding.

(iv) Initiate collaboration (i.e., joint workshops, staff training) with R&D institutions that have capacity and experience in socioeconomic and policy research, such as Philippine Institute for Development Studies (PIDS), International Food Policy Research Institute (IFPRI), IRRI, etc.; PCARRD and PCAMRD to provide coordination.

B. Paradigm Shift to Market-Oriented and Demand-Driven RDE

In the 21\textsuperscript{st} century of globalization and liberalization of trade, Philippine agriculture must change its priority, from primary commodities to high-value products. In its “Global Economic Prospects 2004” paper, the World Bank describes a shift in agricultural trade from traditional commodities, such as grains, tobacco, and coffee, towards high value perishable commodities such as fresh fruits, vegetables, meat, and fish. Local and world demand for these commodities is high and will
continue to increase as the income of poor people increase and as the trend towards urbanization continues. The Philippines has a comparative advantage as a source of supply.

**Constraints:** Orientation of many R&D projects is still traditional and commodity-oriented, and current R&D institutions and management processes do not respond to the new requirements of demand-driven and market-oriented RDE.

A large number of projects still follow traditional RDE approaches focusing on generating, verifying, and promoting productivity-enhancing technologies. But the government has started to support market-oriented R&D effort in a limited number of export commodities (i.e., mango, papaya, Saba banana for chips, economically important seaweeds, and tuna) and non-food crops like cut flowers and foliage (del Rosario, Consolacion and Quinones 2003). The current RDE management systems and RDE continuum approach have to be enhanced to shift the NARS from traditional to market-oriented and demand-driven RDE. The private sector and industry will become key stakeholders in RDE and their participation would be critical and needs to be monitored. But the shift to market-oriented RDE should also consider the need for long-term strategic and basic research (i.e., in biotechnology) and the immediate technological needs of small farmers, fishers, and entrepreneurs.

**1. Setting Strategic Directions in RDE and Technology Commercialization**

One of the targets of the MTPDP (2004-2010) is to accelerate knowledge creation and transfer to upgrade technologies and increase productivity. To accomplish this, the current R&D institutions have to follow a unified strategic RDE direction and agenda. The key RDE agencies have long experience in preparing and implementing long-term strategic plans by PCARRD, PCAMRD, BAR, as individual institutions. These coordinating and funding institutions, including the major commodity research centers (i.e., PhilRice, PCC) have current strategic/corporate plans up to 2010. However, there has been no system-wide RDE agenda. Hence, there is capacity in PCARRD and PCAMRD for strategic planning, priority setting, program planning, fund allocation, and M&E of R&D projects. The management processes and tools have to be modified to enable a system-wide shift to a market-oriented and demand-driven RDE. Some criteria to be considered are:

1. Focus is on high-value crops or products that have high market potential;
2. Contribute to existing/potential comparative advantage or high market competitiveness,
3. High potential complementation of private sector and government research investments,
4. Possible high degree of leveraging through public-private sector partnerships, and
5. Strategy to help smallholder farms diversity into higher value products, including livestock products

There are many ‘matured’ technologies that have been assessed as ready for commercialization. The key R&D institutions (BAR, PCARRD, and PCAMRD) have recently started to implement strategies to focus on technology commercialization. In 2004, BAR carried out an external evaluation of its R&D programs and has identified 26 technologies that are ready for commercialization (list in Annex 2). In 2005, BAR has allocated up to 75% of its budget of ₱155 million to adaptive research and technology commercialization. This is in line with the mandate of DA. PCARRD has an active Technology Outreach and Promotion Division that provides services to the RDE system on intellectual property and technology management to facilitate technology commercialization. Other key R&D institutions should establish similar units and train staff on the new procedures and requirements and develop partnerships with the private sector.
The implementation of two convergence initiatives: the Unified RDE Agenda and the Unified RDE Project Planning, Monitoring, and Evaluation System would streamline these management systems in the key R&D institutions. The guidelines and criteria for selecting projects in the current competitive grants schemes of PCARRD, PCAMRD, and BAR have to be modified. All research proposals should show how the technology to be generated would contribute to improving market competitiveness. The World Bank-assisted Diversified Farm Income and Market Development Project would strengthen the functions of BAR by providing funds for market-related technology development.

2. From Agriculture to Agro-Industrial Development: The Industry Cluster Approach for RDE

The need to be globally competitive requires the Philippines to shift from agricultural development to agro-industrial development. The industry cluster approach would ensure that the RDE agenda and programs are market-oriented so they can respond to the needs of the public and private sectors in a holistic manner. It is a strategic framework that provides a cohesive and integrated approach for analyzing agriculture and agro-industrial development and competitiveness and is a major tool for strategic planning (Gonzales, Elca, and Gonzales 2005).

The industry cluster approach considers all interrelated industries such as input supply industries, farm production industry, post-harvest and processing industries, and packaging and marketing industries. The input industries include producers of quality seeds, biofertilizers and biopesticides, modern breeds of poultry and livestock, feeds for poultry and swine, fish fingerlings, and tools and equipment, such as overhead sprinkles, seeders, and threshers. The cluster industries may include primary processors and suppliers.

An industry cluster is a grouping firm in an industry, the allied business which supports the industry through provision of goods, services, machinery, and specialized inputs (i.e., knowledge), and the buyers, all operating under an environment shaped by the government, the physical and cultural heritage, and available infrastructure (Follosco 2004). Industry cluster refers to the tight connections that bind industries together in various aspects of innovation, shared inputs suppliers, factors of production, and complementary services (Gonzales, Elca and Gonzales 2005). The authors cite the Feeds-Hogs Agro-industrial Cluster Framework as an example (Annex Figure 2), showing details of the core industries, supplier industries, and related and allied industries and services within the cluster and their interrelationships. Unlike an industry sector, an industry cluster looks beyond the production of a good or service to the entire value chain.

The industry cluster approach, described by Gonzales, Elca, and Gonzales (2005) in Annex 3, would provide a holistic or system-wide analytical tool to identify knowledge gaps, constraints, and opportunities from production to processing (primary to secondary and tertiary) to distribution and marketing (export and domestic). The required industry cluster segments within the framework are identified, such as main raw materials suppliers (breeds, feeds from corn, cassava, production technologies, etc.), primary processors or suppliers (technology, machinery, packaging, processing supplies), and secondary/tertiary processors or suppliers (technology, equipment, supplies, etc.). Also to be identified are factor endowments such as R&D capability, natural endowments, infrastructure, human resources, business and policy environment, and capital resources and financing.

In 2004, the National Academy of Sciences and Technology (NAST) has decided to use the industry cluster approach in analyzing and setting priorities for the Philippine Agriculture 2020, a long-term overall framework for agricultural development in the country. Four development goals were
identified to include: food security, poverty alleviation, competitiveness, and sustainability. The challenge is to realign the RDE system to utilize this strategic tool as it starts to implement the agreed Unified RDE Agenda and Programs in 2005. Considerable shift is needed to ensure that the strategic directions are correct and that the RDE capacity is put in place in a systematic manner. NAST has identified the following industry clusters for this analysis:

1. Rice (hybrid, inbred, ordinary)
2. Sugarcane
3. Coconut (coconut, palm oil)
4. Export fruits (mango, banana, pineapple, durian, papaya)
5. Coffee
6. Abaca
7. Vegetables, legumes, and root crops (VELERO)
8. Ornamental (anthurium, chrysanthemum, gladiola, orchids, roses)
9. Medicinal plants and plant producing metabolites
10. Feed corn, livestock, and poultry (corn, poultry)
11. Pasture ruminants (cattle, carabao, and goat)
12. Forest products and services (housing, handicraft, pulp/paper, fuel wood)
13. Capture fisheries (tuna, seaweeds, carrageenan)
14. Culture fisheries – (prawns, milkfish, tilapia)

3. Rationalization of Pro-Poor Small Farmer-Oriented RDE

Most Filipino farmers and fishers are smallholders that live in the rural areas where they make up a large number of the poor population. Agriculture and agriculture-related activities are the mainstay of their livelihood. Their income from agriculture is usually not sufficient to meet basic family needs, and most of them engage in non-farm employment (small village stores, trading and services, food and beverage processing, handicraft making) to supplement their farm incomes. To increase the incomes of small farmers, fishers, and landless cultivators, and to alleviate poverty in rural areas, there is a need to provide productive employment, productive assets (land and/or capital), and access to micro-finance.

There is a need to commercialize smallholder agriculture and to produce high-value and value-added products to be globally competitive. This needs economies of scale to ensure viability and provide a mechanism for producers to express their demands for services. This also means that the national RDE system must address the problems of large private agri-based industries to enhance their viability and global competitiveness. But whatever is the size of agribusiness industries targeted by the RDE, the smallholder producers and entrepreneurs, and the rural poor in the non-farm sector must be integrated in the system.

There is a need to help producers to organize like water user associations or herders associations, and strengthen the capacity of rural producer organizations (RPOs) and various client groups, including women’s and other community groups. Investments are needed to strengthen client group capacities and develop mechanisms for their effective involvement in RDE. Annex 4 describes the role and benefits derived by producer organizations in enhancing RDE by making the system and processes more transparent, accountable, and participatory (World Bank 2004).

Smallholder producers need not limit their activities to profitable farming, although this is possible. Opportunities to realize more income in non-farm activities related to agribusiness exist, such as in the production of inputs; post-harvest handling, processing and packaging of finished products;
transportation and shipping; and marketing. But it is important to ensure the vertical and horizontal integration of all activities, and to meet high-quality standards of the market. A field survey of existing private business firms/commercial producers and traders would be helpful to get their views on the possible integration of smallholders and RPOs in their agribusiness enterprises/cluster industries.

Proposed Actions: 2005

(i) Planning, priority setting, monitoring, and evaluation: Key RDE institutions to start implementing the Unified RDE Agenda and the Unified RDE Project Planning, Monitoring, and Evaluation System; ensure that the agreed initial six convergence initiatives reflect the shift to market-oriented and demand-driven RDE by using appropriate tools and approaches; PCARRD, PCAMRD, BAR, and ERDB to provide overall coordination (summary in Annex 5).

(ii) Revise criteria for priority setting and project selection to include potential impact of the technology to be generated to improve market competitiveness, probability of success, and cost effectiveness of the proposed project; the criteria and strategy should rationalize the need for industry-pull and pro-poor smallholder RDE; BAR, PCARRD, PCAMRD, and ERDB to provide coordination and guidance.

(iii) Review and update current planning, priority setting, and M&E processes and guidelines to conform to new market-oriented and demand-driven RDE (i.e., using the industry cluster approach in strategic planning and priority setting) and identify key performance indicators for M&E; PCARRD, PCAMRD, BAR, and ERDB to provide overall guidance.

(iv) Training and dialogues: Start training of managers, researchers, and extension trainers to apply market-oriented and demand-driven RDE in the preparation of proposals and implementation of RDE projects; improve current training manuals and guidelines to reflect new strategies; ATI to provide overall coordination and training of trainers.

(v) Carry out public-private sector dialogues to learn how private companies apply the industry cluster approach in their operations and how smallholders could be integrated in the system; identify and initiate public-private sector partnerships to pilot market-oriented RDE initiatives (i.e., using the Industry Incubator Model, etc.); ensure the active participation of men and women farmers and fishers and RPO representatives in these dialogues and initiatives; BAR, PCARRD, PCAMRD, and ERDB to provide overall coordination.

C. Streamlining the Philippine AFNR R&D System and Strengthening Linkages

Many research systems in developing countries are constrained by institutional weaknesses that limit their efficiency, effectiveness, and sustainability. These problems are multiplied by growing funding constraints. Serious institutional weaknesses relate to, among other things, duplicating functions among R&D institutions, poor incentives to attract quality scientists, very limited operating budgets, and weak and ineffective linkages with clients and the private sector. Most of the documents reviewed point to similar constraints in the Philippine RDE system, which is exacerbated by its complexity.

Constraints: Large number of public R&D institutions with overlapping functions and roles, many duplicating R&D networks; and weak linkages to farmers and fishers, the LGU extension units, and the private sector.

1. Institutional Arrangements and Key Players
a. Government Departments with R&D functions. There are four key government departments that fund and implement agriculture, fisheries, and natural resources (AFNR) R&D programs in the Philippines: DA, DOST, Commission on Higher Education (CHED), and the Department of Environment and Natural Resources (DENR). Two additional departments are involved in agricultural extension: (1) the Department of Interior and Local Government (DILG), and (2) the Department of Agrarian Reform (DAR). The current highly complex and multi-level institutional arrangements, consisting of 161 public R&D institutions and 263 networks, are shown in Annex Figure 3 and described in more detail in Annex 5. The figure shows a highly complex structure involving numerous units at the national and regional levels (for R&D), and at the provincial and municipal levels (for extension). The target of the MTPDP (2004-2010) is to harmonize the disparate components and networks toward eventual consolidation and unification by 2010. Components of the RDE system are summarized in Table 6.

Table 6. Summary of government departments involved in AFRN RDE and functions, 2004.

<table>
<thead>
<tr>
<th>DEPARTMENT</th>
<th>RDE UNITS</th>
<th>NUMBER</th>
<th>FUNCTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>DA</td>
<td>BAR/Networks</td>
<td>1/30</td>
<td>National R&amp;D coordination</td>
</tr>
<tr>
<td></td>
<td>ATI, RTCs/PTCs</td>
<td>1/16</td>
<td>Extension implementation</td>
</tr>
<tr>
<td></td>
<td>Bureaus/Attached Agencies</td>
<td>5/8</td>
<td>RDE implementation</td>
</tr>
<tr>
<td></td>
<td>RIARCs/Networks</td>
<td>14/30</td>
<td>Regional RDE implementation</td>
</tr>
<tr>
<td>DOST</td>
<td>PCARRD/Networks</td>
<td>1/132</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PCAMRDP/Networks</td>
<td>1/101</td>
<td>National R&amp;D coordination</td>
</tr>
<tr>
<td></td>
<td>PCAMRDP/Zonal Centers</td>
<td>5</td>
<td>Regional implementation</td>
</tr>
<tr>
<td></td>
<td>FPRDI, FNRI, ITDI</td>
<td>3</td>
<td>National R&amp;D implementation</td>
</tr>
<tr>
<td></td>
<td>DOST-Ros</td>
<td>14</td>
<td>Regional S&amp;T implementation</td>
</tr>
<tr>
<td></td>
<td>PSTCs</td>
<td>74</td>
<td>Provincial extension implementation</td>
</tr>
<tr>
<td>DENR</td>
<td>ERDB, ERDS-RD</td>
<td>1/15</td>
<td>National/regional R&amp;D implementation</td>
</tr>
<tr>
<td></td>
<td>FMB</td>
<td>1</td>
<td>National extension coordination</td>
</tr>
<tr>
<td>CHED</td>
<td>PENROs, CENROs</td>
<td>74/170</td>
<td>Prov./Com. Extension implementation</td>
</tr>
<tr>
<td></td>
<td>SCUs</td>
<td>112</td>
<td>RDE implementation</td>
</tr>
<tr>
<td>DILG</td>
<td>PLGUs, MLGU/CLGU</td>
<td>79/1,495/115</td>
<td>Prov./Mun./City extension implementation</td>
</tr>
<tr>
<td>DAR</td>
<td>ARCs</td>
<td>14</td>
<td>Municipal extension implementation</td>
</tr>
</tbody>
</table>

b. Policy making and RDE coordination. There are two councils of DOST, PCARRD, established in 1972 (Presidential Decree 48) and PCAMRD, established in 1987 (Executive Order [EO] 128). These councils coordinate and manage AFNR R&D. PCARRD and PCAMRD have long experience in policy making, planning, budgeting, M&E, and institution and capacity building. The AFMA IRR (EO 127) in 1999 created the Council for Extension, Research, and Development for Agriculture and Fishery (CERDAF), but the council is not currently operational. CERDAF has inter-sectoral members involving government, private sector, and NGOs, similar to the two DOST councils. An integration of these three agriculture-related councils would streamline the institution, downsize staff, and reduce operations cost. A strategy to unify PCARRD and PCAMRD is under discussion in the ongoing reorganization of DOST. The proposed unification calls for integrating the three councils, downsizing staff, and maintain only a small but highly qualified and skilled secretariat staff.

c. DA’s R&D System and Networks. The biggest and most complex R&D system is that of DA; with 28 agencies at national and 14 at regional levels. BAR, created in 1987 (EO 116), coordinates and funds DA’s R&D agencies consisting of 5 bureaus, 8 attached agencies (government corporations), 14
RIARCs (agricultural R&D centers) under the DA Regional Office, and 14 Regional Integrated Fisheries Center (RIFCs) under the Bureau of Fisheries and Aquatic Resources (BFAR). It also provides funding, through a competitive grants program, to 30 national and 30 regional R&D networks. Since AFMA implementation, BAR had spent about ₱170 million for networking and coordination, indicating a high transaction cost, which could fund research projects. In 2004, the network coordination budget of ₱50 million was reduced by BAR to 50%. This amount could be reallocated for direct cost of research which would benefit farmers, fishers, and entrepreneurs in the future.

d. AFNR R&D Networks. PCARRD and PCAMRD are mandated to fund and coordinate the National Agriculture, Fisheries, and Natural Resources R&D System (NARRDS) in the Philippines. ANR projects are implemented by 132 member-agencies of PCARRD’s National Agricultural and Resources Research and Development Network (NARRDN). The 101 member-agencies of PCAMRD’s NARRDS implement aquatic resources and fisheries projects. Many of these agencies also participate in BAR’s 30 R&D networks. The overall R&D structure is large and very complex, with considerable duplication of functions. Integration and streamlining (i.e., downsizing and reorientation) of the key R&D institutions are long overdue. A proposed Unified AFNR RDE system is shown in Annex Figure 4. Streamlining and downsizing the R&D units and networks would improve the efficiency of utilizing limited R&D funds and reduce overhead costs.

e. RDE at DENR. ERDB, created in 1987 (EO 192), implements integrated R&D programs in minerals, lands, and forests in DENR. ERDB funds its projects but also receives grants from PCARRD. Its regional network of Ecosystems Research and Development Service (ERDS) has recently been downsized in 2004, from 15 to 5 zonal centers. DENR extension function is implemented by the Forest Management Bureau (FMB), created by the same EO (192) as ERDB, through 74 Provincial Environment and Natural Resources Offices (PENROs) and 170 Community Environment and Natural Resources Offices (CENROs).

f. RDE in State Colleges and Universities (SCUs). CHED coordinates and funds R&D activities in 112 SCUs. Only about 30 SCUs carry out significant R&D activities, but they play a significant role because 43% of the scientists and researchers in the national RDE system are from these SCUs. Some SCUs host the key national R&D centers (i.e., Philippine Root Crops R&D Center at Leyte State University, and Philippine Biotechnology Institute at the University of the Philippines at Los Banos). Individual SCUs receive direct government R&D allocations, but this has been reduced significantly since 2003. Their main sources of R&D funds are PCARRD, BAR, and PCAMRD grants-in-aid.

CHED has identified 21 Centers of Excellence (COEs) and 2 Centers of Development (CODs) in agriculture with key R&D functions (CHED 2001). In its Long-Term Higher Education Development Plan for 2001-2010, these SCU-COEs/CODs were identified for assistance from CHED to be developed into world-class centers for instruction, research, and extension. The government should give priority to these identified SCU-COEs/CODs for implementation and fund assistance in RDE.

D. RDE Convergence Initiatives

In 2003, DA and DOST initiated discussion of key convergence initiatives to unify the RDE system, by identifying common areas in the R&D agenda and programs, as provided for in the AFMA IRR. Agreements have been reached for six convergence areas. These are significant areas to build on towards streamlining the RDE system and its eventual unification of the disparate components. The convergence initiatives are expected to improve coordination, efficiency, effectiveness, and sustainability of the RDE system. In 2004, a memorandum of understanding (MOU) was signed by the four key RDE agencies involved: BAR, ATI, PCARRD, and PCAMRD. The MOU needs to be
amended to include other key players like DENR for forestry and natural resources management (NRM) and DILG and DAR for extension. This is a positive development and the key institutions identified should start implementation of the convergence initiatives in 2005. These initiatives are expected to lead to an institutional integration of the various components of the RDE system to achieve the MTPDP target of unification of the RDE system by 2010.

Inter-agency committees have drafted reports and implementing guidelines for six convergence initiatives. Regional consultation and planning workshops have been initiated to consult with key stakeholders to get their feedback. Implementation of these agreed convergence initiatives should be a priority of the key RDE institutions involved. The convergence area reports are also used as supporting documents for the ongoing re-engineering of government departments to be implemented in 2005. The six convergence initiatives are listed with summary description in Annex 6

1. Unified RDE Agenda
2. Unified RDE Convergence Networks at national and regional levels
3. Unified RDE Project Planning, Monitoring, and Evaluation System
4. Unified Technology Delivery Program
5. Unified Institutional Development for RDE
6. Convergence Initiatives on Information Communication Technology (ICT)

**Proposed Actions: 2005**

(i) **Convergence initiatives:** Convene representatives of government departments involved in RDE; agree to amend DA-DOST Convergence MOU (2004) to include DENR, DILG, and DAR for extension; and ensure participation of key SCUs with RDE functions; PCARRD, PCAMRD, BAR, ATI, and ERDB to provide overall coordination and guidance.

(ii) Assist RDE agencies to prepare Institutional Action Plans to implement the initial six convergence initiatives, with agreed key performance indicators; PCARRD, PCAMRD, BAR, and ERDB to provide overall coordination and guidance.

(iii) Carry out stakeholders’ consultations to get feedback on convergence areas and enhance participation of the private sector, NGOs, and smallholder producers and entrepreneurs (both men and women), in the proposed reorganization of the AFNR RDE system; BAR, PCARRD, PCAMRD, and ERDB to provide coordination and funding.

(iv) Carry out consultations with CHED and key SCUs on RDE strengthening of SCUs by using the identified COEs/CODs in CHED’s Long-Term Higher Education Development Plan 2001-2010; prepare action plan for SCUs to participate in convergence initiatives; CHED, PCARRD, PCAMRD, and BAR to provide coordination and funding.

(v) **RDE Commission:** Draft/obtain approval of an EO to create a high-powered RDE Commission to draft proposal for unified AFNR RDE System; include in TOR of commission ways to increase the overall RDE budget for the medium- to long-term; National Economic Development Authority (NEDA) and Department of Budget Management (DBM) to lead and provide overall coordination.

**Suggested Changes in Key RDE Organizations:**

The following organizational changes would result into a Unified Agriculture, Fisheries, and Natural Resources RDE System. The proposal for unification of the system by 2010, as targeted by the MTPDP 2004-2010, should be prepared by a high-powered RDE Commission. The organizational changes require the enactment of an RDE law to cover all changes, amendment of an existing law (i.e., Local Government Code for the LGUs integration), or an EO to amend existing EOs and Presidential Decree that created all the key RDE institutions. Except for PCARRD that was created by a
Presidential Decree, PCAMRD, BAR, ATI, ERDB, and FMB were all created by EOs, all of which were signed in 1987. Hence, passing an EO would shorten the legal process. The suggested organizational changes are shown in the proposed Unified AFNR RDE System (Annex Figure 4).

(1) Unified AFNR Council: Integrate DA’s CERDAF and DOST’s two councils (PCARRD and PCAMRD) into a unified agriculture, fisheries, and natural resources council following a semi-autonomous or autonomous council model. The autonomous national agricultural research organizations (NAROs), described in Annex 7 could provide the basic principles and organizational structure of the proposed autonomous Council. It is critical to keep the Council small (‘lean and mean’), well focused, with highly skilled and competent staff. Rename into the Philippine Council for Research for Development in Agriculture, Fisheries, and Natural Resources (PCRD-AFNR); keep a lean, integrated secretariat with high-quality managers and technical staff; proposal to be prepared by the RDE Commission in consultation with DA and DOST; this unified council could be created by an EO.

(2) Unified DA RDE Sub-System: Expand the functions of BAR as apex agency for R&D with funding, management, and implementation functions; place RIARCs/RIFCs under BAR; BAR to continue coordinating R&D centers of DA bureaus and attached agencies; eventual integration of BAR and ATI to form a unified RDE System within DA, rename to the Philippine Agriculture and Fisheries Research for Development Center (PAFRDC); proposal to be prepared by the RDE Commission in consultation with DA; a unified PAFRC could be created by an EO.

(3) Integrate RIARCs and RIFCs into a Unified Regional Agriculture and Fisheries RDE System with strong linkages to national R&D centers and provincial LGU extension units; carry out regional consultations to discuss organizational changes; BAR and ATI to provide coordination.

(4) Expand functions of ATI as apex agency for extension with overall responsibility for extension policy, planning, M&E, training coordination, and communications support; strengthen linkages to LGUs, ARCs, etc.; carry out consultations with departments that have major extension functions; ATI to provide overall coordination and funding; see proposal for BAR and ATI integration into PAFRDC.

(5) Unified DENR RDE Sub-System: Eventual integration of ERDB and FMB to form a Unified RDE System within DENR with strong linkages to NRM RDE institutions, rename to Philippine Environment and Natural Resources Research for Development Center (PENRRDC); proposal to be prepared by the RDE Commission in consultation with DENR; a unified PENRRDC could be created by an EO.

(6) Unified Provincial/Municipal LGU Extension Sub-System: Organically link the provincial LGU and municipal/city LGUs within a province into one extension system; transfer the basic unit of extension from municipal to provincial level where there is critical mass of staff; link closely the LGU and DAR extension units; proposal to be prepared by the RDE Commission in consultation with DILG and DAR.

(7) SCU-COEs: Realign SCU-COE/CODs to the proposed Unified RDE System to ensure their relevance and sustainable funding in the long-term; proposal to be prepared by CHED for discussion with the RDE Commission.

E. Increasing R&D Funding and Accountability

Although most products of agricultural research continue to be public goods, public funding for agricultural research averages only 0.6% of AgGDP for developing countries, compared to 2.6% for industrial countries (Pardey and Beintema 2001). Public R&D systems in developing countries are severely under-funded. In the Philippines, public expenditure represents only 0.4% of AgGVA (David 2004), in contrast to the 1% that is recommended for developing countries.
**Constraints:** Serious under-funding of R&D programs and projects due to drastic reduction of government budgets; funding is highly dispersed in many R&D institutions and networks; and poor transparency and accountability.

1. **Overall Funding for R&D**

Despite the critical role of R&D in helping increase food production in the Philippines, R&D investments in agriculture, in general, have not received priority attention from the government. David (2004) cites that the agricultural intensity ratio is 0.40% of AgGVA. Recent increase in budgetary allocations was due to increased R&D budget of BAR until 2003 when it started to decline.

AFMA targets RDE investment to increase to 10% of the total AFMA budget (₱20 billion), which would approximate the 1% recommended level for developing countries. However, this funding level has not been met in the past six years of AFMA implementation. Aside from funding constraints, the AFMA policy paper cited disproportionate distribution of allocated resources, fragmentation and duplication of functions, and weak link between research and extension. Insufficient funding is compounded by irregularity of budget releases, ineffective absorptive capacity of DA to fully utilize its allocations, and lack of a cohesive planning and resource allocation framework. This makes programming difficult and leads to resources being allocated on pressing issues. Long-term initiatives, such as cutting-edge scientific endeavors receive inadequate funding and attention. The opportunity cost of under-investment in agricultural R&D is very high.

A SEARCA study (2003), in formulating an indicative investment plan for agriculture and fisheries RDE, determined that the Philippines has to substantially increase its investment in agricultural RDE: (i) to narrow the technology and yield gaps it faces vis-à-vis a number of its Asian neighbors, (ii) RDE plays a critical role in the effective restructuring of the agricultural industries to become competitive globally, and (iii) high returns to previous investments in agricultural R&D. The study indicated that the Philippines has to raise its current agricultural research intensity ratio of about 0.4% to at least 0.75% by 2010 and about 1.5% by 2020 (details in Annex 8).

In the Philippines, research expenditures across commodities and regions have been highly incongruent to the relative economic importance of commodities in terms of their GVA contribution to total agriculture (David 2004). The author cited that the estimated RIRs range from 0.05% for corn and 0.15% for cattle, hog, and chicken as a group to an extremely high ratio of 25% for cotton (Table 8). This very wide range of RIRs indicates large biases in fund allocation in favor of certain commodities and themes. It could be corrected by an effective and rigorous priority-setting exercise as described in Annex 9 (SEARCA 2003). The congruence model cited could be a useful framework and tool for the initial analysis of the allocation of R&D funding among commodities.

**Table 7. Indicative estimates of research intensity by commodity, Philippines, 1994-1996.**

<table>
<thead>
<tr>
<th>COMMODITY</th>
<th>RESEARCH INTENSITY RATIO (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall (excluding SEAFDEC)</td>
<td>0.41</td>
</tr>
<tr>
<td>Overall (including SEAFDEC)</td>
<td>0.45</td>
</tr>
<tr>
<td>Rice</td>
<td>0.25</td>
</tr>
<tr>
<td>Corn</td>
<td>0.05</td>
</tr>
<tr>
<td>Sugar</td>
<td>0.50</td>
</tr>
<tr>
<td>Coconut</td>
<td>0.30</td>
</tr>
<tr>
<td>Fibers</td>
<td>Cotton 25.0</td>
</tr>
<tr>
<td></td>
<td>Abaca 1.00</td>
</tr>
<tr>
<td>Tobacco</td>
<td>1.10</td>
</tr>
</tbody>
</table>
Livestock | Carabao | 3.60
--- | --- | ---
Fisheries | (excluding SEAFDEC) | 0.12
(incuding SEAFDEC) | 0.35
Forestry | 3.50

Note: SEAFDEC is the Southeast Asia Fisheries Development Center.
Source: David 2004

2. Public RDE Funding in Key R&D Institutions

In 2003, the three key R&D institutions: BAR, PCARRD, and PCAMRD spent a total of ₱322.06 million. A comparison of the breakdown of R&D expenditures is shown in Table 8. The key observations are, on the average: (i) 42% was spent for supporting R&D projects as grants with much higher percentage of BAR’s budget spent for R&D (53%); (ii) only 15% was spent for S&T services and technology delivery (extension); (iii) 21% was spent for integration and coordination of the national and regional networks and linkages; and (iv) 16% was spent for general administration and support services for PCARRD and PCAMRD only. The cost for network coordination and linkages and administrative support (37%), which does not include BAR’s core budget of ₱20 million, is high indicating a high transaction cost for R&D. If this amount were spent for direct research cost, it would produce R&D outputs that could benefit farmers and fishers eventually.

Table 8. Expenditure of DA-BAR, DOST-PCARRD and PCAMRD in 2003 by Activity.

<table>
<thead>
<tr>
<th>Items of Expenditure</th>
<th>BAR</th>
<th>%</th>
<th>PCARRD</th>
<th>%</th>
<th>PCAMRD</th>
<th>%</th>
<th>TOTAL</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>₱ Million</td>
<td></td>
<td>₱ Million</td>
<td></td>
<td>₱ Million</td>
<td></td>
<td>₱ Million</td>
<td></td>
</tr>
<tr>
<td>Research and Development</td>
<td>85.70</td>
<td>53</td>
<td>42.69</td>
<td>32</td>
<td>8.18</td>
<td>30</td>
<td>136.57</td>
<td>43</td>
</tr>
<tr>
<td>S&amp;T Education and Training</td>
<td>14.55</td>
<td>9</td>
<td>1.38</td>
<td>1</td>
<td>1.59</td>
<td>6</td>
<td>17.52</td>
<td>5</td>
</tr>
<tr>
<td>S&amp;T Services and Technology Delivery</td>
<td>40.42</td>
<td>25</td>
<td>8.26</td>
<td>6</td>
<td>0.80</td>
<td>3</td>
<td>49.48</td>
<td>15</td>
</tr>
<tr>
<td>Development, Integration, and Coordination of NRS</td>
<td>21.02</td>
<td>13</td>
<td>38.56</td>
<td>29</td>
<td>7.42</td>
<td>28</td>
<td>67.00</td>
<td>21</td>
</tr>
<tr>
<td>General Services and Support Services</td>
<td>42.69</td>
<td>32</td>
<td>8.80</td>
<td>33</td>
<td>51.49</td>
<td>16</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>161.69</strong></td>
<td><strong>100</strong></td>
<td><strong>133.58</strong></td>
<td><strong>100</strong></td>
<td><strong>26.79</strong></td>
<td><strong>100</strong></td>
<td><strong>322.06</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Sources: BAR, PCARRD, and PCAMRD Annual Reports 2003

In 1999-2004, a total of ₱1.565 billion was allocated to support BAR’s six major programs, with 39% for research and 35% for capacity and facilities development. There have been significant increases in the R&D budget of BAR; but it has declined sharply since 2003. In 2002, BAR’s budget was ₱380 million, down to ₱176 million in 2003, and to ₱155 million in 2004 as well as in 2005. The continuing decline in funding, due to government budgetary constraints, has been disruptive since R&D needs long-term investments over many years to ensure quality and credible outputs.

In 2003, PCARRD received ₱133.58 million for ANR R&D from government appropriations (PCARRD 2004). PCARRD was able to generate ₱17.8 million from foreign sources through partnerships with IARCs and ARIs. PCARRD spent about 32% for R&D projects. About 29% was
spent for coordination of the NARRDN, indicating an equally high transaction cost for R&D. In 2003, PCAMRD received ₱26.79 million from the national government, and it generated ₱11.1 million from external grants (PCAMRD 2003). About 30% of the budget was spent for R&D projects, and like PCARRD, it also spent 28% of its budget for coordination of its network.

3. Improving Efficiency, Transparency, and Accountability of R&D Funding

A more rigorous priority setting is needed to improve the efficiency, transparency, and accountability of R&D allocations. To ensure better returns from increased investment in R&D, the efficiency of allocation across commodities needs to be improved. The congruence model (described in Annex 9) can be used as an initial step in the process of refining the allocation of R&D funds by commodity. But to measure the allocative efficiency of R&D, there is a need to have experts’ opinion (i.e., R&D teams of PCARRD and PCAMRD) and analysis of technological possibilities, and potential economic and social impacts of the new technology (i.e., ex-ante evaluation).

The Competitive Research Grants Scheme of PCARRD and PCAMRD has ensured efficiency and transparency in the utilization of limited public R&D funds for many years; but it has not increased the relevance of R&D outputs. BAR’s Competitive Research Grants scheme will be strengthened, through the World Bank-assisted Diversified Farm Income and Market Development Project, to improve accountability to clients and ensure market orientation of R&D projects. Annex 10 describes the benefits, policy and implementation issues, and lessons learned by other countries that have implemented Competitive Research Grants Programs (CRGPs). This information would be especially useful in establishing Competitive Extension Funds.

In 2004, the government introduced an organizational performance indicator framework with clear specified outputs by agency by using Major Final Outputs (MFOs). These MFOs are used for budget preparation and analysis and later to measure the performance of each agency. This mechanism would also make the agencies accountable to the funding donors and clients of R&D. An active M&E system would be a key in its implementation.

**Proposed Actions: 2005**

(i) **Budget review and realignment:** Carry out consultations to review the overall government RDE budget in all departments with RDE functions to identify areas of serious overlaps; realign the budgets with the requirements and priorities agreed in the Unified RDE Agenda; BAR, PCARRD, PCAMRD, and ERDB to provide coordination and analysis.

(ii) **Assist RDE institutions to realign their RDE programs and activities with budgetary allocations to enable these institutions with major RDE functions to achieve their MFOs; include RDE outputs in the mid-year institutional performance review; BAR, PCARRD, PCAMRD, and ERDB to provide guidance and training of staff.**

(iii) **Financial management:** Identify an inter-agency convergence committee to initiate discussion of a convergence initiative for sustainable R&D financing; prepare guidelines and plans for a Unified Financial Management System to facilitate budget analysis; BAR, ATI, PCARRD, PCAMRD, and ERDB to provide coordination and funding.

(iv) **Modify the guidelines and criteria used in the BAR, PCARRD, and PCAMRD Competitive Research Grants Programs to improve transparency and accountability; identify key performance indicators and means to monitor.**

(v) **M&E:** Start implementing the Unified Project Planning, Monitoring, and Evaluation System to link project outputs with budgets and expenditures; BAR, PCARRD, PCAMRD, and ERDB to provide coordination and guidance (summary in Annex 6)
(vi) **Staff training:** Start training of relevant staff in key RDE institutions on M&E and financial management and the use of analytical tools.

**F. Reorienting and Developing Human Capital for R&D**

**a. Number of Scientists/Researchers.** The Philippine NARS is considered a medium-sized research system. In 2002, there were about 3,116 scientists/researchers in agriculture, natural resources, and fishery R&D in five government departments (Table 9). This number has not considered that in many RDE institutions, such as SCUs, the scientists/researchers do not do fulltime research since they have teaching and other responsibilities. This number should also be viewed in the fact that trained scientific professionals are leaving the country, a loss of both investment and human capital. This also creates significant gaps in the ability of the R&D system to absorb and apply transferred technology.

About 43% the scientists and researchers are located in SCUs; most of them involved in basic and cutting-edge research. University staff has been given priority for long-term R&D capacity building in the past, and many key R&D centers are located in SCUs. Since scientific discoveries build on prior knowledge and expertise, their role in the R&D system remains critical. Sustaining intellectual momentum in the country is also undermined by the tremendous loss of knowledge that occurs through interruptions of funding in the national R&D system leading to loss that is far larger than the absolute loss of talent (Pardey and Beintema 2001).

**Table 9. Number of scientists/researchers by government department, 2004.**

<table>
<thead>
<tr>
<th>DEPARTMENT</th>
<th>AGENCY</th>
<th>NUMBER</th>
<th>PERCENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHED</td>
<td>SCUs</td>
<td>1,324</td>
<td>42.5</td>
</tr>
<tr>
<td>DA</td>
<td></td>
<td>1,225</td>
<td>39.3</td>
</tr>
<tr>
<td></td>
<td>Bureaus</td>
<td>607</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Attached Agencies</td>
<td>388</td>
<td></td>
</tr>
<tr>
<td></td>
<td>RIARC's</td>
<td>230</td>
<td></td>
</tr>
<tr>
<td>DENR</td>
<td>ERDB</td>
<td>67</td>
<td>2.1</td>
</tr>
<tr>
<td>DOST</td>
<td></td>
<td>485</td>
<td>15.6</td>
</tr>
<tr>
<td>DILG</td>
<td></td>
<td>15</td>
<td>0.5</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td>3,116</td>
<td>100</td>
</tr>
</tbody>
</table>

Sources: DOST-PCARRD/PCAMRD and DA-BAR databases.

**b. Research Management Personnel.** Three national agencies have a coordinating function for agriculture, natural resources, and fisheries R&D. A total of 361 personnel in three national agencies are involved in coordinating and managing R&D activities in three separate R&D networks. This large number of highly qualified management and technical specialists involved in R&D management is apparent. The distribution of staff by agency in 2003 is as follows:

- PCARRD had 254 regular staff; 27 with Ph.D. and 67 with M.Sc. degrees.
- PCAMRD had 47 regular staff; 6 with Ph.D. and 14 with M.Sc. degrees.
- BAR has 60 regular staff.

**c. Strengthening Capacity for Market-Oriented R&D.** To facilitate the shift and market-oriented and demand-driven RDE, there is considerable re-orientation and strengthening of capacity of scientists, researchers, and extension staff to respond to this paradigm shift. As the agreed unified convergence initiatives are implemented in 2005, the capacity of key RDE institutions to apply the
industry cluster approach, the industry incubator model, and other mechanisms to ensure market-oriented RDE should be put in place through aggressive training of staff.

One aim of the current World Bank-assisted Diversified Farm Income and Market Development Project is to realign the research and technology dissemination agenda to support private sector demand for more market-driven research and technology (World Bank 2004). This will address the weakness of past RDE agenda that paid little strategic attention to agricultural commodities with greater market potential. Accordingly, BAR would be strengthened through (i) funding for market-related technology development, (ii) modification of the evaluation criteria for awarding competitive research grants with strong market development orientation, and (iii) training of researchers and extension trainers on market-oriented R&D. The experience of BAR in this project in using modified management processes and mechanisms (i.e., open, multi-year Competitive Research Grants scheme) would be useful as other R&D institutions shift to market-oriented RDE.

d. Human Capital and Facilities Development. The MTPDP aims to improve the competitiveness of the human capital of the Philippines. Basically, a shift from traditional, commodity-oriented to market-oriented and demand-driven RDE would require that the expertise and skill mix of many scientists, researchers, and extension staff be realigned to the new RDE requirements. The staff must be trained/re-trained on new emerging themes such as biotechnology, ICT, bioinformatics, knowledge management, and geomatics, in addition to the basic technical fields. There is need for a pool of entrepreneurial scientists who are trained on market intelligence, market-related research, impact chain analysis, industry cluster analysis, etc.

The current Human Resources Development Programs of various RDE institutions have to be reviewed to determine the core competencies and skill mix of scientists and researchers, and identify current gaps in expertise. There is a need to realign the staffing based on the emerging areas and requirements of market-oriented RDE. Increased funding for both degree and non-degree training of researchers, extension staff, and other support groups would be critical since capacity building is a long-term process. And a highly skilled human capital for R&D and S&T will keep the Philippines competitive globally and the country needs to catch up. The capacity-building component of the Diversified Farm Income and Market Development Project would be a good start. The government’s plan to establish a science fund for human capital and facilities development should be reviewed and implemented.

An innovative linkage programs with industrial countries, involving placement of mid-career scientists in foreign research institutions to capitalize on advanced research was introduced by the national research agency Empresa Brasileira de Pesquisas Agropecuarias (EMBRAPA). The program is called EMBRAPA’s Foreign R&D Lab or LABEX. This program is innovative in facilitating technology spill-ins. A description of the collaboration through LABEX-USA and LABEX-France is given in Annex 11.

The aging R&D laboratories and support facilities in Philippine RDE institutions need critical infusion of capital for upgrading, including high-end science equipment. Fund allocation for infrastructure of DA-BAR increased by 55% in 2001 and 70% in 2002. Facilities in 63 research centers, mainly in SCUs, were upgraded. For example, the post-harvest and mycotoxin laboratories of DA’s Bureau of Post-Harvest Research and Extension (BPHRE) need to be modernized to carry out its critical role as National Reference Laboratory. But due to recent budget cuts of up to 60%, BAR’s infrastructure targets will not be fully met in 2004 and 2005.

Proposed Actions: 2005-2006
(i) **Personnel review and planning:** Review core competencies, sufficiency of number of staff in basic disciplines, skill mix and expertise, and gaps in key RDE institutions to rationalize staffing based on the needs of the Unified RDE Agenda; BAR, ATI, PCARRD, PCAMRD, and ERDB to provide coordination and guidance.

(ii) Carry out consultations with private R&D institutions, NGOs, and IARC partners to discuss access to information on RDE capacity in these institutions; BAR, ATI, PCARRD, PCAMRD, and ERDB to provide coordination and funding.

(iii) Update/prepare Human Capital Development (HCD) Program for RDE institutions considering the requirements of the emerging S&T areas and market-oriented RDE and partnerships; BAR, PCARRD, PCAMRD, and ERDB to provide coordination and funding.

(iv) **Implementation and funding:** Start implementing the Unified Institutional Development for RDE, with sustained annual funding; BAR, ATI, PCARRD, PCAMRD, and ERDB to provide coordination, guidance, and fund sourcing (summary in Annex 5).

(v) Implement a Unified RDE Personnel Information and Monitoring System to link all institutional RDE personnel databases; follow the same format for data collection, coding, and analytical tools; BAR, ATI, PCARRD, PCAMRD, and ERDB to coordinate and provide training of staff.

(vi) Revisit the proposed science fund for human capital and facilities development; negotiate funding to initiate implementation; BAR, PCARRD, and PCAMRD to lead.

(vii) **Reorganization:** Review the training functions of ATI and PCARRD’s current Human Resources Development Center (HRDC) to minimize duplication and strengthen linkages (2005); negotiate integration into a Unified HCD Center for both long-term (degree) and short-term (medium-term) training of RDE staff.

**VI. The Philippine Agriculture, Fisheries, and Natural Resources Extension System**

Two milestones have significant impact on agricultural extension in the Philippines. The first was the passage of the Local Government Code (Republic Act 7160) in 1991, which devolved the extension function of DA to the LGUs at the provincial and municipal levels. DA’s BAEx was abolished and its staff was transferred to the LGUs. Twelve years after devolution, different extension players still have different conceptual understanding of their function in the overall development process, an underlying reason for the “incomplete” devolution of extension (Contado 2004). A technical and professional service became politicized causing low morale among extension personnel, low priority given to extension by LGUs, and continuing weak extension capacity and linkages to R&D and private sector institutions.

The second milestone was the passage of AFMA (RA 8435) in 1997. AFMA recognized the critical role of extension in agricultural development. AFMA provided for the establishment of a National Extension System for Agriculture and Fisheries (NESAF), with three sub-systems: national government, local government, and the private sector. The system was to be provided with about 10% of the total AFMA budget for its programs and activities. ATI was recognized as the apex extension and training agency within DA. Unfortunately, integration of extension through NESAF has not come about and the expected budget level has not materialized.

A review of six years implementation of AFMA in agricultural extension indicated very slow progress and insignificant outputs in extension. The main outputs (guidelines, manuals, and communication materials) did not contribute to achieving the AFMA targets. Training of about 2,000 LGU extension
workers per year, out of a total of over 32,000, was not significant to change the skill mix of extension workers in the past six years. ATI’s overall training strategy and plan needs to be revised and provided funding by LGUs.

**A. Streamlining the AFNR Extension Sub-System and Strengthening Linkages**

**Constraints:** Too many small autonomous decentralized extension units in a highly dispersed, uncoordinated extension system; no coherent DA agricultural extension support system; weak linkages to R&D and private sector institutions; and weak M&E.

There are 1,891 publicly funded agencies and LGUs that have recognized extension or advisory function and resources (Contado 2004). The Philippine extension system is overwhelmingly public. Some private agribusiness companies and NGOs also provide more focused extension services in specific commodities or defined areas. Annex Figure 3 shows the complexity of the Philippine public extension system. The number of institutions with extension functions that is located in six departments is summarized in Table 10. Private sector extension is mainly focused on the promotion of agriculture-related inputs (hybrid seeds, fertilizers, herbicides, pesticides, agricultural machinery). NGO extension offices are small but better-focused on targeted groups and communities; hence, are perceived by clients as more effective.

**Table 10. Number of agencies with extension function and their responsibility.**

<table>
<thead>
<tr>
<th>DEPARTMENT</th>
<th>AGENCY</th>
<th>NUMBER</th>
<th>EXTENSION RESPONSIBILITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>DILG</td>
<td>Provincial LGUs</td>
<td>79</td>
<td>Non-formal education to farmers and fishers</td>
</tr>
<tr>
<td></td>
<td>City LGUs</td>
<td>115</td>
<td>Non-formal education to farmers and fishers</td>
</tr>
<tr>
<td></td>
<td>Municipal LGUs</td>
<td>1,495</td>
<td>Non-formal education to farmers and fishers</td>
</tr>
<tr>
<td>DA</td>
<td>ATI</td>
<td>1</td>
<td>Training and communication support to LGUs and DA units</td>
</tr>
<tr>
<td></td>
<td>Bureaus</td>
<td>5</td>
<td>Technology transfer, technical advice to farmers, fishers, processors, traders</td>
</tr>
<tr>
<td></td>
<td>Attached Agencies</td>
<td>8</td>
<td>Training and technical advice to farmers on specific commodities</td>
</tr>
<tr>
<td>DOST</td>
<td>S&amp;T Centers</td>
<td>74</td>
<td></td>
</tr>
<tr>
<td>CHED</td>
<td>SCUs</td>
<td>112</td>
<td>Information and training of LGU extension workers</td>
</tr>
<tr>
<td>DAR</td>
<td>Office of Support Services</td>
<td>1</td>
<td>Training and technical advice to CARP beneficiaries</td>
</tr>
<tr>
<td>DENR</td>
<td>FMB</td>
<td>1</td>
<td>Technical advice on forestry and NRM topics</td>
</tr>
<tr>
<td></td>
<td>Private Sector Agribusiness Enterprises</td>
<td>Xx</td>
<td>Technology transfer and demonstrations on agricultural inputs</td>
</tr>
<tr>
<td>NGOs</td>
<td>NGOs</td>
<td>Xxx</td>
<td>Information, technical and social advice, and community organizing</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td>1,891</td>
<td></td>
</tr>
</tbody>
</table>

Source: Contado 2004

**1. Extension Services at National Level**

In 1991, when agricultural extension was devolved to the local governments, the then BAEx was abolished. DA’s extension function was significantly reduced to training support. ATI was established in 1987 (EO 116) as DA’s training institution. In 1997, AFMA recognized ATI as the apex agency for extension and training within DA and was tasked to train agricultural extension workers in the LGUs. In 2004, ATI’s network was reduced from 34 to 16 training centers.
Under AFMA, ATI’s mandate would be realigned to include policy making, planning, M&E, training coordination, and overall extension guidance. This shift did not happen. With support from the World Bank’s Diversified Farm Income and Market Development Project, ATI’s mandate will be reoriented; from primary training provider to overall training coordination with strengthening of its capacity. Market-oriented approaches will be used to reorient extension training to bring producers and traders together (World Bank 2004).

After the devolution of extension, DA continued to carry out extension and advisory functions through its 5 bureaus and 8 attached agencies. Unlike other DA Bureaus, the extension mandate of BFAR, was boosted by AFMA implementation. In 2000, BFAR maintained 1,134 extension personnel with a budget of ₱200 million. Some DA-attached research centers (i.e., PhilRice for rice and PCC [Philippine Carabao Center] for carabao) have been quite successful in carrying out RDE activities. Both centers have been internationally certified as COEs for R&D.

2. The Devolved LGU Extension Services

The largest portion of the current extension force is in the LGUs; located in 79 provinces, 115 cities, and 1,495 municipalities. There are an estimated 25,117 extension workers in the LGUs in 2000. The organization and management of the devolved extension system is not hierarchical. Extension offices at provincial and municipal/city levels are all autonomous; hence, are not linked to each other vertically or horizontally. The devolution resulted to a very large fragmented and uncoordinated system of extension offices, with weak linkages to ATI at the national level or other extension providers at different levels.

A recent assessment of the LGU extension services indicated organizational weaknesses resulting to inefficiencies, ineffectiveness, and very weak linkages to R&D institutions, the private sector, and other extension providers (Contado 2004). These constraints are multiplied by very serious under funding for extension activities, low priority of extension given by LGU management, and low capacity of the large cadre of extension workers.

A Municipal/City Agricultural Officer heads the municipal/city extension office, with about 10 staff consisting of agricultural extension worker, home economists, and rural youth workers. The municipal/city extension units are too small and do not meet the economic scale to ensure an efficient, effective, and sustainable extension service. A provincial LGU, headed by a Provincial Agricultural Officer, with about 300 staff, is a more viable operational unit for the devolved agricultural extension (Contado 2004). Currently, these two groups have their own separate extension programs involving farmers and fishers. The provincial LGU could coordinate all the municipal and city LGUs in a province. This streamlined structure (Annex Figure 4) would facilitate extension planning, monitoring, and evaluation of extension activities; and provision of communication support to farmers, fishers, and small entrepreneurs.

3. Other Extension Providers

Three other government departments have extension functions. DAR implements the Comprehensive Agrarian Reform Program (CARP); and has its own 1,700 development facilitators (staff with extension function) who provide technical advice and practical farming guidance to farmer-beneficiaries in Agrarian Reform Communities (ARCs). This extension force is in addition to the LGU extension workers in the same localities.
PCARRD and its 14 regional consortia have active linkages to farmers, in partnership with LGUs, NGOs, cooperatives, and DA agencies, to provide science-based information and technologies to farmers and fishers. Its Techno Gabay Program works through various delivery modalities. One such model is the Farmers’ Information and Technology Services (FITS) Center. There are 159 FITS in 14 regions (PCARRD 2004). The regional consortia monitor the FITS and provide technical and information advice. FITS was cited in the AFMA and MTPDP 2004-2010 as an extension model to be scaled up to reach more farmers and fishers.

Private sector technology transfer activities relate directly to the promotion of their specific products to farmers to enhance their adoption of new technologies (i.e., hybrid seeds, pesticides or herbicides, biologics, etc.). These private companies also carry out training of target farmers or contract farmer groups. Local NGOs provide community facilitation and training of farmer groups in more delineated areas (i.e., specific communities or villages). Their targeted interventions are more effective, usually with social focus, but are more difficult to scale up to involve a significant number of farmers because of the small size of most local NGOs. Private sector and NGOs are critical extension providers to give farmers other options and to ensure a pluralistic extension system.

4. Investing in Information and Communications Technologies

The information and communications technology (ICT) revolution provides new options for accessing information by providing it directly to farmers and rural households, extension workers, agribusiness entrepreneurs, and others. Most extension programs, including those in the Philippines, have yet to effectively integrate mass media and ICTs into systems for supporting extension staff. ICTs offer opportunities to reach more people and to carry out various extension functions more effectively and efficiently. The benefits, policy and implementation issues, and lessons learned from the application of ICTs by various developing countries are described in Annex 12.

5. Improving Coordination of Extension

Unlike R&D activities that are coordinated by BAR, PCARRD, and PCAMRD at the national level, there is no formal structure or mechanism for coordinating the disparate components of the agricultural and fishery extension system at all levels. The result is an imbalance, with an overly coordinated agricultural R&D system and an uncoordinated agricultural extension system. This imbalance may be one of the causes of the slow adoption of new technologies by farmers and fishers, in spite of the reported large number of ‘mature’ technologies generated by the R&D system. The proposed unification of the AFNR RDE System is also expected to improve extension services delivery (Annex Figure 4).

Proposed Actions: 2005-2006

(i) Coordination and linkages: ATI to realign its functions from training provider to strategic planning, funding, and coordination of training, and dissemination of information; strengthen ATI’s capacity in extension management and in ICT.
(ii) Start implementing the Unified Technology Delivery Program and Convergence Initiatives on ICT; extension institution to prepare Institutional Action Plan for implementation; ensure participation of private sector, NGOs, and other extension providers in implementation; ATI/BAR, PCARRD, PCAMRD, and ERDB/FMB to provide coordination and guidance (summary in Annex 5).
(iii) Strengthen the linkages of ATI to R&D institutions and to LGUs’ extension units through joint planning, implementation, monitoring, and evaluation; ATI to provide coordination and guidance.
(iv) M&E: Include extension in the Unified Project Planning, Monitoring, and Evaluation System; train extension staff on M&E processes and procedures; ATI/BAR, PCARRD, PCAMRD, and ERDB/FMB to provide coordination and guidance (summary in Annex 5).

(v) Reorganization: Seek approval of an appropriate legal instrument to organically link the provincial and municipal/city LGUs within a province and transfer the basic unit of extension from municipal to provincial level, where there is critical mass of staff; RDE Commission to prepare proposal and discuss with DILG.

B. Sustaining Funding and Accountability in Extension

A PIDS comprehensive study of the agricultural extension system noted that public funding for extension in the country is estimated to be about ₱6 billion annually (David et al. 2001). This is about 1.3% of the AgGDP of the country. FAO’s Global Consultation on Agricultural Extension in 1989 recommended at least 1% of the AgGDP as a standard budget for agricultural extension (Contado 2004). Under AFMA, the government was expected to provide up to 10% of total AFMA budget for agricultural extension, but this level was not attained. Overall, the public budget for extension has been increasing. However, lack of transparency and accountability to clients has affected the effectiveness and credibility of extension institutions.

Constraints: Extension funding is dispersed over many small, uncoordinated, autonomous units; long delays in budget releases and often insufficient; no mechanism to ensure transparency and accountability, and lack of overall M&E system.

A. Public Funding for Extension

About 90% of the funding for agriculture and fishery extension is from government allocations. In 1998, the total expenditure for extension was ₱4.79 billion or 14.6% of the total expenditure for agriculture (₱32.78 billion). About ₱3.7 billion (79%) of this amount was allocated to the LGUs (Table 11); with the remaining distributed to national government agencies (i.e., DA). The almost 15% expenditure for agriculture and fishery extension shows that a substantial amount is expended for extension activities. As already noted, the absence of a coordinated organization and common agenda for extension may have affected the efficiency of utilization of these funds.

Even after 12 years of devolution and six years of AFMA implementation, fund transfers from the national government to the LGUs remain the major source of income for the LGUs. This is true for both provincial and municipal LGUs. Since 1993, the Internal Revenue Allocation (IRA) constituted 75-80% of total funds for provinces, 40-50% of cities, and 60-75% of municipalities. Comparison of the budget before and after devolution showed drastic reduction in extension expenditures. Although DA’s extension allocation has also increased, there are no institutionalized financial transfer instruments for LGUs to receive DA funds through collaborative programs.

<table>
<thead>
<tr>
<th>SOURCE OF FUND</th>
<th>MILLION ₱</th>
<th>PERCENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total expenditures for agriculture and natural resources</td>
<td>32,777</td>
<td></td>
</tr>
<tr>
<td>NGA Regular Core Functions</td>
<td>11,892</td>
<td>36</td>
</tr>
<tr>
<td>NGA Special Projects</td>
<td>16,986</td>
<td>52</td>
</tr>
</tbody>
</table>
In 1999/2000, ₱893 million was allocated for extension by 5 DA bureaus (47%) and 7 DA attached agencies (53%). This substantial amount is about 21% of the total allocation for extension from the government (Table 12). Among the DA bureaus, BFAR had the highest allocation, showing the government’s focus on fishery extension under AFMA. In the absence of an extension-coordinating agency within DA, it has been difficult to monitor the efficiency of fund utilization or in determining the field impact of extension investment.

### Table 12. Fund allocation for extension in 5 DA bureaus and 7 DA attached agencies, 1999/2000.

<table>
<thead>
<tr>
<th>DA AGENCY</th>
<th>EXTENSION BUDGET (₱,000)</th>
<th>TOTAL/PERCENT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bureaus</strong></td>
<td></td>
<td>423.0/47%</td>
</tr>
<tr>
<td>BAI</td>
<td>145.0</td>
<td></td>
</tr>
<tr>
<td>BPI</td>
<td>27.0</td>
<td></td>
</tr>
<tr>
<td>BFAR</td>
<td>244.0</td>
<td></td>
</tr>
<tr>
<td>BPHRE</td>
<td>2.0</td>
<td></td>
</tr>
<tr>
<td>BSWM</td>
<td>5.0</td>
<td></td>
</tr>
<tr>
<td><strong>Attached Agencies</strong></td>
<td></td>
<td>469.9/53%</td>
</tr>
<tr>
<td>CODA</td>
<td>13.8</td>
<td></td>
</tr>
<tr>
<td>FIDA</td>
<td>35.0</td>
<td></td>
</tr>
<tr>
<td>NTA</td>
<td>148.0</td>
<td></td>
</tr>
<tr>
<td>PCA</td>
<td>161.0</td>
<td></td>
</tr>
<tr>
<td>PCC</td>
<td>45.0</td>
<td></td>
</tr>
<tr>
<td>PhilRice</td>
<td>12.0</td>
<td></td>
</tr>
<tr>
<td>SRA</td>
<td>55.0</td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td>892.9/100%</td>
</tr>
</tbody>
</table>

Source: Contado 2002

### 2. Improving Efficiency, Transparency, and Accountability of Extension Funds

There is considerable experience in other countries in using mechanisms to improve the transparency and accountability in managing extension funds. Introducing some appropriate mechanisms in the Philippines would improve the management of extension funds. Extension funds are allocated and directly released to individual agencies without oversight from an extension-coordinating agency (i.e., ATI).
Research competitive grants mechanisms are already in use by Philippine R&D institutions. The Grants-in-Aid of PCARRD and PCAMRD is a competitive fund with specific criteria, guidelines, and procedures. A similar competitive research grant fund is in place in BAR, which is being strengthened through the implementation of World Bank’s Diversified Farming and Market-Oriented Development Project of DA. Operations manuals are already available in R&D, which could be modified for use in extension. The Philippine government is already familiar with the process of allocating grants-in-aid funds, which the extension agencies could build upon. Aggressive promotion and training of extension staff that will carry out a similar grant scheme in extension is needed.

Active participation of men and women farmers/fishers, civil society groups, NGOs, the private sector, and development partners would improve transparency and accountability of public extension providers. Some extension mechanisms that could be studied by extension agencies in the Philippines for possible piloting and adoption are:

(1) Competitive Extension Fund following the current Competitive Research Grants model of BAR, PCARRD, and PCAMRD (Annex 10).
(2) Farmers’ Fund or Demand-Driven Fund, pooled amount contributed by donor and cost-shared by RPOs or groups of farmers, or cooperatives which could be used by farmers to buy their own extension services (Annex 11).
(3) Contracting extension and applied research following various models involving public and private sector funding and delivery of services (Annex 13).

Proposed Actions: 2005-2006

(i) **Strategic planning:** Carry out stakeholders’ consultations participated by public and private extension service providers and key extension partners to develop a system-wide strategic plan for extension that is market-oriented and client-driven considering the agreed Unified RDE Agenda; ATI to provide overall coordination.
(ii) **Realign/update LGU extension work plans and budget to the provincial and municipal development programs and the Unified RDE Agenda; consider current institutional MFOs; ATI, and SCUs to provide guidance.**
(iii) **Extension mechanisms:** Review and introduce mechanisms to ensure transparency and accountability to clients such as extension competitive grants scheme, contracting extension, extension demand-driven fund; ensure significant participation of men and women farmers/fishers, micro-, small- and medium-sized entrepreneurs, NGOs, and the private sector; ATI to provide guidance in testing mechanisms and document results.
(iv) **M&E:** ATI to develop a Unified Extension M&E System for Extension, with identified key performance indicators and related to institutional MFOs; relate/link with overall RDE Unified Project Planning, Monitoring, and Evaluation System; ATI to provide coordination and staff training; PCARRD, PCAMRD, and BAR to provide management guidance.
(v) **Staff training:** Train relevant staff in key extension agencies, especially LGUs, on M&E procedures and analytical instruments; ATI and SCUs to provide training, and PCARRD and PCAMRD to provide management guidance.

**C. Reorienting and Developing the Human Capital for Extension**

*Constraints:* Large number of extension workers but no critical mass at basic municipal level; skills of extension workers need upgrading; lack of overall Human Resource Development Program and training plans; and poor coordination and quality of training.
B. Number of Extension Staff

The agricultural extension system in the Philippines is highly public-oriented. There is an estimated 32,444 extension personnel in six government departments (Table 13). This number is too large for the size of the Philippine agriculture sector and too dispersed over many government units. Majority of the extension workers (25,117) are located in provincial and municipal/city LGUs offices, as frontline providers of extension advice to farmers and fishers. The almost 10,000 extension personnel within DA agencies is a significant number and needs to be reviewed, with their roles precisely defined to reduce duplication of functions across agencies.

<table>
<thead>
<tr>
<th>DEPARTMENT</th>
<th>INSTITUTION/AGENCY</th>
<th>NUMBER</th>
<th>TOTAL/PERCENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>DA</td>
<td>ATI</td>
<td>804</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5 Bureaus (minus BPI)</td>
<td>1,851</td>
<td></td>
</tr>
<tr>
<td></td>
<td>7 Attached Agencies</td>
<td>1,460</td>
<td>5,575/17%</td>
</tr>
<tr>
<td>DILG</td>
<td>78 Provincial LGUs</td>
<td>6,906</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1,525 Municipal LGUs</td>
<td>15,272</td>
<td></td>
</tr>
<tr>
<td></td>
<td>84 City LGUs</td>
<td>2,919</td>
<td></td>
</tr>
<tr>
<td>DOST</td>
<td></td>
<td>xxx</td>
<td></td>
</tr>
<tr>
<td>CHED</td>
<td>30 SCUs</td>
<td>xxx</td>
<td></td>
</tr>
<tr>
<td>DAR</td>
<td>OSS</td>
<td>1,772</td>
<td>1,772/5%</td>
</tr>
<tr>
<td>DENR</td>
<td>FMB</td>
<td>xxx</td>
<td></td>
</tr>
<tr>
<td>Private sector</td>
<td>Private Agro-business Enterprises</td>
<td>xxx</td>
<td></td>
</tr>
<tr>
<td>NGOs</td>
<td>NGOs, Foundations, CBOs, RPOs</td>
<td>xxx</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>Public Sector only</td>
<td>32,444</td>
<td></td>
</tr>
</tbody>
</table>

Note: xxx means that number is not known

Sources: Contado 2004 (data from PIDS study in 2000); Contado 2002

C. Developing Human Capital for Extension

A PIDS study (David et al. 2001) showed that majority of the extension personnel who were transferred to the LGUs from DA have college degrees (68%). The current total extension personnel are about 46% women; there are 57% women in the field extension staff. The extension staff profile needs to be reviewed and analyzed in preparation for strategic planning for extension and in preparation of a unified National Agricultural Extension Agenda and Programs.

The LGUs do not have Human Resource Development Plans, which would guide capacity building and training of extension staff. All trainings done by ATI are short-term focused on DA’s priority commodities (rice, corn, high-value crops, and fisheries). In addition, training courses on institutional development and livelihood were carried out. The ATI Strategic Action Plan for 2004-2008 does not include a long-term degree program to build sustainable human capacity for agriculture and fishery extension.

In 2003, ATI reported that it has carried out a total of 1,389 courses with 58,953 participants (ATI 2004). This consisted of 1,085 regular ATI courses and 304 training courses for the Guinintuang Masaganang Ani (GMA) Programs of DA. The main beneficiaries of extension training were farmers (over 32,000), and mostly on rice production (Figures 4 and 5). About 5,000 extension workers and
2,500 LGU representatives were trained on various topics. All these training courses were carried out by ATI, with minimal training done by other extension providers. ATI’s regional training centers drew resource persons from SCUs. The total cost of 1,389 trainings was ₱11.7 million, of which 29% was provided by ATI, with cost-sharing from LGUs and other partners.

Under AFMA, an Expanded Human Resource Development Program was initiated in 1999, coordinated by ATI for long-term staff development of DA agencies. A total of 154 DA staff (29 from ATI) participated in advanced degrees in five Philippine universities under the Local Scholarship Program (ATI 2004). Since 2000, about 60 scholars have gone abroad under the Fulbright-Philippine Agriculture Scholarship Program. These long-term scholarship programs should be enhanced and extended to extension workers of other departments with major extension functions, like the LGUs. Returning scholars should have a re-entry program when they return to their institutions.

D. Changing the Core Competencies and Skill Mix of Extension Staff

With the shift to market-oriented and demand-driven RDE, there would be a need to realign the current extension workers to remain relevant to the new extension needs and priorities. The core competencies required for the emerging areas would have to be developed through a strong HCD Program. The skill mix of staff should reflect new trends and participatory approaches in rural development and extension (i.e., better targeting of poor farmers and fishers, women farmers, entrepreneurs, etc.). Agricultural development must now focus on agribusiness entrepreneurship; developing organizational and management skills, leadership, and organizing facilitation skills; and use of new technologies such as ICT. Extension workers have to be trained on participatory approaches and entrepreneurial skills. The preparation of an overall strategic HCD Plan should be top priority for ATI. The strategy should also ensure a shift in value orientation of extension staff to be people-oriented.

Proposed Actions: 2005-2006

(i) Personnel review and planning: Carry out an overall review of extension personnel in all government departments with extension function (DILG, DA, DOST, DAR, DENR, CHED/SCUs); review to include private sector and non-government extension providers; ATI to provide coordination.

(ii) ATI and SCUs to assist the LGUs prepare extension training plan based on the requirements of the provincial/municipal development plan and current MFOs.

(iii) Training needs assessment: Carry out training needs assessment, reflecting emerging areas and market-oriented RDE, as basis for preparing a Unified Human Capital Development Program and institutional training plans for extension; ATI and SCUs to provide coordination and guidance.

(iv) M&E: ATI to develop an Extension Personnel Information and Monitoring System with databases containing current list of public and private extension service providers, names of extension workers/specialists, their education and area of expertise, technical, managerial, and entrepreneurial skills, and other information to facilitate quick analysis and matching of extension staff with client needs; PCARRD and PCAMRD to provide management guidance.
(v) **Long-term training:** ATI to upgrade the DA’s Expanded Human Resource Development Program for degree training and open it to other departments with key extension functions (i.e., DILG/LGUs, DAR/ARCs); lobby for increased funding to allow more degree scholars to train in local and foreign universities (medium-term).

(vi) ATI to ensure that scholars prepare a re-entry plan to be submitted for funding to their agency/donors before completion of their degree program to ensure that they will utilize their new expertise and knowledge upon their return.

(vi) ATI to build its staff capacity to improve overall training coordination, quality, and relevance of extension training; enhance participation of other training institutions (SCUs, NGOs, POs) with ATI providing training of trainers capacity (medium- to long-term).

### VII. Summary Recommendations and Proposed Organizational Changes: Phasing of Next Steps

A summary of the key levers for RDE and initial actions to be taken by relevant government agencies are indicated in Table 14, including output indicators and timeframe. The phasing of the key recommendations and proposed actions related to the proposed organizational changes are indicated below.

#### Phase I: Implement Agreed Convergence Initiatives (2005)

1. Start implementing the agreed six convergence initiatives of DA and DOST.
3. Amend DA-DOST Convergence MOU (2004) to include DENR, CHED, DILG, and DAR for extension and NMR.
4. Carry out consultations with key stakeholders and RDE partners; identify other key convergence areas.
5. Draft/negotiate/obtain approval of an EO to create a high-powered AFNR RDE Commission, with NEDA and DBM leadership and coordination.

#### Phase II. Draft Proposal for a Unified AFNR RDE System (2006-07)

1. AFNR RDE Commission to draft proposal for a Unified AFNR RDE System and Agenda (2006).
2. Carry out consultations with key stakeholders and RDE partners to get feedback (2006).
3. Draft /obtain approval of RDE law or appropriate legal instrument (EO) to unify the AFNR RDE System and Revised RDE Agenda (2006-2007).

#### Phase III: Implement new RDE System and Reform Agenda (2008-2010)

1. Implement a Unified AFNR RDE System and Revised RDE Agenda with significant funding allocations (2008).
(2) Carry out consultations to inform key stakeholders and RDE partners and to get feedback (2008).
(3) Monitor changes annually; carry out impact evaluation by using agreed key performance indicators to synchronize with planning of the next MTPDP (2008-2009).
(4) Review and revise Unified AFNR RDE Agenda and Programs to conform with next MTPDP Directions and Targets (2010)
Table 14. AFNR Research, Development and Extension: Strategic thrusts, key levers, initial actions, and output indicators.

<table>
<thead>
<tr>
<th>KEY LEVER OR AGENDA</th>
<th>RESPONSIBLE AGENCIES</th>
<th>INITIAL ACTIONS</th>
<th>OUTPUT INDICATORS</th>
<th>TIME FRAME</th>
<th>EXPECTED IMPACT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Strategic Thrust 1: Increase private sector role and public-private sector partnerships in AFNR RDE</strong></td>
<td>1) Private sector firms active in RDE 2) PCARRD, PCAMRD, BAR, ERDB (coordination, cost-sharing of activities, and guidance on new mechanisms)</td>
<td>1) Carry out public-private sector dialogues to identify areas of common and complementary interests in RDE using unified RDE Agenda. 2) Prepare joint proposals to enhance public-private sector partnerships and joint ventures in RDE; with cost-sharing or external funding. 3) Introduce mechanisms to enhance public-private sector partnerships such as industry incubator model, industry clustering approach, etc.</td>
<td>j) No. of satisfactorily completed joint public-private sector activities funded through cost-sharing, joint ventures, or own funding. 2) Documented successful approaches that promoted public-private sector partnership; no. of beneficiaries.</td>
<td>Short- to medium-term</td>
<td>High</td>
</tr>
<tr>
<td><strong>Strategic Thrust 2: Shift paradigm from traditional commodity-oriented to market-oriented and demand-driven AFNR RDE</strong></td>
<td>1) PCARRD, PCAMRD, BAR, ATI, ERDB (coordination and guidance on new initiatives) 2) Key public AFNR RDE institutions (implementation) 3) Private sector, NGOs, donors, and IARC/ARI partners</td>
<td>1) Start implementing agreed six RDE Convergence initiatives in 2005. 2) Amend DA-DOST Convergence MOU to include DENR, DILG, DAR and CHED for NRM and extension in 2005. 3) Introduce approaches and analytical tools to ensure market-oriented and demand-driven AFNR RDE. 4) Consult key stakeholders and AFNR RDE partners to get feedback. 5) Monitor changes annually and revise programs and budgets accordingly.</td>
<td>1) All key RDE institutions implemented convergence initiatives satisfactorily. 2) Amended Convergence MOU to include extension and NRM. 3) Documented successful market-oriented approaches and analytical tools. 4) Annual M&amp;E reports</td>
<td>Medium-to Long-term</td>
<td>High</td>
</tr>
<tr>
<td>KEY LEVER OR AGENDA</td>
<td>RESPONSIBLE AGENCIES</td>
<td>INITIAL ACTIONS</td>
<td>OUTPUT INDICATORS</td>
<td>TIME FRAME</td>
<td>EXPECTED IMPACT</td>
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<tr>
<td><strong>Strategic Thrust 3: Reorganize and unify the AFNR RDE System and strengthen R&amp;D and extension linkages</strong></td>
<td>Reorganize the AFNR RDE units of key government departments to eliminate duplication of structures, delineate functions, strengthen linkages, and increase utilization efficiency of limited funding.</td>
<td>1) DBM and NEDA (lead, coordination, and advocacy) 2) DA, DOST, DENR, CHED, DILG, DAR (implementation and policy advocacy)</td>
<td>1) Draft/obtain approval of EO to create RDE Commission by end of 2005. 2) RDE Commission to draft proposal for Unified AFNR RDE System and Revised Agenda by 2006; TOR to include ways to increase RDE funding in the medium- to long-term. 3) Consult key stakeholders and RDE partners.</td>
<td>1) Approved EO and RDE Commission created and operational. 2) Draft proposed Unified AFNR RDE System and Revised Agenda agreed by key stakeholders 3) Increased efficiency in utilizing limited RDE funds (changes in RI ratio)</td>
<td>Short-term</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1) Philippine Legislative bodies, Office of the President 2) DBM and NEDA (lead, coordination, and advocacy) 3) DA, DOST, DENR, CHED, DILG, DAR (implementation and policy advocacy)</td>
<td>1) Draft/Obtain approval of AFNR RDE law or Executive Order(s) to unify AFNR RDE System by 2006/07. 2) Draft IRR and guidelines and prepare Institutional Action Plans by 2007. 3) Monitor changes annually; carry out impact evaluation by 2009. 4) Prepare revised 5-year AFNR RDE Agenda and budget by 2009 to synchronize with preparation of next MTPDP.</td>
<td>1) Approved AFNR RDE Law or Executive Order(s); with IRR and guidelines 2) Approved Unified AFNR RDE System and Agenda implemented by 2008 3) Revised AFNR RDE programs and budgets</td>
<td>Medium- to Long-term</td>
</tr>
<tr>
<td><strong>Strategic Thrust 4: Re-orient and build capacity of human capital and upgrade facilities for AFNR RDE</strong></td>
<td>Prepare a unified Strategic RDE Human Capital and Facilities Development Plan to re-orient human capital to new thrusts, emerging S&amp;T areas, and market-oriented, demand-driven AFNR RDE.</td>
<td>1) ATI, PCARRD and PCAMRD (lead, coordination, and guidance) 2) RDE institutions under DA, DOST, DENR, CHED, DILG, DAR (implementation) 3) Private sector, NGOs, and donor, IARC/ARI partners</td>
<td>1) Review current HRD and Facilities Upgrading Programs of key RDE institutions, including LGUs by 2005. 2) Carry out training needs assessment based on new RDE organization and streamlined functions by 2006. 3) Prepare a unified long-term Strategic Human Capital and Facilities Development Plan with budget by 2006. 4) Assist LGUs to prepare Extension HCD Plan and budget for extension based on local development plan by 2005; intensify training of LGU extension staff. 5) Assist LGUs to prepare capacity building plans for RPO, NGO, CBO partners.</td>
<td>1) AFNR RDE training needs assessment report 2) Agreed Strategic Human Capital and Facilities Development Plan 3) Approved joint Provincial and Municipal LGU Extension HCD Plan with budget</td>
<td>Medium- to Long-term</td>
</tr>
<tr>
<td>KEY LEVER OR AGENDA</td>
<td>RESPONSIBLE AGENCIES</td>
<td>INITIAL ACTIONS</td>
<td>OUTPUT INDICATORS</td>
<td>TIME FRAME</td>
<td>EXPECTED IMPACT</td>
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<tr>
<td><strong>Strategic Thrust 5: Improve efficiency, transparency, and accountability of financial management of RDE funds; and increase overall RDE funding</strong></td>
<td></td>
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<td>Improve efficiency, transparency, and accountability of financial management of AFNR RDE limited funding.</td>
<td>1) PCARRD, PCAMRD, BAR, ATI, ERDB (coordination and financial management guidance) 2) All RDE institutions under DA, DOST, DENR, CHED, DILG, DAR (implementation and policy advocacy)</td>
<td>1) Review trends in expenditures vs. budget allocation of RDE institutions, including private research institutions; identify areas of inefficiencies and opportunities to make changes; agree on action plan to implement changes. 2) Introduce financial management processes and tools, and M&amp;E system that would improve efficiency, transparency, and accountability of AFNR RDE institutions. 3) Reorganize AFNR RDE units in various departments to reduce overhead cost of RDE (see Strategic Thrust 4)</td>
<td>1) AFNR RDE Expenditures Review Report showing reduced overhead costs for RDE (or increased direct costs for RDE). 2) Documented successful financial management processes and tools adopted by AFNR RDE system; indicated cost benefits achieved. 3) M&amp;E system in place and working.</td>
<td>Short- to medium-term</td>
<td>Medium to High</td>
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<tr>
<td>Increase agricultural research intensity ratio from current 0.40% to at least 0.75% by 2010 (to be confirmed by Agriculture 2020 document)</td>
<td>1) NEDA and DBM (lead/advocacy) 2) New AFNR Governing Council, DA, DOST, and DENR (policy advocacy) 3) RDE institutions under DA, DOST, DENR, CHED, DILG, DAR (implementation of efficiency measures) 4) Private sector, donors, and development partners (cost-sharing, loans/grants support)</td>
<td>1) Develop strategies to generate and leverage RDE funding for new RDE Agenda and Programs and discuss with potential donors, development agencies, private sector, and RDE partners. 2) Develop proposals on public-private sector joint ventures and/or partnerships to increase funding of market-oriented RDE. 3) Diversifying RDE fund sources such as royalties, fee for services provided, research and extension contracts, industry’s own funding, producers’ own funding, and income-generation activities by RDE institutions.</td>
<td>1) Significant annual increases in AFNR RDE funding from donors and partners leveraged by limited government budget. 2) 0.75% agric. research intensity ratio achieved by 2010. 3. Documented successful fund generation schemes by AFNR RDE system to diversity sources of funds for RDE; increased total funding from external sources (donors, private sector, RPOs, NGOs, IARCS/ARIs partners)</td>
<td>Medium- to Long-term</td>
<td>Medium to High</td>
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VIII. References


This section describes joint venture arrangements between the government and private sectors to share the cost and returns of research and development (R&D). There are two primary approaches in which the government and private sector can build partnerships. The first approach involves both research and development. A good example is the Australian Rural Research and Development Corporation (RRDC) scheme. The second approach is where the public (and academic) sector undertakes research while the private sector undertakes the development work. The public sector (including academe) has research skills while the private sector use the research results to develop technology and product adapted to specific production environments, tests products widely, and undertakes market development (Echeverria, Trigo and Byerlee 1998). A good example is the Cooperative Research and Development Agreement (CRADA) scheme in the United States.

Perhaps, the most promising institutional options to strengthen the Philippine R&D system is the establishment of a joint government-private sector funded and managed institution similar to Australia’s RRDCs. This model provides joint public-private funding, greater private sector involvement in R&D planning, programming, and implementation, and greater flexibility of operations and accountability to clientele.

Rural Research and Development Corporations (RRDCs) of Australia

Australia’s RRDCs were established during 1985-1989 through various acts of the Parliament (i.e., Australian Meat and Livestock Research and Development Corporation Act, Horticulture Rural and Development Act, Primary Industries and Energy Research and Development Act). During the five-year period, 14 RRDCs were set-up (i.e., in meat, horticulture, dairy, cotton, fisheries, forestry and wood, grains, pigs, sugar, etc.). These centers were to bridge the gap between research and product development. All but one RRDC (on land and water) are recipients of compulsory levies collected from their industry which are matched by the Australian government dollar for dollar up to a maximum of 0.5% of the ex-farm gate values of the industry concerned. The RRDC on land and water is fully funded by the government but it can leverage its funds with those of other RRDCs.

In 1989, the Australian Minister of Primary Industry stated the challenge of the RRDCs as: “A major priority is to obtain more industry involvement in funding and directing research and to establish an integrated approach whereby industry is encouraged to invest in projects and to identify needs, while at the same time researchers have the incentive to find solutions to problems that have been identified. It will be necessary for administrative and organizational arrangements to be less restricted, more flexible, and more responsive to the external environment. A major objective is to make the system more ‘demand-led’ to meet the needs of all end-users, including industry, government, and the general community.”

Apart from autonomy to allow the corporations to act quickly and make important decisions without referring to higher authorities, the RRDCs were made accountable to industry by requiring industry approval of the Five-Year R&D Plans and the Annual Plans of the RRDCs. The RRDC Boards were
selected by independent committees based on skills and not representation in order to prevent agricultural and research organization politics to have strong influence in the disbursement of funds.

The RRDCs have been successful, especially as catalysts for strategic planning of their respective industries. This is because the RRDCs realized that an R&D Plan is most relevant if it is a subset of an Industry Strategic Plan. The strategic planning process led the industries to think rationally what research is important or not for their industry’s future. The process also enabled the RRDC Board and staff to have deeper, factual information about their respective industries, stakeholders, and markets. The RRDC could develop R&D plans with a high degree of confidence, relevance, and industry ownership.

RRDCs developed different approaches to improve the traditional public research fund model of relying on submissions from individual researchers and approving those that meet certain criteria. The RRDCs have strong focus on adoption and innovation that have beneficial effects on the industry. This led the RRDC to package and communicate research results better, to deal professionally with intellectual property and commercialization, and to encourage producers to influence the way results are delivered. Social benefit cost analyses of the R&D results of a number of RRDCs show very high rates of return. The positive impact of the RRDCs on the industries has had the important feedback to the RRDCs in terms of increased funding, from A$26.5 million in 1984/85 to A$148.7 million in 1987/98.

Cooperative Research and Development Agreement (CRADA) of United States

The CRADAs have become an important mechanism for technology transfer in the U.S. The number of CRADAs in the U.S. increased from 9 in 1987 to 227 in 1995. The value of CRADAs grew from USD 1.6 million in 1987 to USD 61.3 million in 1994. The CRADAs resulted in a growing number of patents awarded.

An important objective of CRADA is to link the fundamental, pre-technology research capacity of U.S. Federal laboratories with the commercial research and marketing expertise of the private sector (Fulgie et al. 1996). Government support for fundamental, pre-technology research is warranted because it is socially valuable but not profitable for private firms to undertake in as much as the benefits are not appropriable. The CRADAs provide a legislated mechanism (under the 1986 Technology Transfer Act) for the U.S. federal research agencies to pursue technology transfer activities with the private sector. Under a CRADA, a Federal laboratory may provide personnel, equipment, and laboratory privilege but not financial support to a cooperating institution (i.e., private company, university, non-Federal government agency). Rules regarding the ownership of inventions are spelled out in the CRADA.

The CRADA scheme assumes that the government has significant capacity to undertake basic and pre-technology research. In the Philippines, however, there is little government support for, and capacity to undertake fundamental research. The focus of much of the government agricultural R&D has been more applied technology-generation activities. Thus, the CRADA scheme may need to be modified in order to be relevant to Philippine conditions. The cooperative agreement between the government and the private sector institutions can be pursued for technology adaptation and generation. As in the U.S. CRADA, the cooperative agreement can spell out the use of personnel and facilities of the cooperating institutions and the rules on intellectual property rights.

References


A. Technologies Already Commercialized

Crops – PhilRice

1. **Production of carbonized rice hull** – a process of making quality carbonized rice hull was developed, including low-cost equipment. The product is made from incomplete or partial burning of rice hull (12-14 sacks) placed in a mound around an open-type carbonizer. Cool the blackened rice hull in large drums, then bagged. Some uses include: organic fertilizer and soil conditioner, base material for making microbial inoculants, charcoal for fuel, active ingredient for pesticide or insecticide making. To date, five peoples’ organizations began exporting carbonized rice hull to Japan. Based on the first export venture, the net income more than doubled the cost of production of ₱13,057.

2. **Hybrid rice production** – increased area planted to locally developed hybrid rice from around 30,000 ha in 2002 to 200,000 ha in 2004. Yield of hybrid rice averages 6 t/ha. There are already 33 seed growers’ cooperatives producing 60% of seed requirements, located in Isabela, Kalinga, Nueva Ecija, Davao Oriental, and Cagayan. Adoption rate in 2004 was 7.4% or 8.4% for wet season in irrigated areas comparing well with China’s (9.0%) three years after program inception.

3. **Minus-one element technique for rice** – made testing of nutrient deficiency in rice more reliable, less costly, and easier (can be done by farmers and extension workers), leading to proper diagnosis of soil-limiting nutrients and increase in fertilizer use efficiency. The basis of diagnosis is the actual performance of the rice plants (i.e., reduced plant height and tiller count, delayed maturity, etc.); thus, determining limiting nutrients not diagnosed in the soil chemical test (e.g., zinc and sulfur). It is still recommended that farmers subject the soil to chemical analysis every 3-5 years to quantify available nutrients.

Crops – BAR

4. **Using diagnostic kits for detection of banana bract mosaic virus and banana mosaic virus through monoclonal antibody technology (Fruits Network)** – 3,444 diagnostic kits for BBMV and 1,101 diagnostic kits for BMV were produced, while 4,552 samples each against BBMV and BMV have been indexed for two years. BIOTECH is one of the very few laboratories in the world producing monoclonal antibodies against BBMV. The use of BIOTECH-produced kits to minimize spread of diseases is now being recognized not only in the Philippines but in other countries as well. The kits are much cheaper than commercial imported kits. This means savings of the country’s dollar reserves.

Crops – PCARRD

5. **Rapid composting and use of compost as fertilizer** – uses *Trichoderma harzianum* as the fungus-compost activator to hasten decomposition of farm wastes from the usual 5-6 months to 3-5 weeks. Already adopted by farmers and cooperatives nationwide.

6. **Banana tissue culture** – provided required clean planting materials within a shorter period at minimum cost. A tissue culture facility with 15,000 plantlets/month capacity will give 84% internal rate of return. It has three years payback period, 15% net present worth, with ₱1,057,327 opportunity cost of capital. Entrepreneurs and SCUs in Regions 2, 4, and 11 have already adopted this technology.
7. **Hot water treatment of mangoes** – removed sooty mold, dirt and dust, insects, chemical residues, and other debris. It removes latex stains on the fruit surface. It is non-polluting since no chemicals are used. It evens ripening of mangoes. It minimizes the damaging effects of vapor heat treatment when applied 4-8 hours prior to VHT. It is easy to perform.

8. **Papaya Ring Spot Virus -resistant Sinta papaya** – first Philippine-bred hybrid papaya, which is a cross between Line No. 5 and Line No. 3. It is moderately resistant to the virus and produces more quality fruits than ordinary papaya strains. It is semi-dwarf, hence easier to harvest. It is early maturing (8-9 months); hence, there is early returns for farmers. The plant is prolific, which bears 17-50 fruits per tree. Cavite strain normally yields five fruits per tree when infected with PRSV. It is sweet and has a firmer flesh. It weighs 1.2-2 kg per fruit, which makes it easy to transport. The East West Company in Bulacan. Has started to commercialize the Sinta papaya.

9. **Bio-N fertilizer for rice and corn** – an inoculant in powder form, which benefited farmers by converting atmospheric nitrogen into a form usable by rice and corn plants. It contains any of the two important strains of bacteria isolated from ‘talahib’ (*Saccharum spontaneum* L.) roots. It cost P20/pack.

10. **Portable spindle-stripping machine for abaca** – made operation of the machine and extraction of good quality abaca fiber easier and safer over the traditional stationary-type abaca spindle-stripping machine. Abaca farmers in Regions 5 and 8 have been using this machine.

11. **Package of technologies for foliage plants production** – developed foliage plants hybrids with desirable characteristics (e.g., compact growth habit, good leaf arrangement and retention) and faster mass propagation techniques (e.g., Kulob and plastic tent methods that provide right temperature for successful rooting, allowing transplanting in just 2-3 weeks). Ornamental growers in Laguna, Cavite, and Bulacan. have adopted the package of technologies.

**Livestock – PCARRD**

12. **Wet season confinement of goats** – a system of raising goats where animals are confined in elevated housing and fed with soilage (freshly cut grasses and/or tree leaves) during the wet season. Strategic and sustainable parasite control by using either herbal or chemical anthelmintics or its combination is also practiced to complement with the wet season confinement technology. Benefited goat farmers in terms of reduced kid mortality from 66% to 2.6%, increased animal inventory of about 227%, and net profit of about P1,000/doe per year.

13. **Production of triple cross pigs** – a crossbreeding technology used for the production of slaughter pigs. Triple cross production technology involves utilization of single cross (Large White X Landrace) female parental line mated to either a Duroc or Duroc X Pietrain cross terminal boar. This resulted to 3-4 additional pigs weaned per sow per year and an increase of about 10-20% in average daily gain in slaughter pigs. Triple cross pigs were observed to produce better carcasses.

14. **Production of improved native chickens** – a combination of vaccination and artificial brooding technologies. This package of technology is accomplished by keeping chicks in artificial brooders from day-old to 30 days old during dry season or up to 45 days old during wet season before they are let loose in the field. The chicks are also given vaccination shots against new castle disease and fowl malaria before they are released in field. Once the chicks are on the range, strategic supplemental feeding system (provision of supplemental feed, e.g., grains, farm by products and kitchen wastes, during rainy days and in times when natural feeds are scarce) is practiced to augment the nutrients from
natural feed materials available in the field. Through this technology, mortality is reduced from 80 to 20-30%. Adopters of this package of technology realized a net profit of about ₱25/ bird.

**Forestry – PCARRD**

15. **Propagation techniques and plantation establishment for giant bamboo** – uses branch cuttings as planting material for mass production of giant bamboo. This spares the culm, normally used as planting material and for other important purpose, from being cut. Already adopted by bamboo growers in Inpalutao and Impasugong in Bukidnon.

16. **Seasoning schedule for Yemane (Gmelina arborea)** – a modified low temperature-drying schedule, which decreased drying time from 56 days to 31 days with 60-65% recovery, while the moderately high temperature took only 28 days with 45% moisture content to desired MC of 12%. This resulted in substantial reduction in drying time, energy requirements, and energy costs. With this technology, the industry is helped in its difficulty in drying yemane, a plantation species now widely becoming a raw material for wood furniture and other crafts.

17. **Species-site compatibility assessment for improved forestation planning** – different species have different site requirements for optimum growth. Many forestation efforts have failed in the past because of trial and error. This technology minimizes failure of forestation efforts through the development of classification functions, which can be used to categorize forestation sites as to whether they are good, average, or poor for establishing plantations of yemane and mahogany. Various regional, provincial, and community environmental offices of DENR have adopted this in its reforestation projects.

**Fisheries - PCAMRD**

18. **Improved Nile tilapia strains (e.g. GIFT and GET-EXCEL)** – the development of improved strains boosted fish farmers’ productivity and profitability. BFAR now has a nationwide network of hatcheries for disseminating the improved strain (fingerlings) to end-users.

19. **Milkfish hatcheries establishment** – reduced the need for importing fry from other countries. Sea cage farming of milkfish has rapidly expanded and provided reliable supplies of the fish for processing of value-added products for the local and export markets.

20. **Fast-growing and disease-resistant varieties of Kappaphycus and Eucheuma spp.** – fast-growing and disease-resistant varieties of Kappaphycus and Eucheuma spp. have been selected and are now being propagated by farmers to support the country’s seaweed processing industry for the export market of carrageenan.

21. **Network of diagnostic centers for white spot disease detection in shrimps** – uses probiotics and “closed systems” which contributed to shrimp disease mitigation. This network of diagnostic centers has been set-up by the DA-BFAR.

22. **Establishment of marine sanctuaries and adoption of integrated coastal management approach** – bolstered the rehabilitation of degraded coastal ecosystems (i.e., coral reefs, mangroves) and mitigated destructive methods of fishing in many coastal municipalities.
B. Technologies for Commercialization or Dissemination

*Crops - BAR*

1. Mass production, formulation, and field efficacy of nuclear polyhydrrosis virus (NPV) against *Spadopiera litura* attacking onions, peanuts, and asparagus (Biotech Network) – The NPV wettable powder at 30 gms/L with 10% mollases is comparable to Lambda cyhalothrin and Cymbush in controlling *S. litura*. It is a unique and distinct isolate compared to the reported/published in other countries; requires low investment; and is adaptable for village-level production. This technology shows promise if production is to be commercialized as this will decrease cost of spray of onion per week (one cropping season is four months) by 30%; and initially benefit a total of 78 onion farmers from Nueva Ecija and 215 members/farmers (one cooperative) from Pangasinan.

2. Biological control-based IPM for Asian corn borer (Corn Network) – developed less laborious, fast and easy mass rearing technique of earwig/Orius as biological control agents.

3. Corn hybrids and fertilizer rates for Region I – used different hybrid corn varieties with varying fertilizer rates in 26 locations region wide for the dry season. This resulted to location-specific corn technologies, which increased productivity.

4. Pest management scheme against two major pests of orchids by using biological control (Ornamentals Network) – Determined 1) median lethal time and median lethal dose, 2) horizontal transmission of infection from male to female beetle, 3) virulence of *B. basiana* to thrips established, 4) infectivity of *B. basiana* on Orius, 5) functional response of all stages of Orius, and 6) numerical response of adult Orius. This management scheme is projected to reduce pesticide usage by 100%, provide cost savings of 75%/ha per application, and adoption of 10% of orchid growers during initial introduction up to 50% of all growers expected to adopt.

5. Testing and production of white corn, special corn types and yellow corn varieties (Corn Network) – evaluated varieties in marginal and fertile uplands; analyzed profitability of farmers’ practices versus project-introduced technologies; and devised monitoring procedures for Asian corn borer and its natural enemies. Strategies developed through the project will serve as effective models in other areas and for other commodities.

6. Integrated management of two-spotted red spider mites on roses (Special Project) – use of water busting at 20-25 psi, pruning, and enhancing of natural enemies’ population were found effective in managing TSM.

7. Trichoderma soil inoculant for control of club root disease of cabbage – uses *Trichoderma* soil inoculant to decrease use of chemical fungicide for controlling club root disease of cabbage.

8. Biological control of Malayan black bug by using two biological control agents (Special Project) – simplified methods of mass rearing of the egg parasitoid *Telenomus triptus* and mass production of *Metarhizium anisopliae* as biocontrol agents of the Malayan black bug were developed.

9. Three species of Trichoderma for biological control of damping-off and other diseases of vegetables (Special Project) – efficacy of *T. parceramosum*, *T. pseudokoningii*, and *T. harzianum* in controlling fungal disease were found to be either equal or higher than that of chemical fungicides.

10. Commercialization of *Trichoderma* Biocon pellets – at the rate of 30 kg/ha, the pellets can replace chemical fertilizers by 50%, as well as chemical fungicide and growth hormone normally applied by
farmers. It also induces faster seedling growth and vigor and increases rice yield by as much as 18% regardless of amount of chemical fertilizers applied.

11. Integrated management of Potato leafminer (Liriomyza huidobrensis) (Special Project) – effective, affordable, safe, easily followed technologies in managing PLM including decision to be done before planting, management practices at planting, vegetative and tuber initiation period, at harvest and after harvest were packaged.

12. Ectomycorrhizae and Endomycorrhizae as biocontrol agents against soil-borne pathogens of corn, tomato, and peanut – introduction of mycorrhizal fungi, involving Basidiomycetous fungi and Mykovam, in the soil caused a stimulation of growth and increased yield of crops even in the presence of pathogens.

13. Use of rapid immunofilter paper assay (RIPA) (include in list of acronyms) for detection of abaca viruses – RIPA technique was found to be cheaper, easy to use, and effective in laboratory/onsite detection of abaca viruses, such as BTV, abaca mosaic virus and bract mosaic virus.

14. Use of flowering shoots as planting material to improve production of flowering potted Mussaenda – uses flowering shoots as planting materials, planted in coco peat and riversand, makes plants ready for commercialization in 30 days. Growers projected to net at ₱30,647 with production cost of only ₱15,913/year.

15. Quality enhancement of post-production system of priority ornamentals (Ornamentals Network) – reduced postharvest losses from 10% to 20% by 1) generating quality profile of roses, mums, and orchids; 2) optimized concentration of pulsing solution for cold-stored mums; and 3) optimized storage temperature of roses. Potential additional income per bundle of rose during peak season is around 76%.

16. Tissue culture to produce virus-free and true-to-type planting materials of garlic (Allium sativum L.) – uses 1) tissue culture to produce in vitro bulblets, 2) enzyme-linked immunosorbent assay ELISA to index materials for presence or absence of virus, 3) isozyme protein markers to check if true-to-type, and 4) field planting to increase bulb production. These combined technologies will try to minimize/eliminate disease during planting and thus improve yield of garlic.


18. Use of cellulases for the food and other industries (L&P Network) – improves yield of starch obtained from cassava by 10%. This technology translates to higher starch production from cassava, sweet potato, and taro, which are used for feed and other industrial applications. This also means higher income for processors.

19. Lipid molecular species and fractions of the oil from local seeds and nuts (Special Project) – majority of oil samples from seeds and nuts were unsaturated, making them potential materials for high-value specialty oil products.

Livestock - BAR

20. Production of defined competitive exclusion mixture against Salmonella in chicks (Special Project) – reduces salmonella population in chicks dosed with the mixture of L. acidophilus, L. plantarum, and Peptostreptococcus tetradius.
21. **Ocean color sustainable fisheries** – by using satellite remote sensing: 1) information on abundance of phytoplankton in the ocean which is directly correlated to fish population, and 2) presence of risks such as frequency of typhoon will help fishermen where to fish.

22. **Pilot-scale multi-species hatchery for commercially important sea cucumbers and gastropods** – sped up the production process of aquatic animals like: pilot reseeding of abalones; spawning induction trials by thermal shock in sea cucumbers; reseeding of sea urchins, larval settlement, and metamorphosis in top shells. These echinoderms and gastropods are gaining worldwide importance for its commercial potential and health benefits.

23. **Acclimatizing and osmoregulatory agents for successful propagation and in captive breeding of seahorse** – 13 inorganic components (N, P, Mg, S, K, Na, Ca, Cl, Fe, Cu, Zn, Mn, Br) were detected in the pouch fluid of seahorse. Salinity levels inside the pouch differed significantly (p<.05) in concentration with respect to the seawater. Data obtained can be used in the design of appropriate feeding techniques and other environmental simulations strategies for the successful breeding and propagation of seahorse in captivity.
Annex Figure 1. Milestones (1910-2000) in the evolution of the Philippine rice farming system showing trends in rice production, area, and productivity as affected by technological innovations and other factors.
Source: del Rosario and Agarrado 2004


Industry clusters refer to the tight connections that bind industries together in various aspects of common behavior. These aspects may include geographic location, sources of innovation, shared input suppliers, factors of production, and complementary services. Unlike an industry sector, an industry cluster looks beyond the production of a good or service to the entire value chain. Clusters are industries that are connected by the flow of goods and services, which is stronger than the flow linking them to the rest of the economy.

1. Operational Concept and Framework

Almost every analysis of industry clusters begins with Michael E. Porter’s diamond of advantages – a characterization of his four key drivers of competitiveness. Porter states that industries’ success in the international markets is the primary barometer of the competitive strength of a nation. The success of any given industry can be traced to four major factors shown in Figure 1:

- nature of a firm’s strategy, structure and rivalry;
- factor conditions;
- demand conditions; and
- presence of related and supporting industries.

![Figure 1. Porter’s Model of Competitive Advantage.](source: Gonzales et al. 2005)
Competitive industries must depend on the competitiveness of their intermediate input suppliers, who must depend on the capabilities of their suppliers, and so on, back through all the links in the value chain. But such industries also depend on service providers, sources of basic and applied research and development, capital goods suppliers, wholesalers and distributors, and suppliers of trained workers. Even competitors are important, including direct competitors to the industry as well as competitors to the industry’s suppliers, since their presence maintains pressure to continually upgrade processes and techniques and to seek new opportunities. Competitors also provide opportunities for cooperation in solving joint problems or addressing industry-wide issues.

2. Identification and Analysis

The process of identifying and analyzing industry clusters requires a considerable amount of time, resources, and collaboration among public and private institutions. The process of developing a broad and comprehensive understanding of industry clusters is a lengthy exercise. From an economic development perspective, the investment in time and resources is justified because the process provides a comprehensive framework of analyzing interrelated industries.

Industry clusters are generally identified through the use of quantitative analysis techniques, such as location quotients and input-output analyses. Location quotients track the relative concentrations of industries within a region, and input-output analyses show the buyer-seller linkages among industries. While quantitative analyses will indicate the presence of a cluster, they do not address whether there is really a functional or dynamic relationship between the industries in the cluster. It is necessary to supplement quantitative analyses with qualitative techniques, such as interviews, surveys, and focus groups with key industry representatives. The qualitative analysis will help determine what type of relationships exist between the industries in the cluster, and will help identify industry clusters that may be overlooked by conventional data analysis.

3. Agriculture and Agro-Industry Clusters

Industry cluster is a major tool in strategic planning. The competitiveness of an industry cluster depends not only on the industry itself but also equally important, what is happening or what will happen to the supplier industries, support and related industries, and the institutions that influence them.

An industry cluster is a strategic framework that provides a cohesive and integrated approach for analyzing industrial development and competitiveness. A cluster is a grouping of key and support industries, infrastructure and institutions that are inter-linked and inter-dependent. It emphasizes the importance of support industries, institutions and the links between such industries and the leading firms.

The major components of an industry cluster are the core industries, the supplier industries, and the related allied industries and services. Annex Figure 2 shows the Feed-Hogs Agro-Industrial Cluster Framework. The core industries include the swine production and primary processing (slaughter), and the downstream industry of meat processing, all inter-related in the supply chain. Among the main supplier industries are feed ingredients such as corn and wheat.

The supplier industries provide raw materials (feeds, biologics, etc.), processing suppliers, packaging, machinery and equipment, utilities, etc. The related and allied industries and services include banking
and finance, research and development, education and training, industry/trade association, and
government and non-government institutions that can affect the cluster performance.

Industry associations and institutions are key elements in a cluster. The industry associations (National
Federation of Hog Farmers, Philippine Association of Hog Raisers) are implementing institutions. They
are also the investors. In the public sector, the following agencies are involved: (1) the Department of
Agriculture and its agencies (Bureau of Animal Industry and the National Meat Inspection
Commission) implements sectoral policies, support services, and regulation; (2) the Department of
Public Works and Highways for construction and maintenance of national roads, (3) the Maritime
Industry Authority for shipping rates and regulation; (4) the Philippine Ports Authority for setting rate
and regulation of ports, (5) the Land Transportation and Franchising Board for land freight rates and
regulation, and (6) the Department of Trade and Industries for foreign trade and incentives.

While clustering is important, the industry association(s) must execute the master plan. What is of
strategic importance is that the three industries are linked by specific cost targets: cost of corn to swine
producers, and cost of port to meat processors. When corn is not cost-competitive, the swine industry
may not be competitive if it uses corn. High cost of pork to processors affects the latter’s
competitiveness.
Annex Figure 2. Feed-Hogs Agro-Industrial Cluster Framework
Source: Gonzales, L., C. Elca and A. A. Gonzales. 2005
Annex 4. Role of Rural Producer Organizations in Extension and Research.


In pluralistic extension systems, various clients groups help to formulate client demands for services. Producer groups are the major focus for agricultural extension services, though other organizations, based on community membership, specific social or developmental objectives, or specialized client groups, such as youth clubs or women’s organizations, can be equally important to extension programs. Rural producers’ groups fall generally into two categories with differing objectives and potentials, as well as differing extension needs.

Community-based, resource-oriented groups. These are generally small informal groups of farmers and rural people with diversified production systems. They require extension assistance for community organization, marketing, and collaborative management of natural resources. One type of such farmer grouping is the extension contact group organized for the convenience of extension service delivery. Other informal groups may be semi-permanent, coming together for a specific purpose and dissolved when this has been achieved, such as managing natural resources. These seldom evolve into formal organizations and, although they can assume varied roles in extension and information service delivery, their major strength is in serving as a contact point for extension.

Community-based and market-oriented groups. These are generally larger and more formal organizations, with more sophisticated needs for extension assistance in production and marketing, business planning, and development for specific products. These groups can play a wider role in extension because they are more likely to be able to define needs, co-finance service delivery, and coordinate extension and information activities.

Current trends likely to increase the importance of producer organizations (POs) and facilitate their involvement in extension include moves to decentralize government, better definition of respective roles of public and private sectors, more competitive markets, improvements in rural infrastructure and services, and better-educated producers.

Benefits

Extension systems face challenges in delivering information services to larger numbers of rural people scattered over wide, sometimes inaccessible, areas. Client organizations help extension “reach” members but, more importantly, serve to organize demand for extension services. They enable members to participate in defining in defining objectives and needs, provide feedback to help programs deliver more relevant services, become more accountable to clients, and establish a base for co-financing and eventual self-financing of services. In working with client-organizations, extension services build important social and human capital, empowering clients to analyze and resolve their own problems (Box 1 and 2). As agricultural markets become more competitive and demand for information and services increases, there will be a growing need for more permanent, formal organizations to provide rural services.
Box 1. Norway: agricultural research/extension circles

Norway’s agricultural research/extension circles are an example of farmer-owned and led extension services. About 25% of Norwegian farmers are Circle members, paying annual fees and electing management boards. Circle programs combine extension and adaptive research and include field experiments, soil testing, farm policy analysis, information and advisory services, and promotion of agricultural communities. Priorities are established in membership meetings, with research ideas and guidelines obtained from the national university. Factors contributing to program success include farmer ownership and leadership, combination of adaptive research and extension, fee-based membership, public sector financing, and adaptation of an existing institutional model.

Source: Haug 1991

Box 2. Malawi: National Smallholder Farmers’ Association

The National Smallholder Farmers’ Association was formed in 1997 to provide services and promote social and economic development of smallholders. It is financed through a government levy, member dues, user fees, and donor support and its 96,000 members are organized into about 5,000 local “clubs”. Groups of 5-10 clubs are federated into Group Action Committees organized into 32 separate associations.

Services are focused on marketing, using collective bargaining power to negotiate favorable transportation rates and market terms and prices, and providing assistance for feasibility studies, training and technical and management advice. Associations work with traditional crops (tobacco, maize, cotton, and groundnuts), but they are giving increased attention to higher-value and export crops (chili peppers, paprika, ginger, turmeric, and sesame). The associations have field staff and operate farm supply shops that serve as informal information centers.

Source: Walton 2002

Policy and Implementation Issues

Varied roles of client organizations. Client organizations can convene members for disseminating information and training, contract extension services on behalf of members, provide input to program governance and priority setting, lobby government for extension services, or assume full responsibility for providing services to members.

Market orientation. Some special interest clients (i.e., women’s groups, environmental conservation groups) may continue to support extension systems due to personal commitment, but few producer groups will sustain interest if there is no direct economic benefit. For this reason, sustainable extension programs generally must support marketing activities or market-oriented agricultural production to generate financial benefits that provide a basis for sustainability of the extension system.

Dual role for extension. Extension services support clients through establishing client organizations and strengthening their programs and core management systems, in addition to providing technical and advisory services to promote innovation. Increase profitability, implement projects, and develop linkages to other sources of assistance.
Level of organization. Producer organizations face a dilemma in terms of scale of operation. Community-based organizations (CBOs with 10-30 members) can achieve group cohesion and unite around common local objectives, but they lack economies of scale and political influence. National or regional organizations can be more effective advocates with government and achieve economies of scale in operations, but they may lose touch with rural membership base. A strategy of linking community groups in a national federation seeks to combine these strengths (FAO 2001).

Equity concerns. Many groups that are dominated by local elites do not truly empower producers or reach disadvantaged groups (Chamata and Shingi 1997). Ensuring participation of women, minority groups, and the poor might require changes to organizational procedures to ensure that these groups are not excluded. If this fails, establishment of separate organizations might be necessary to provide equal opportunity to participate in organized governing bodies at the local, regional, national, and international levels, as well as by promoting leadership training for rural women and ethnic minorities.

Lessons Learned

Institution building. Extension services can work with producer organizations as full partners, representing members’ interests. This requires patience and a long-term perspective. Donor support can strengthen client organizations and stimulate demand for extension, but, having donor funding carries a risk of undermining long-term stability of the organizations (Dellon 2000).

Existing vs. new organizations. Working with existing organizations is often more successful than starting new ones, especially if groups are formed by a project specifically to qualify for a special subsidy or benefit.

Group promotion. Responsibility for promoting client organizations has often fallen to poorly prepared extension agents with little training or understanding of principles of group formation. Most extension programs need dramatic improvement in staff skills (social, legal, and business) for working with client groups, whether informal community groups or larger formal organizations.

Accountability and advocacy. Producer organizations are often seen as mechanism for small-scale farmers to make public extension agencies more accountable and responsive, and as advocates for continued program funding. Accountability is enhanced only if client organizations have real control over program resources and management. There are only a few instances of producer organizations effectively defending extension program funding (as in Venezuela) (Carney 1996). Building effective organizations that can lobby for and influence extension priorities will take time and possibly new organizational arrangements.

Recommendations for Practitioners

National extension strategies and program mechanisms will vary depending on types of producers or clients, local institutions, and local opportunities and problems. Extension agencies should consider options for working with client organizations in any program. Public support should be oriented toward empowering clients, organizing sustainable groups, developing human capacities, and encouraging participatory problem-solving through extension investments that:

- Define the role of client organization, which depends on the type of client. Organization of large farmers and those producing cash crops are most likely to be able to assume full responsibility for organizing and financing extension services. Organizations of small farmers with diversified production systems are likely to be effective partners in planning and
implementing programs in conjunction with other service providers but will generally remain dependent on public financing for services.

- Carry out social assessments, including gender analyses, to understand better the dynamics of client groups and their leadership and assess the participation and benefit distribution by gender, age, ethnicity, and income level.
- Devote resources to build client organization capacity and increasing member participation in planning, implementation, co-financing, and evaluation of extension programs. Extension programs need to emphasize training both for client organization staff and members, as well as for extension service providers.
- Promote independence of client organizations, enabling them to identify extension needs, select service providers, and evaluate program performance. Channeling funding through client organizations to procure services, rather than providing them directly from public agencies or public agency contracts strengthens organizational autonomy and influence.
- Plan for collaboration among client organizations, local government, the private sector, and producers in providing services.
- Encourage transparency in program operations so members are fully aware of program objectives, status, and finances. This may prevent the misuse of organizations by politicians.

References


Annex 5. Organization of the Philippine Research, Development, and Extension System in Agriculture, Fisheries, and Natural Resources.

The following is a brief description of the National Agriculture, Fisheries, and Natural Resources (AFRN) Research, Development, and Extension (RDE) System.

1. The National AFRN Research and Development System

a. Institutional arrangements and key players. There are four key government departments that fund and implement the agriculture, fisheries, and natural resources (AFNR) research and development (R&D) programs in the Philippines: the Department of Agriculture (DA), the Department of Science and Technology (DOST), the Commission on Higher Education (CHED), and the Department of Natural Resources (DENR). Two additional departments are involved in agricultural extension: (1) the Department of Interior and Local Government (DILG), and (2) the Department of Agrarian Reform (DAR). The complex and multi-level institutional arrangements with their separate RDE networks are shown in Annex Figure 3. The figure shows a highly complex structure involving numerous units at national, regional, provincial, and municipal levels that have duplicating roles and organizational arrangements. The target of the Medium Term Philippine Development Plan (MTPDP) for 2004-2010 is to harmonize the disparate components and networks towards eventual consolidation and unification by 2010.

b. Policy-making Bodies for RDE. The Agriculture and Fisheries Modernization Act (AFMA) Implementing Rules and Regulations (IRR) established the Council for Extension, Research, and Development for Agriculture and Fisheries (CERDAF) but the Council is not currently operational. CERDAF is chaired by the DA Secretary, with inter-sectoral members involving government, private sector, and non-government institutions. CERDAF has similar functions and membership as the two Science and Technology (S&T) Councils of DOST. Hence, there is duplicating structures at the highest policy-making level of government.

The Philippine Council for Agriculture and Resources Research (PCARRD) and the Philippine Council for Aquatic and Marine Resources (PCAMRD), under DOST, are governed by their own Governing Councils (GC), chaired by the DOST Secretary. There are three other S&T Councils for Health, Industry and Energy, and Advanced Sciences. The S&T Councils are inter-sectoral with members that represent the key government agencies, the private sector, non-government organizations, and client groups, similar to CERDAF. The two S&T Councils have high-quality technical staff with long and extensive experience in policy-making, planning and budgeting, and R&D management. The PCARRD and PCAMRD Governing Councils are each supported by a Technical Advisory Committee (TAC) and a Secretariat located in Los Banos, Laguna.

There is a need to rationalize CERDAF and the two DOST S&T Councils to reduce duplicating structures and functions, and its cost implications. A strategy to unify DOST’s S&T councils is under discussion, as part of the ongoing government reorganization. Such discussion should include DA, DENR, and other key stakeholders. Integration into a single RDE council would improve the efficiency, effectiveness, and sustainability of this model in policy-making and management, especially with the current funding constraints. Integration and downsizing the staff would produce a lean and high quality technical staff that could reduce the current high transaction cost of R&D in the Philippines. Changing its legal status from the current public Council following a semi-autonomous or
The autonomous Council model would reduce the political pressure and improve its effectiveness and efficiency as a policy-making body and in setting the future directions for RDE in the country.

c. DA’s Agriculture and Fisheries R&D System. The biggest and most complex R&D System is that of DA. It continues to suffer from under-funding, low technical and management capacity, and inadequate skill-mix of researchers on the emerging R&D topics such as biotechnology. Their linkages are weak especially to the LGU extension units, client groups (farmers, fishers, small entrepreneurs, etc.) and rural producer organizations (RPOs), and other key stakeholders (the private sector, non-government organizations or NGOs, civil society organizations or CBOs, etc.).

The Bureau of Agricultural Research (BAR) coordinates and funds DA R&D agencies consisting of five bureaus, seven attached agencies, and 14 regional RDE centers (RIACs). It also provides funding, through a competitive grants program, to 30 national R&D networks (21 commodity-oriented and nine discipline-oriented), and 30 R&D networks at the regional level (BAR 2003). Since AFMA implementation, BAR had spent about P170 million for networking and coordination, a very high transaction cost. Such amount, if used to carry out research, would have generated technologies to benefit farmers and fishers. In 2004, the coordination networking fund of P50 million was reviewed by BAR and reduced by 50%.

The DA Bureaus with R&D functions are the: (1) Bureau of Animal Industry (BAI), BPI, (2) Bureau of Fisheries and Aquatic Resources (BFAR), (3) Bureau of Plant Industry (BPI), (4) Bureau of Post-harvest Research and Development (BPHRD), and (5) Bureau of Soils and Water Management (BSWM). The DA Attached Agencies include: (1) Cotton Development Authority (CODA), (2) Fiber Development Authority (FIDA), (3) Philippine Carabao Center (PCC), (4) Philippine Coconut Authority (PCA), (5) Philippine Rice Research Institute (PhilRice), (6) National Dairy Authority, (7) Philippine Fisheries Development Authority, and (8) Sugar Resources Authority (SRA). The bureaus report to an Undersecretary responsible for R&D while the attached agencies have their own Boards. Regional RIARCs report to their Regional Executive Directors (RED). Considerable duplication of functions and different reporting responsibilities result to inefficiencies and poor accountability within the system.

d. DOST’s S&T Councils and Networks. There are two DOST S&T Councils that fund and coordinate R&D activities in the country: (1) the Philippine Council for Agriculture, Forestry and Natural Resources Research (PCARRD), and (2) the Philippine Council for Marine and Aquatic Research and Development (PCAMRD). These Councils manage, coordinate, and fund agricultural and aquatic resources R&D. R&D projects are implemented by 132 member-agencies of the National Agricultural and Resources Research and Development Network (NARRDN) under PCARRD (PCARRD 2003), many agencies also participate in the DA RDE networks. In aquatic resources, R&D activities are implemented by PCAMRD’s National Aquatic Resources Research and Development (NARRDS), with 101 member-agencies (PCAMRD 2003). PCARRD had decentralized management and coordination of R&D to 14 Regional R&D Consortia, most members of which also participate in the DA regional RDE networks. The DOST-coordinated R&D system makes the overall RDE system even more complicated, and increases duplication of functions.

e. RDE in State Colleges and Universities (SCUs). The Commission on Higher Education coordinates and partly funds R&D activities in SCUs. These university-based research programs play a major role in the implementation of agricultural R&D in the Philippines. There are 112 SCUs that carry out R&D projects with funding from their own direct allocation (through CHED), through the competitive grants scheme of DA, and the grants-in-aid scheme of PCARRD and PCAMRD. The SCUs are members of the DA commodity and thematic networks as well as PCARRD’s agriculture
and natural resource network (NAARDN), and PCAMRD’s fisheries network. Their network membership is a mechanism to provide leadership to the R&D/S&T community and to access funding for R&D implementation.

CHED has identified 21 Centers of Excellence (COEs) and 2 Centers of Development (CODs) in agriculture with key R&D functions (CHED 2001). In its Long-Term Higher Education Development Plan for 2001-2010, these 23 SCU-COE/CODs were identified for assistance from CHED to be developed into world-class centers for instruction, research, and extension. Priority should be given by the government to these identified SCU-COE/CODs for implementation and fund assistance in RDE.

2. The National AFNR Extension System

a. DA-ATI as Apex Agency. The current organization of the Agricultural and Fisheries Extension System is shown in Annex Figure 3. The structure shows disjointed and autonomous agencies at various levels. At the national level, ATI, that was established in 1987, was recognized as the apex agency for extension and training in DA (through AFMA) and as the strategic link of research and extension. However, its function remains mainly training extension staff. ATI had been managing 4 National Training Centers, 16 Regional Training Centers and 17 Provincial Training Centers but with the reorganization of ATI in 2004 to redefine its functions, these training centers had been reduced to 16 Regional Training Centers by integrating centers in a region. This serves to consolidate its operation at the regional level to achieve regional unity and synergy.

ATI has a total of 804 personnel located at its headquarters, in regional/provincial training centers, and in an International Training Center for Pig Husbandry (ATI 2003). The ATI has just completed its Strategic Action Plan for 2004-2008 to strengthen its function to support LGUs and DA agencies to train extension staff, provide information and communication support, and extension guidance.

Without realignment and expansion of its mandate as an apex extension agency (as provided for in AFMA), to include policy, monitoring and evaluation, training, and overall extension guidance, ATI’s impact would remain limited. Under the World Bank-assisted Diversified Farm Income and Market Development Project, there will be a shift in the role and function of ATI from training provider to strategic planning, coordination, funding, and information dissemination. There will be an overall reorientation of extension training using market-oriented approaches to bring producers and traders together.

b. Extension in other DA Units. DA has five bureaus and seven attached agencies with extension or advisory functions. These DA bureaus and attached agencies have implementing units at regional, provincial, or municipal levels. In 1991, most bureaus have their extension function and personnel devolved to the LGUs. For example, currently, the Bureau of Animal Industry provides limited advice and information to livestock and poultry farmers and processors. Their devolved staff became the Provincial, Municipal, or City Veterinary Officers. The BAI technical staff has limited linkage with these LGU veterinary officers.

Unlike the other DA bureaus, the extension mandate of the Bureau of Fisheries and Aquatic Resources (BFAR), was boosted by the AFMA. In 2000, it maintained 1,134 extension personnel with a budget of P200 million. This change through AFMA provided focus on the needs of fishers and the fishery-related industry.

DA’s eight commodity-specific attached agencies also have extension activities in addition to their development functions. Their extension staff works directly with farmer-cooperators or in partnership
with LGUs to provide commodity specific technical advice and extension advice. Two DA attached research centers (PhilRice for rice and PCC for carabao development) have been more successful in carrying out RDE activities, compared to the bureaus or other attached agencies. They are internationally certified as centers of excellence for R&D.

c. The Devolved LGU Extension System

Both the Local Government Code (Republic Act 7160) and AFMA (Republic Act 8435) put the responsibility of providing direct extension support to farmers, fishers, women and youth, and other clients to the devolved LGUs. The personnel and funding of the then Bureau of Agricultural Extension (BAEx) were transferred to the LGUs and BAEx was abolished. It was replaced by the DA Agricultural Training Institute that was created in 1987, but ATI has no extension function.

**Agriculture and Fishery Extension Offices in LGUs.** The largest portion of the current extension force is in LGUs in 79 provinces, 115 cities, and 1,495 municipalities. There are an estimated 25,117 extension workers in the LGUs in 2000. The organization and management of the devolved extension system is not hierarchical. Extension offices at provincial and municipal/city levels are all autonomous, hence, are not linked to each other vertically or horizontally. The devolution resulted to a very large fragmented and uncoordinated system of offices, with weak linkages to ATI at the national level or other extension providers at all levels.

The provincial extension office is headed by a Provincial Agricultural Officer (PAO). The municipal/city extension office is headed by a Municipal/City Agricultural Officer (MAO/CAO), and with about 10 staff working on agricultural extension, home economics, and rural youth workers. The municipal/city extension units are too small and do not meet economic scale to ensure an efficient, effective, and sustainable extension service. Each of the 1,609 municipal and city LGUs have only about 10 staff, hence, it is too small as an operational unit for extension. The provincial LGU, with about 300 staff, is a more viable operational unit for the devolved agricultural extension (Contado 2004). Currently, these two groups have their own separate extension programs working with farmers. The PLGU could coordinate all the MLGUs in a province to facilitate extension planning, monitoring and evaluation of extension activities, communication support, and provide overall extension guidance.

d. Extension in other Government Departments

Three other government departments have extension implementation function. The Department of Agrarian Reform (DAR) that implements the Comprehensive Agrarian Reform Program (CARP) of the government. DAR has its own 1,700 development facilitators (staff with extension function) who provide technical advice and practical farming guidance to farmer-beneficiaries in agrarian reform communities. This extension force is in addition to the LGU extension workers in the same localities.

The Commission on Higher Education (CHED) coordinates the activities of the SCUs. All agriculture SCUs has three functions: education, research, and extension. There are 30 SCUs with agricultural extension function. Each SCU has an Agricultural Extension Department or Center to carry out this function, in partnership with DA units or with LGUs. They are also the key partners of ATI in the training of LGU extension workers. The clients of SCU extension are not limited to farmers.

The Department of Environment and Natural Resources (DENR), through its Forest Management Bureau (FMB), promotes community-based forest management practices to rural communities. FMB has five technical divisions and regional offices. The DENR also has the Environment Research and Development Bureau (ERDB) that is responsible for technology development.
PCARRD and its 14 regional consortia have active linkages to farmers in partnership with LGUs, NGOs, cooperatives, and DA agencies, to provide science-based information and technologies to farmers and fishers. The Techno Gabay Program (TGP), PCARRD’s banner program for technology promotion and utilization, works through various delivery modalities. One such model is the 159 Farmers’ Information and Technology Services (FITS) Centers located in 9 host agencies (LGUs – provincial, municipal, barangay; SCUs; NGOs; DA, DOST, DENR, DAR) in 14 regions (PCARRD 2004). The Regional Consortia receive funds from PCARRD to monitor the FITS and provide them with technical and information advice. The FITS was cited in the AFMA and MTPDP 2004-2010 as an extension model to be scaled up to reach more farmers and fishers.

3. Coordination of the Extension System

Unlike R&D that is coordinated by BAR, PCARRD, and PCAMRD, there is no formal structure or mechanism for coordinating the disparate components of the agricultural and fishery extension system at all levels. The result is an imbalance, an overly coordinated agricultural R&D system and an uncoordinated agricultural extension system. This imbalance may be one of the causes of the slow adoption of new technologies by farmers and fishers, in spite of the reported large number of “mature” technologies generated by the R&D system. A proposed long-term reorganization of the RDE system to also improve extension service delivery is shown in Annex Figure 4.

A recent assessment of the LGU extension services indicated organizational weaknesses resulting to inefficiencies, ineffectiveness, and very weak linkages to R&D institutions, the private sector, and other extension providers (Contado 2004). These constraints are multiplied by very serious under funding for extension activities, low priority of extension given by LGU management, and low capacity of the large cadre of extension workers.

References


Annex Figure 3. Philippine Public Research, Development, and Extension System in Agriculture, Fisheries, and Natural Resources, 2004

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Annex Figure 4. Proposed Unified Philippine Research for Development System in Agriculture, Fisheries, and Natural Resources.

Sources: PCARRD, PCAMRD, BAR and ATI. 2004. Inter-Agency Committee Reports on RDE Convergence Initiatives. Quezon City, Philippines.

In Section 81 of Republic Act 8435 (AFMA), DA in coordination with DOST and other appropriate agencies and research institutions, shall enhance, support, and consolidate the National Research and Development System in Agriculture and Fisheries (NaRDSAF) and ensure linkages with the National Extension System in Agriculture and Fisheries (NESAF). In 2002 and 2003, DA and DOST have identified convergence initiatives to: (1) bridge the gap between R&D and extension delivery services (Figure 1); (2) maximize impact of R&D on farmers, fishers, and entrepreneurs; and (3) rationalize the use of resources. An MOU was signed by PCARRD, PCAMRD, BAR, and ATI on October 3, 2003 to pursue these convergence initiatives to implementation. The RDE convergence areas identified are: (1) Unified RDE Agenda; (2) Unified RDE Network; (3) Unified Program Planning, Monitoring, and Evaluation (PPME); (4) Unified Technology Delivery; (5) Unified Information and Communication Technology; and (6) Unified Human Resource and Infrastructure Development.

Implementing rules and guidelines were approved on October 1, 2004 for the Unified Technology Delivery Program, Unified PPME, and Unified RDE Network for Agriculture. Only the Joint Circular for the Unified Technology Delivery Program has been signed by the four agencies on December 2004. Implementing rules and guidelines on the other convergence areas are yet to be presented to the National Convergence Steering Committee (NCSC) (include in acronyms) for deliberation and approval.

The DA-DOST convergence MOU states that in the very near future, critical institutions, such as BFAR and DA’s National Fisheries Research and Development Institute (NaFRDI), DENR-ERDB, and DAR’s Bureau of Agrarian Reform Beneficiaries and Development (BARBEDE), will be enjoined to participate in this convergence initiative in recognition to the important roles of the fisheries and natural resources sectors, as well as the agrarian reform communities in rural development.

Summary of the Six DA-DOST Convergence Initiatives

1. Unified RDE Agenda. There was a consensus to adopt the unified RDE agenda for the eight priority commodities, which include: rice, corn, abaca, coconut, sugarcane, coffee, swine and poultry, and ruminants. Recommendations for the unified agenda for six additional commodities plus soil and water, agricultural machineries system, and postharvest are being prepared.

2. Unified RDE Network. It was agreed to: (1) establish 14 NCRDE networks with the inclusion of four other systems (agricultural machinery systems, soil and water resources, postharvest, and agroforestry), two are under study (fiber crops and fruit crops); (2) designate 14 NCRDE centers based the mandates and staff capacity of existing R&D institutions; (3) form a national commodity team for each of the 14 commodities with team leaders coming from the NCRDEC; (4) formulate the terms of reference of the NCRDEC; (5) integrate PCARRD’s NARRDN and DA-BAR’s network of agencies into a National RDE Network, composed of BAR, ATI, PCARRD, DA attached agencies, SCUs, and the private sector; (6) establish a unified regional RDE network called Regional RDE Convergence Network (RRDECN); the members will decide the base agency following the BAR, PCARRD and ATI guidelines; and regional agencies that did not conduct R&D activities in 2000 to 2004 will be dropped.
3. **Unified Program Planning, Monitoring, and Evaluation.** PCARRD, PCAMRD, BAR and ATI agreed to: (1) prepare the framework/guidelines for unified program planning that shall be implemented for all RDE convergence areas and; (2) develop an M&E mechanism for extension activities to include: (a) on-line submission of project proposals; (b) shortened processing for review and approval of proposals from the current two years to one year; (c) unified/standardized project formats and reporting systems; (d) expanded coverage of the allowable project expenditures to allow greater financial independence of researchers; and (e) tracking proposed projects status.

4. **Unified Technology Delivery.** The four agencies agreed to finalize the guidelines/framework for the Unified Technology Delivery Program, which involves the promotion and dissemination of the different technology delivery modalities that BAR, ATI, PCARRD, and PCAMRD shall bring in into the convergence program at the regional and local levels. The locus of convergence is the LGU at the provincial and municipal levels with the establishment of a core center of convergence called Unified Information and Technology Service Center.

5. **Unified Information and Communications Technology.** It was agreed to establish a central knowledge bank which: (1) is web-based/on-line; (2) uses open-source system; (3) utilizes a standard application system (i.e., common data structure; common data elements to be generated; central server at BAR, mirror sites at PCARRD, PCAMRD, ATI; dynamic, reliable, timely and up-to-date, info service); and (3) includes the following databases/services: on-line submission of proposals, R&D monitoring, technologies, FITS, micro-medium small enterprises, human resources, equipment/infra, SCINET Integrated Library Management System. The system was generally acceptable but needs to be enhanced through the inclusion of regional data bases, addressing interconnectivity of some FITS center, and conducting pilot testing of KB portal model.

6. **Unified Institutional and Facilities Development.** The four agencies agreed to: (1) create a national ID-RDE inter-agency committee for granting scholarships, funding, upgrading of soil laboratories, accreditation criteria for SCUs, awards system, among others; (2) unify guidelines for human resource development (HRD) and facilities development; (3) unify criteria for accreditation of SCUs offering degree program in agriculture and fisheries; (4) unify the M&E system; (5) unify policy guidelines for the awards systems; and (6) unify the ID-RDE plan for 2004 to 2010.

**Source:** World Bank. 2004. *Investments in Agricultural Science and Technology.* In: *Agriculture Investment Sourcebook.* The World Bank, Washington D.C., USA. (Agriculture Investment Note was prepared by Derek Byerlee and Gary Alex.)

Public agricultural research systems provide a basis for innovation and increased productivity necessary for a sustainable and competitive agricultural sector. National agricultural research systems are becoming increasingly pluralistic, with increasing role for the private sector, new mechanisms for research funding, and more global scientific linkages. Despite these changes, public research organizations continue to have a central role in basic and long-term research, to provide public goods products, and to support overall development of the research system. However, many public research organizations need to resolve problems of low productivity and relevance if they are to effectively carry out these roles.

Most research organizations were established in the 1950s and 1960s as research departments under ministries of agriculture. These organizations grew over time with strong donor support, but soon ran into problems due to lack of compatibility between civil service rules and the requirements for efficient research execution. By the 1980s, these problems led many such organizations to seek greater autonomy and sufficient flexibility to efficiently manage financial, physical, and human resources for agricultural research. Autonomy was expected to allow the research institute to get rid of excess staff, and improve management systems and personnel policies. Three major types of national research organizations (NAROs) evolved:

1. **Semiautonomous organizations** have legal status different from the regular civil service but lack a legal corporate identity. Such organizations provide some flexibility in financial and personnel management, but often continue to follow civil service rules. Their power to set their own business rules is often ambiguous, and they lack adequate flexibility to carry out modern scientific research. Most NAROs fall into this category.

2. **Publicly-owned corporations** have a mixed, public-private governing body that, in principle, has the power to set the rules for financial, personnel, and asset management. However, since such organizations remain in the public sector, their flexibility is often constrained by political factors and public funding continues to dominate. Research organizations in Colombia, Uruguay, and Brazil are in this category. In the Philippines, the research centers of the Department of Agriculture’s Attached Agencies (government corporations) are of this type. Examples are research centers of the Philippine Coconut Authority, Philippine Cotton Corporation, Philippine Fiber Development Authority, etc.

3. **Private or non-government research corporations** are fully private entities that operate for-profit or not-for-profit. These organizations have full powers and more independent from political processes, though they might still receive considerable financial support from the government. The Crown Research Institutes in New Zealand, ANAPO in Bolivia (private for profit) and some research foundations such as FUNDAGRO in Ecuador (private not-for-profit) are examples. In the Philippines, the Twin Rivers Research Center (for banana research) is an example.

In practice, newly created autonomous and semi-autonomous research organizations have generally found themselves still reliant on public funding, and substantially under the control of the ministry of agriculture. Autonomy has not resolved all problems, but it has generally proven preferable to
managing research programs within the government bureaucracy (Box 1). Whatever their legal base (public or private), national or sub-national organizations will likely continue to form the backbone of the national research systems, and will continue to rely on public funding (Eicher 1999). Long-term development of these organizations must be planned in the context of the overall national research system, and with a view to the roles that the research organization will play in that larger system.

Box 1. Uruguay: Effective reform

During the 1980s, it became apparent that the Uruguayan Agricultural Research Center under the Ministry of Agriculture was constrained by civil service regulations and poor linkages to farmers. In 1989, the National Agricultural Research Institute was created as a publicly owned legal entity, but with full powers to set its own business rules along private sector lines. The institute is governed by a Board of Directors, with two members from government and two from farmer organizations. Farmers contribute about 40% of its budget through a levy (0.4%) on sale of agricultural products. Government is obliged by law to provide a matching contribution.

Total research funding has increased and the institute has developed a good reputation for its research work. One key success was strong links to clients through decentralized research stations with regional advisory councils of farmers. Commodity working groups, roundtable consultations, and a technology diffusion unit further strengthen relations with clients.

Source: Allegri 2002

Benefits

Major reasons for creating legally independent NAROs include administrative flexibility and increased stakeholder participation.

Administrative flexibility enables NAROs to obtain competent management, maintain a creative environment, and have dependable operating budgets. Good research depends on respected leaders and highly qualified scientists motivated to perform. This requires a flexible recruitment and promotion system, the ability to reward outstanding performance, and dismiss unproductive scientists, and a collegial, non-hierarchical, and non-bureaucratic institutional environment.

Increase political status of an autonomous organization can give the director the same political status as the most senior government official in the sector and can increase the influence of the research organization in national policy debates, and can be an asset in negotiating agreements with local or international organizations.

Increasing stakeholder involvement includes farmers and their associations, the broader scientific community, and other branches of the government in the governance and financing of the research organization (Box 2). This helps focus research on the most critical problems facing agriculture, informs users of new technologies being developed, and diversifies the base of funding for research. Participation by the broader scientific community, especially by universities, facilitates research collaboration and enhances scientific rigor in evaluating research program.
Policy and Implementation Issues

Decentralization reforms are being pursued in many countries with a view to improving public services. For research systems, especially in larger countries, these can serve to provide administrative flexibility, facilitate close links to clients, and allow for better on problems of a particular province or agro-ecological zone. Both decentralization and deconcentration can realize some of these outcomes, but may sacrifice economies of scale and scope, and loss the critical mass of scientists and facilities that is often necessary for productive research. Still, decentralizing adaptive research is important in almost all cases as a means of improving responsiveness to client needs.

Box 2. Cote d'Ivorie: Private National Agricultural Research Center

By the early 1990s, poor human and financial management, weak staff accountability, and lack of farmer input to program content caused inefficiency within the Cote d'Ivorie public research institute. Agricultural research came under strong pressure to provide technical support to producer organizations (Pos) and extension staff. As a result, the National Agricultural Research Center was established as a private company with minority financial participation by the state. Board members are elected by the general assembly, which has a majority of users. After an external selection process, researchers were appointed and given three years to choose between remaining as civil servants with the Ministry of Sciences or becoming Center staff with private status. The researchers agreed to take Center employee status, provided their retirement and health insurance rights were guaranteed.

The Center’s structural reforms and decentralization facilitate relationships with the private sector; new salary and incentive system is enjoyed by researchers; and POS, that have strong representation on the board, support the new structure. Following four years of discussion, POS, the Center, the extension agency, the Ministry of Agriculture, and donors are setting up a National Decentralized Inter-professional Fund for Agricultural Services Financing, which will finance research, extension, training, and PO development. The fund will be managed by users, with funding from levies on major crops to ensure financial sustainability for core agricultural services. The government and donors may provide additional funding.


Salary scales for scientists are a recurring problem in public research organizations. Although good scientists generally compete on international or regional markets, many NAROs maintain civil service salary scales for scientists that are inadequate. While this is indefensible, there is no easy solution without broader civil service reform, as senior civil servants generally resist increasing salaries for scientists above those of other government officials. Ongoing reforms in China are using a rigorous review process to identify about one-third of the scientists who are internationally competitive and who will be put on a special pay status that will quadruple their salaries; other scientists will be assigned to privatized research organizations or retired. Other incentive options include: providing opportunities for consulting or contract research, liberal training and sabbatical policies, and arrangements to commercialize research innovations.

Lessons Learned

Key reforms. To be truly independent, NAROs must have an independent governing body to prevent undue political interference. A governing body representative of major stakeholders, selected on the basis of professional merit, should have freedom to select the chief executive officer based on merit and
to establish policies for open, transparent, merit-based recruitment and promotion, performance-based evaluation and reward systems. The chair of the governing body should generally be a highly respected individual from outside the government.

**Separation of funding and execution.** Increasingly, the bodies that fund research can separate from those that perform research. Competitive and contractual funding mechanisms favor organizations that can deliver high quality, relevant research. They need to compete for grants, and the signing of results-oriented contracts often improves performance.

**Operating rules.** In creating or reforming an autonomous research body, considerable time and resources are required to develop appropriate rules and policies. A governing body and a chief executive officer with requisite skills and experience from outside the public sector facilitate this process. Those with only public sector experience are likely to copy government business rules and policies, defeating major objectives of autonomy. Particular attention should be paid to developing human resource management and incentive systems.

**Recommendations for Practitioners**

Past experience provides a number of good practices for the successful NARO reform and related investments.

- A thorough analysis of current performance is required to lay the foundation for clear mission and vision statements that establish a clear role for the organization, define public sector roles, and link the organization to funding sources, technology transfer agencies, and national policy organizations.
- Planning should be fully participatory through workshops and consultations that include a full cross section of farmer categories.
- Identifying a leader, or a “change manager”, is important as independent research organizations with poor leadership often fail.
- An effective governing body that is highly professional, representative of key stakeholders, and independent is critical. Terms of reference for the governing body should clearly define its role in formulating policies and priorities for the organization, but avoid interference in its day-to-day management.
- Institutional and legal reform should be accompanied by strategies to diversify funding usually through: participation in competitive grants schemes, commercialization of research products, tapping of private funding through production levies, contracts with the private sector, and joint ventures.
- The price of flexibility is greater accountability for results. Funding agencies must establish realistic, clearly understood performance measures of evaluating performance. The staff of funding agencies needs training in this area.

**References**


A first key challenge in ensuring better returns from the increased investment in agricultural R&D is that the investment is efficiently allocated across commodities. A popular approach to examining the commodity allocation of R&D resources is the congruence model. The congruence ratio or the research intensity ratio for a commodity is the amount of R&D spending for that commodity. The implicit assumption of the congruence model is that the proportion of R&D spending to the value of production in one commodity is equal to that of any other commodity.

David et al. (1999) estimated the research intensity ratios by commodity for 1994-1996 using data on government research expenditures only. The findings show an extremely wide dispersion of the research intensity ratios, ranging from nearly 0% for corn to about 25% for cotton. The findings also indicated that the research prioritization was biased towards minor crops over major crops.

The congruence model is acknowledged to have a number of limitations. Hence, the congruence model could be used largely as the initial step in the actual process of refining further the allocation of R&D spending by commodity. To some extent, the initial congruence ratios raise questions that help refine the process. The refinement needs to be based on explicit rationale, such as judgments about differences in technology opportunities, the extend to which the private sector can support R&D in particular commodity, objectives other than economic efficiency such as poverty alleviation (Fulgie et al. 1996). Priority setting should account the timing of research benefits and costs, discount rates, probable adoption rates, technological opportunities, and market characteristics of different commodities.

Table 7 indicates the usefulness of the congruence model as a framework for the initial analysis of the allocation of agricultural R&D among commodities. The data suggest that the allocation of agricultural R&D in the Philippine in the mid-1990s was not optimal (David et al. 1999). The deviations from the congruence model do not appear to come from clear-cut rationale such as poverty alleviation, technological possibilities, or significant export potential. For example, in terms of poverty alleviation, R&D investments that increase the yield of white corn will benefit many of the poorest farmers in the country. However, there was almost no funding for corn research. Similarly, it could be argued that the amount spent for coconut and sugar is not sufficient given the strong competition (and for sugar, subsidies) from other countries. The research intensity ratio of 25% for cotton is clearly misallocated because the country has a huge comparative disadvantage vs-à-vis other countries owing to agronomic conditions and factor costs (i.e., Pakistan and Egypt).

Framework for Efficient Allocation of R&D Investment

In principle, the condition for the efficient allocation of R&D resources is that the additional million pesos of R&D spending in each commodity will give the same social benefits. Fulgie et al. (1996) lists three questions that R&D prioritization process must address to attain efficient allocation of R&D investment:
(1) What are the possibilities of advancing knowledge or technology if resources are allocated to a particular commodity, problem, or discipline?

(2) What will be the value to society of the new knowledge or the new technology if the research effort is successful?

(3) Of the research needed to sustain productivity growth and meet other goals, what research will not be undertaken by the private sector?

Based on these questions, it is clear that in order to measure the allocative efficiency of agricultural R&D, there is a need to have expert opinion and analysis of technological possibilities and the potential economic and social impacts of the new technologies (Fulgie et al. 1996).

The first question highlights the fact that R&D is an inherently risky activity because the outcome from R&D spending is uncertain. This is especially the case for developed countries (i.e., U.S.) where R&D spending focuses on extending the knowledge frontier or developing new technologies. Scientists on the leading edge of research are the persons who can provide expert opinion on the technological possibilities. In the Philippines, much of the R&D spending is likely to be more adaptive research. In principle, it may be easier for the scientists to assign probabilities of success for adaptive research than cutting edge research.

The second and third questions involve explicitly resource allocation issues. In theory, for a small open economy, the most efficient allocation of R&D investment is based on the principle of comparative advantage, assuming that the probability of technological success is the same across commodities. This means it is best to allocate agricultural R&D to those industries or commodities that the country already exports or the country is close to having comparative advantage. (A country has comparative advantage in a crop if it can produce the crop more cost efficiently relative to other crops in the country and relative to other countries.) This is because the country can expect to export more of the commodity where it has comparative advantage and, in exchange, import commodities where the country cannot produce comparatively cost efficiently. In so doing, the country will benefit more from the investments in agricultural R&D. This is especially so where the export crop constitutes a large share of total agricultural production, because of the additional multiplier effects to the rest of the economy. Similarly, in the case where the country lost comparative advantage primarily from technological backwardness (due to lack of R&D investments) in the face of rising domestic demand, then R&D investments that reduce the technological gap and increase productivity in the industry would have significant benefit to the country’s producers and consumers.

For basic food commodities, like rice and white corn, food security tends to be more politically compelling than resource efficiency. In this case, the concern for resource efficiency as embodied in the principle of comparative advantage may need to be tempered to some extent by the concern for food security. This is especially true in the case for crops like rice where the world’s major producing and consuming countries are all located in Asia, and therefore, are vulnerable to the same agro-climatic shocks such as the El Nino or La Nina phenomenon. As a result, international prices of rice can be expected to be more volatile than other major grains. In the case of food security considerations, import substitution through higher yields from increased agricultural R&D investments is preferable to import substitution through increased tariff and non-tariff protection of domestic producers against imports.

Nonetheless, it must be pointed out that there exists the trade off between efficiency and the pursuit of self-sufficiency for food security. Where at the margin the social costs of ensuring self-
sufficiency is so much higher than the import price of the commodity, it is best not to aim for total self-sufficiency and import at the margin. Thus, Malaysia does not target 100% production self-sufficiency in rice; it sources the rest of its consumption requirements of rice from imports. Clearly, in this case, the policy challenge is in the management of the appropriate level of buffer stock in order to ensure relative stability of the domestic price.

In view of the above, in the allocation of agricultural R&D investments across commodities, a small open economy is most likely to get the highest returns on R&D investments if it is spent more on:

1. Commodities where the country has comparative advantage or close to having comparative advantage, and
2. commodities where there is large domestic consumption.

This is because an increase in yield and reduction in the unit cost of production in such commodities arising from R&D investment will have the greatest impact on domestic production, exports, and import substitution.

**Commodity Ranking for R&D Investments**

The commodity prioritization of R&D investments based on the criteria of comparative advantage and the importance of consumption and food security can be as follows:

**Group A: Top most priority. Export-oriented or potentially exportable commodities with a large share of domestic production.** These are the commodities where the country has revealed comparative advantage and where the linkages with the rest of the economy are substantial. Thus, improvement in farm production and processing efficiencies has significant positive effects on the whole economy at the same time that the country’s international competitiveness is enhanced. These are also the commodities where the potentials for joint private sector and government financing of agricultural R&D through industry-wide research cess or firm-specific research investments are greatest. *The commodities in this group include coconut, tropical fruits, fishery, and sugar.*

**Group B: Basic food grains for food security reasons.** This group comprises rice and white corn. Productivity gains through R&D in rice give large welfare benefits especially to consumers through lower prices in real terms. Similarly, improvement in yield of white corn benefits the poor rural households in the Visayas and Mindanao who rely on white corn for their food grain. In addition, the reduction in the price of rice in real terms tempers the demand of workers for wage increases considering that rice accounts for a large share of the workers’ budget. Basic food grains provide much of the calorie requirements of workers; moreover, calories account for the preponderant share of the poverty threshold income. Thus, improvement in the yield of the basic food grains has positive effect on the status of poverty in the country.

**Group C: Import substituting commodities with large share of domestic consumption (and production).** Productivity improvement, through R&D, in this sub-group gives large welfare benefits especially to consumers through lower prices (in real terms) and to less extent producers. In turn, the reduction in prices in real terms tempers the demand of workers for wage increases, considering that these commodities are important items in the workers’ food budget. The country’s non-agricultural sector, especially the labor-intensive manufacturing industries would benefit from the tempering of wage increases. Thus productivity improvement in these
commodities has significant effects on the country’s farmers, consumers, and non-agricultural producers. In addition to sugar, the commodities in this group are yellow corn, poultry and livestock, and root crops. The group could be described almost as the feed-livestock/poultry cluster. Domestic demand for meat is growing fast in the country, which provides the impulse for growing demand for yellow corn for feeds. Cassava and sweet potato are also major alternative feed ingredients.

**Group D: Less dominant commodities with significant potentials for export niches and import substitution possibilities.** There are significant returns to R&D in these crops, although the magnitude of social impact would be less because they are not dominant in the country’s production or consumption. Nonetheless, the welfare benefits could be substantial in the areas where the crops are well suited. These commodities include traditional export crops like abaca, crops that have promising export niches like ornamentals and vegetables, hitherto export crops that have become net import items like coffee, and emerging import substitution crops like oil palm, and legumes (including soybean for food).

**Group E: Lowest priority to no priority: Commodities where the country has huge comparative disadvantage.** Examples are cotton, soybeans (except for food).

A final caveat to the commodity prioritization above is that the final ranking and relative allocation of R&D resources will change depending on the expected yield changes by commodity arising from the R&D investments. This will allow for a quantifiable comparison of benefits and costs of R&D investments by commodity, and thereby provide a cleared basis for the optimal allocation of additional R&D resources. However, this requires program-by-program and project-by-project benefit-cost evaluation.

**References**


Despite the increase in government expenditures on agricultural research and development (R&D) during the 1990s, the magnitude of investment remains much lower than the comparator countries in the Asian region. For example, the expenditures of government agencies on agricultural R&D in Thailand amounted to Bhat 3.83 billion in 1992 and Baht 4.49 billion in 1993. In contrast, the Philippines, spent only P 0.86 billion in 1993 and P 0.92 billion respectively in these two years. (The bhat and peso have almost the same value vis-à-vis the US dollar at that time.) Since the population of Thailand is lower than the Philippines’, the per capita agricultural R&D expenditures in Thailand were about four times higher that that of the Philippines. It is likely that in the late 1990s and early 2000s, it is likely that the gap between the two countries remain substantial in favor of Thailand.

Similarly, Malaysia’s investments in agricultural R&D in the early 1990s were much higher than that of the Philippines. Expenditures of Malaysian government agencies and non-profit institutions amounted to US$ 99.5 million in 1991 and US$ 106.0 million in 1992. These values were about 2.7 times higher than the corresponding amounts for the Philippines. The gap in per capita terms was even higher given that the Malaysian population was only 29% of the Philippines’ at that time.

The Philippines comes up short in agricultural R&D expenditures as compared with its two neighbors, Malaysia and Thailand. The Philippines also comes up short vis-à-vis China, Japan, South Korea, and Taiwan. In short, the Philippines has not invested in agricultural R&D as the other major East Asian countries (except Indonesia).

The Philippines has to substantially increase the level of investments in agricultural R&D as well as extension. But what is the appropriate level of investments in R&D? It is extremely difficult to have hard and fast rules on the appropriate level of R&D. In the end, it is a matter of considered judgment based on the following considerations:

1. The importance of agricultural R&D as compared to other factors in raising agricultural productivity;
2. How far the country should rely on its own research effort vis-à-vis the research efforts if international research centers (i.e., IRRI, CIMMYT) or research institutions in other countries;
3. Past investments in agricultural R&D; and
(4) Ex-ante expectations on the returns from the additional investments in agricultural R&D.

Nonetheless, it is good for the Philippines to substantially increase further its investment in agricultural research, development, and extension (RDE) for the following reasons:

(1) If the country is serious in narrowing the technology and yield gap it faces vis-à-vis some of its neighbors;
(2) Given the critical role that RDE plays in the effective restructuring of the country’s agricultural industries so they will meet more effectively the increased competition from imports and/or competitor exports.
(3) Given the high returns to previous investments in agricultural R&D.

David et al. (1999) showed that the average agricultural research intensity ratio (RIR) among developing countries was about 1.0% of the gross agricultural value added (AgGVA). The agricultural RIRs of Thailand and Malaysia were already 1.4% and 1.1%, respectively during the mid-1990s. In comparison, the agricultural RIR of the Philippines is 0.4% during this period. The average RIR tends to increase as the level of development rises. Developed countries have agricultural RIRs of more than 2.0%.

In view of these considerations, it is best for the Philippines to raise its current agricultural research intensity ratio of about 0.4% to at least 0.75% by 2010 and about 1.5% by 2020.

Table 1 presents two alternative target agricultural R&D expenditures for the period 2004-2020. The “Low” target assumes a real growth of agriculture (including fishery but excluding forestry) gross domestic product (GDP) of 2.5% per year during 2004-2010 and 2.7% per annum during 2011-2020. The agricultural research intensity ratio is assumed to reach 0.75% and 1.0% of the agricultural GDP by 2010 and 2020, respectively.

The “High” target assumes a real growth rate of agricultural GDP of 3.0% per annum during 2004-2010 and 3.5% per annum during 2011-2020. The agricultural research intensity ratio is targeted to rise to 0.75% in 2010 and 1.5% in 2020. Note that in both scenarios, the year 2004 is assumed to be largely a recovery year for R&D expenditures in view of the substantial drop in agricultural R&D budget in 2003 due to a very tight national government budgetary constraint.

Table 1. Targeted Agricultural R&D Expenditure, 2004-2020
(in Billion Pesos at Constant 2002 Prices).

<table>
<thead>
<tr>
<th>YEAR</th>
<th>A (LOW SCENARIO)</th>
<th>B (HIGH SCENARIO)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>2.48</td>
<td>2.50</td>
</tr>
<tr>
<td>2005</td>
<td>2.86</td>
<td>3.22</td>
</tr>
<tr>
<td>2006</td>
<td>3.26</td>
<td>3.90</td>
</tr>
<tr>
<td>2007</td>
<td>3.67</td>
<td>4.79</td>
</tr>
<tr>
<td>2008</td>
<td>4.10</td>
<td>5.63</td>
</tr>
<tr>
<td>2009</td>
<td>4.91</td>
<td>6.53</td>
</tr>
<tr>
<td>2010</td>
<td>5.39</td>
<td>7.47</td>
</tr>
<tr>
<td>2011</td>
<td>5.54</td>
<td>8.12</td>
</tr>
<tr>
<td>2012</td>
<td>6.06</td>
<td>8.81</td>
</tr>
<tr>
<td>2013</td>
<td>6.23</td>
<td>9.53</td>
</tr>
<tr>
<td>2014</td>
<td>6.80</td>
<td>10.29</td>
</tr>
<tr>
<td>2015</td>
<td>6.98</td>
<td>11.09</td>
</tr>
<tr>
<td>2016</td>
<td>7.59</td>
<td>11.94</td>
</tr>
<tr>
<td>Year</td>
<td>Real Growth Rate</td>
<td>Nominal Growth Rate</td>
</tr>
<tr>
<td>--------</td>
<td>------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>2017</td>
<td>7.79</td>
<td>12.83</td>
</tr>
<tr>
<td>2018</td>
<td>8.45</td>
<td>13.78</td>
</tr>
<tr>
<td>2019</td>
<td>8.68</td>
<td>14.77</td>
</tr>
<tr>
<td>2020</td>
<td>9.38</td>
<td>15.81</td>
</tr>
</tbody>
</table>

**Assumptions:**

<table>
<thead>
<tr>
<th>Growth Rate of GVA in Agriculture</th>
<th>Years</th>
<th>Growth Rate of GVA in Agriculture</th>
<th>Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003-2010</td>
<td>2.5</td>
<td>2003-2010</td>
<td>3.0</td>
</tr>
<tr>
<td>2011-2020</td>
<td>2.7</td>
<td>2011-2020</td>
<td>3.5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Research Intensity Ratio</th>
<th>Years</th>
<th>Research Intensity Ratio</th>
<th>Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.75% in 2010</td>
<td>1.0% in 2010</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.0% in 2020</td>
<td>1.5% in 2020</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 1** also shows that the average growth rate in real terms of target agricultural R&D for 2004-2010 is 13.8% per annum under the “Low” scenario and 20.1% per annum under the “High” scenario. The growth rates are projected to decelerate to an average growth rate in real terms of 5.7% per annum under the “Low” scenario and 7.8% per annum under the “High” scenario. The real growth rate during 2004-2010 is higher than the 8-9% real growth rate during the growth period of 1992-1996. The higher annual growth rate for 2004-2010 reflects the “build-up” stage, when capital expenditures and investment in human resources are needed in addition to the operating expenses in order to develop the foundations of a stronger agricultural R&D system. Moreover, in a number of commodities, a critical core of researchers and research facilities need to be developed (i.e., abaca, vegetables, ornamentals, coffee, fruits, legumes) in order for the R&D system to be effective and the social returns from the R&D efforts robust and ensured.

**Reference**


Competitive Research Grants Programs

Competitive research funds are being introduced in many countries for financing agricultural research, to mobilize available research capacity, stimulate scientific creativity, and promote efficiencies in the research system. Competitive research funds can be an effective mechanism for allocating resources for agricultural research and can drive reform of the overall research system. High-quality review, administrative efficiency, and transparent processes are essential to program credibility, but most programs have yet to develop sustainability strategies. Many countries are seeking to reform the national agricultural research systems that have become unproductive due to lack of operating funds, incentives, and flexibility. Competitive research funds are used as financing mechanisms to mobilize available scientists for work on key problems, develop institutional linkages and research capacities across organizations, and to link scientists with users of new technologies.

Competitive Research Grants Programs

In competitive research grants programs (CRGPs) research providers are selected on a competitive basis, using calls for proposals and scientific peer review to allocate funding. CRGPs are often linked to establishment of an agricultural research fund, open to a variety of potential contributors who may wish to finance specific research on technology transfer activities through the fund. CRGPs complement “core” funding or “block” grant funding, which annually allocate funds to specified public research organizations for their core research programs, infrastructure, and human resources.

Benefits

CRGPs are flexible and can be used to accomplish objectives difficult to achieve through block funding. CRGPs can restrict funding to specific research topics (for example, rice); types of research (for example, adaptive on-farm research); projects requiring collaboration between organizations or with farmers; or research within a specific region or discipline (Box 1). Their flexibility makes CRGPs a useful tool in building national agricultural research systems, as they can:

- Mobilize the best available scientists, including those in universities and the private sector, for work on specific high-priority projects.
- Develop a pluralistic research system by providing operating costs to better utilize available human and physical infrastructure from a wide range of institutions.
- Promote research partnerships and collaboration between different organizations, disciplines, or countries.
- Make research more demand-driven by involving clients in setting priorities and financing, executing, and evaluating research.
- Increase total research funding by mobilizing funds from farmers, industry, and other sources.
- Improve research quality and innovation by selecting projects based on rigorous technical review of scientific merit, sound work plan, and expected results.
Box 1. Ecuador: competitive grants

The Program for Modernization of Agricultural Services in Ecuador finances a competitive research grants program (CRGP) that has funded 112 research projects. The program has supported strategic work on innovations to open new export markets through controlling fruit fly (cherimoya, guava, zapote, and other Andean fruits), decreasing production costs for new export products (snails, tree tomatoes, tabacco, mushrooms, and artichokes), and controlling disease and insects in traditional export crops (banana, cacao, and coffee).

The program introduced a new research culture and brought new organizations into the research system. Research projects are being executed by 45 different public and private organizations, with most projects directly linked to potential users of the technologies. The government contracted program management to a private agency to develop procedures and ensure objectivity in program operations. Research project costs averaged US$ 116,000, of which 54% is financed by grants and 46% by executing agencies, mostly through in-kind contributions. By leveraging of co-financing for research projects, the program helped increase national research funding by 92% to approximately 0.54% of agricultural GDP.

Source: World Bank Internal Documents

Policy and Implementation Issues

Success with competitive funding generally requires realistic expectations, clear priorities, efficient and transparent program management, and involvement of stakeholders in setting priorities. It is important to be especially clear about objectives and desired long-term outcomes, and to design CRGPs accordingly.

Base for competition. CRGPs require sufficiently large numbers of potential research providers to ensure a competitive environment and adequate expertise to peer review and monitor activities, a problem in small countries. CRGPSs must also enjoy strong support from research organizations and relevant government ministries. Protection from political interference in resource allocation is crucial to maintaining program credibility.

Limitations. Competitive grants can be an important element of overall research funding, but are inherently unstable and do not provide continuity required for some types of many programs. CRGPs should, therefore, be used to complement core funding that provides infrastructure, human resource development, salaries, and support for long-term research programs requiring continuity (such as crop breeding).

Priority setting. Comparative funding can promote demand-driven research by involving key stakeholders, especially users, in setting priorities, formulating projects, and screening proposals. However, purely demand-driven approaches with individual proposals considered in isolation can lead to a fragmented portfolio of projects that lacks synergies between activities and does not address national priorities. Important technological or market opportunities can be lost because of farmers’ lack of information and preference for short-term results.

Program sustainability. Most programs financing CRGPs envision them as permanent features of the agricultural research system. This requires mechanism to ensure institutional and financial sustainability. The institutional structure for a CRGP must be efficient and transparent if it is to win ongoing support from researchers and clients. An independent, influential, and respected governing board can help defend the program and sustain its institutional vitality.
**Cost and co-financing.** Introducing CRGPs can involve high upfront cost although established funds in industrial countries have held overhead costs to less than 5%. Continuity of program funding is critical, and program design should consider sources for future funding, including:

- Co-financing from the research provider (a grantee) to increase overall funding and demonstrate commitment to projects being financed.
- Phasing in government funding for the CRGP, with donor financing gradually declining as a percentage of total program funding.
- Building the CRGP into existing research funding so that competitive funding is used to complement the core research program.
- Establishing an agricultural research fund to support the CRGP with funding from a variety of sources, including an endowment.
- Creating mechanisms for the private sector (farmers’ organizations, NGOs, and agribusiness) to finance grants in areas of special interest to the financier.

**Lessons Learned**

Programs must maintain operational efficiency, vitality, and transparency throughout implementation with strict standards for accepting and evaluating proposals.

**Proposal preparation.** Competitive grants are being introduced where there is no history of competitive funding, where there are poor incentive systems in research organizations, and where producers especially smallholders are not well organized to express their demands. Proactive support for applicants to develop proposals helps ensure good quality proposals by investing up front in building capacity for on-farm diagnosis, problem definition, socio-economic evaluation, and writing proposals. This may include workshops, field exercises, and establishment of local networks with farmer organizations and extension.

**Governance and management structure.** A sound governance and management structure is critical to efficient operation and integrity of a CRGP (see table below). Pluralistic governance requires an umbrella council, board, or steering committee with strong private and non-government participation. A program secretariat with financial management powers and an appropriate level of technical expertise is necessary for efficient day-to-day program operations.

<table>
<thead>
<tr>
<th>Governing Board</th>
<th>Responsible for overall policy for program; oversees operations; establishes program priorities and policies; represents program with funding agencies.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical Advisory Committee</td>
<td>Responsible for technical oversight of operations; provides technical input to preparation of calls for proposals; advises on peer reviewer selection; monitors technical quality of research projects. This is sometimes a subcommittee of the governing board or is combined with the technical review panel.</td>
</tr>
<tr>
<td>Secretariat</td>
<td>Responsible for management of program and daily operations; provides support for governing and technical bodies; facilitates communications</td>
</tr>
</tbody>
</table>
Technical Review Panel | Responsible for evaluation, scoring, and ranking proposals and making recommendations for funding.
---|---
Source: Authors

**Decentralization.** Research, both basic and strategic, usually requires competition and selection at the national or international level, whereas adaptive research CRGOs might be managed entirely at the state or district level. Decentralized management is especially useful in developing regional capabilities for adaptive research and developing linkages with producers. Decentralized CRGPs often benefit from oversight by a national secretariat.

**Institutional reform and capacity building.** Competitive funding can be an important tool in the reform process, gradually changing the mentality of tradition-bound research organizations. In Eastern Europe and Central Asia, CRGPs have worked around entrenched institutional structures resistant to change, financing critically needed research and demonstrating mechanisms that better link research to clients.

**Phased growth.** Programs should start small and build on experience as scientists and administrators become familiar with program operations and until the program’s reputation and credibility have been established. New programs require learning period as scientists come to understand and accept the proposal-writing process, and as the funding body gains experience with proposal solicitation and review.

**Recommendations for Practitioners**

Care in each step of the program implementation process is essential for efficient and effective CRGP operations and related investments. In all programs, transparency and good communications with the scientific community enhance efficiency and quality of research. Sound programs require:

- **Clear program objectives** that are established from the outset to determine the size, structure, duration, and type of grants to be made whether for bringing new institutions into the research system, building institutional capacity, promoting partnerships, enhancing quality of research, developing linkage to clients, resolving a high priority problem, or increasing the total level of research funding.

- **Eligibility and screening criteria** for proposals and grant recipients as these provide the basis for proposal review and ensure quality proposals. Criteria generally cover: scientific quality, clarity of work plan, timeliness of completion, relevance to priorities, experience of proponent, adequacy of institutional support, adequacy of budget, and compliance with co-financing arrangements. Review sheets with scoring and ranking systems provide a transparent basis for selection decisions.

- **Calls for proposals** to provide comprehensive information on program objectives and priorities and clear, detailed guidance for submitting proposals. Eligibility requirements should be as flexible as possible to enhance participation of non-traditional research suppliers. Calls
for proposals should be advertised widely to ensure that all eligible candidates are aware of the program.

- **Technical review** of all eligible proposals to evaluate each proposal according to the criteria established. High standards of review from the beginning of the program contribute to quality projects in the long term. Technical advisory panel members should have clear terms of reference and be selected for their scientific expertise.

- **Formal award of grants** generally made by the governing board based on recommendations from technical review panels, possibly with consideration of additional criteria, such as regional equity, strategic partnership development, and funding mobilization.

- **Monitoring and evaluation** based on detailed targets and milestones provided in project proposals, and on semi-annual and annual reports from grant recipients. Program evaluations must be planned when the program is launched, and should focus on project outputs, outcomes, and impacts. The monitoring and evaluation system must cover individual grant projects, portfolio management by the CRGP secretariat, and institutional, economic, and social impacts of the CRGP.

**Selected Readings**


Brazil has a broad agricultural research system. In the mid-1990s, the national research agency Empresa Brasileira de Pesquisas Agropecuarias (EMBRAPA) had 2,064 researchers and an extensive infrastructure. State (province) research systems had an additional 2,395 researchers, and university teaching and research faculty numbered over 4,000. However, this capacity was underutilized and lacked adequate operating funding and linkages between institutions. As in many developing countries, the need to include private sector research, to increase competition, and to make research demand-driven and responsive to farmer needs, was recognized. There was a need for strengthening domestic capacity by capitalizing on research resources outside the private sector, and encouraging technology and scientific spill-ins (or activities) from advanced research institutions.

In 1997, the Agricultural Technology Development Project, a World Bank-assisted project, led by EMBRAPA was initiated to increase the efficiency and sustainability of resources in the Brazilian agricultural research system. This was to be accomplished in four ways by: (i) stimulating development of a more integrated and diversified National Agricultural Research System, with greater participation of the private sector; (ii) increasing the role of clients in defining research and technology transfer priorities; (iii) refocusing public sector research on public goods, such as research on family farms, natural resource management, and upstream technology activities not attractive to the private sector; (iv) helping EMBRAPA to address issues of decentralization and diversification of the research system; and (v) facilitating increased scientific spill-ins from advanced research institutions.

Nearly two-thirds of project funding allocated to a Competitive Research Grants Program (CRGP) acted as a catalyst for the long-term transition of the research system toward a diversified system of agricultural research and technology transfer. A committee, with representatives from various public, civic, and private stakeholders including farmer groups, selects the best research proposals.

A companion institutional capacity building program aims to increase the capacity of institutions to bid for grants, and includes support for research management improvements, training, special studies, public-private partnerships, and international collaborative research programs. The international collaborative linkages program includes a program for “EMBRAPA’s Foreign R&D Lab,” referred to as LABEX.

Under the LABEX program, promising Brazilian senior scientists in mid-career are assigned to research programs in advanced research institutions in industrial countries. These scientists observe the latest scientific developments in their field, develop joint programs for future collaboration, and facilitate interaction between research teams in areas relevant to the Brazilian agro-livestock sector. LABEX was initiated as a cooperative program between EMBRAPA and the Agricultural Research Service of the U.S. Department of Agriculture (USDA). The LABEX program operates I the United States and France, and is under analysis for collaboration in Asia, probably with Japan.

Benefits and Impact

The competitive grants resulted in establishing relationships between EMBRAPA and the wider scientific community. About 259 institutions are full participants, and another 400 are collaborating on research projects. EMBRAPA has now adopted the competitive system for all its research subprojects, including the World Bank-supported project.
The LABEX program is innovative in facilitating technology spill-ins. LABEX-USA, the first such collaboration in the Americas, established a “virtual laboratory” concept. Focus areas in this partnership are: natural resource management (NRM) in Amazonia; the Cooperative Program in Animal Genome; International Cooperation and Sustainable Agriculture I the Insect Genome; and Management of Swine Effluents in the State of Santa Catarina. LABEX-USA has already made significant contributions including: sequencing of genome of the bacteria responsible for Pierce disease in California grapevines; experiments in prevision-measurement of climatic variations to determine soil electricity conductivity and stresses I nitrogen, phosphorus, and water; and studies in intellectual property and biotechnology designed to establish modalities for more open use of patented/protected processes.

The LABEX-France model involves research partnerships with Agropolis in Montpellier, increasing the capacity of EMBRAPA to find new technologies and opportunities for cooperation with the European public and private sectors in agriculture. Priority areas for LABEX-France are biotechnology and advanced biology, agro-industrial technology, and sustainable management of natural resources. A Brazilian researcher from each focus area is located in France, developing research activities applicable to Brazilian concerns, and locating new technologies and opportunities for cooperation. The physical infrastructure available in LABEX-France collaboration provides several advantages over the traditional forms of research cooperation as it reduces costs of conducting research; allows activities to be initiated or closed without overheads and infrastructure investment; and develops integrated research teams around specific projects.

**Lessons Learned**

Brazil has an extensive and well-developed agricultural research capacity. Rapid advances in science, and limited research funding, even in the best of circumstances, make it essential to avoid duplication of research effort and to access new technologies and scientific knowledge in the most cost-effective way.

EMBRAPA’s LABEX program seeks to leverage EMBRAPA resources by developing collaborative research, education, training, and outreach efforts in areas of mutual interests with international research institutions. This strategy is likely to be relevant to many other countries, especially those with more limited research and educational capabilities than Brazil.
Annex 12. Information and Communications Technology in Extension.


Information and Communication Technologies (ICTs) offer opportunities to reach more people and to carry out various functions within extension systems more effectively and efficiently. ICTs can provide easy access to local or global information and knowledge and are simple channels for two-way communications. New technologies can give farm families better access and can be a major empowering resource. Key communications tools for improving extension services include:

a. **Development communications.** This is essential to extension services, providing easily understood information for electronic and face-to-face communications.

b. **Mass media.** This includes broadcast (radio and television), print (newspapers, magazines, and brochures), and other approaches, such as poster campaigns, traditional theatre, and songs. Public extension services have been slow to realize the potential of mass media, but private firms use mass media effectively in advertising campaigns. Increasing rural literacy and basic education should make mass media communications more effective in reaching large numbers of small-scale farmers.

c. **Rural telecommunications systems.** These range from the pay phone to digital wireless phones and the Internet and are powerful tools for expanding the flow of information of all types, and facilitating market transactions, changes in employment, competition, emergence of new industries, and social transformations (Talero and Gaudette 1996). Phone communications enhance quality of life and make working and living in rural areas more attractive.

d. **Information technologies.** These manage large volumes of information that can be used in planning, administering, and monitoring extension programs. Technologies, such as remote sensing, geographic information systems, global positioning systems, and weather and climate forecasting generate knowledge that extension systems provide to clients.

Benefits

New information technologies and the inventiveness of agricultural scientists, farmers, rural women, and entrepreneurs are leading to new mass media and ICT applications in agriculture. Communications technologies can help extension systems provide information better, cheaper, and faster. The ability of information technologies to manage large quantities of data enables these systems provide new services. Desktop publishing, Power-Point presentations, digital images, and lower-cost audio-visual hardware improve communication effectiveness. Computers and new software allow farmers, producer organizations, and extension agents to access information on a range of new technologies, markets, and other information from local or remote databases.

ICTs and traditional mass media can help the farmer compete in the evolving knowledge economy where competitive advantage is often dependent on timely access to high-quality information. Changes in farming systems also require extension systems to provide more knowledge and information support as producers diversify to new crops, meet higher food quality standards, or adapt to greater resource constraints. Many benefits derive from linking new technologies with traditional media. Internet searches identify global knowledge resources for local print media use; call-in Internet radio shows
allow listeners to phone in questions that can be researched on the Internet before the results are then reported over the radio.

**Policy and Implementation Issues**

In expanding use4 of ICTs, extension systems will need to address the costs and policy issues of reaching clients in rural areas.

**The digital divide.** In 1999, Latin America, Africa, and the Middle East accounted for only 4.2% of all people connected to the Internet. There were only 0.7 telephones per 100 people in rural areas of low-income countries, compared to 48.5 in rural areas of high-income countries (Hudson 1998). Rural areas are also much less connected than urban areas. Physical infrastructure is not the only factor: rural people are often less able to use ICTs because of lower education, skill levels, and incomes. Women have less access to ICTs than men. In selected developing countries, women accounted for 6-37% of Internet users. Women’s lower access to ICT is due to cultural and social attitudes that restrict women’s use of new technologies or that require seclusion of women; financial dependency on male family members; and less educational opportunities for women (Wete 1991).

**Cost effectiveness.** Public extension services can mainstream mass media in cost-effective extension programs. In Malawi, even in the early 1980s, direct extension agent-to-farmer services cost USD 21 per contact; a one-day farmer training course cost USD 4.5 per participant; a mobile film show cost USD 0.17 per farmer per hour; and a radio program cost USD 0.004 per listener per hour (Perraton et al. 1983). Advances in communications technologies have further reduced costs and opened opportunities for new and better applications of ICTs.

**Cost recovery.** Many extension services (market information and farm level advisory services) provide private benefits that should be paid for by users. Cost recovery is import in expanding rural access to information services. Revenue from advertising associated with information dissemination (radio or television advertising) or subscriptions (magazines, or Internet advisory services) offer opportunities for self-financing mass media services. Public extension agencies need to establish good business relations with private partners, either by selling advertising to private firms for government-owned media or providing high-quality information products for use by private sector publishers and broadcasters.

**Training and support.** Introducing computers and new communication technologies in traditional extension agencies can improve efficiency but can also have major implications for training and technical support costs, in addition to the initial hardware costs. Investments in curricula of training programs and staffing are needed to provide extension service providers with the capacity to effectively use new technologies and to link clients and sources of information.

**Policies and regulations.** Regulatory constraints may limit rural access to communication technologies. National and international regulations constrain expansion of local radio. Protection of telecommunications monopolies, restrictions on voice-over Internet protocol, and regulation of Internet use often limit rural access to ICTs. Extension programs can identify such policy constraints and raise them with national policymakers. Educating rural constituencies about these policy issues can create a constituency for reform.
Lessons Learned

The falling costs and ever-increasing capacity of ICTs, their ease of use and potential for wide coverage, and the entertainment value of cleverly packaged information and educational media present opportunities to mix different types of digital and traditional information technologies.

Matching media to messages. Radio and television reach many people quickly with simple messages. Print is good for getting detailed information to people. Inter-personal communications, group meetings, and demonstrations are best for teaching and developing credibility. A range of media can be combined in an overall communications strategy, but this is something that public extension often does poorly.

Developing content. The use of ICTs and mass media is not a one-time investment. There must be capability and commitment to continuous development of quality information and educational materials to supply clients through these media. Effective development communications requires active participation of intended beneficiaries and continuous assessment of their interests.

Knowing the client. Knowing the audience characteristics, preferences, needs, interests, and access to media are critical to understanding the potential use of specific media, analyzing and targeting audiences, and designing media products.

Institutional arrangements. Support for development communications in public extension services is complicated by the number of government agencies requiring such services. Limited demand from any one institution often makes it desirable for extension services to contract out communications support to specialized agencies. This requires a recurrent budget item for communications support, but avoids investment in costly equipment that may be underused and poorly maintained.

Telecenters. Rural telecenters (or telecottages) have efficiently provided rural people with access to ICTs; however, financial sustainability is still a major problem for such centers. Generally, telecenters work best when Internet access is part of a larger information centers and linked to rural radio and other information centers. Telecenter networks are useful in exchanging ideas and good practice experience. Varying institutional arrangements are possible (Box 1).

Box 1. India: Info Village Project in Pondicherry

The Info Village Project in Pondicherry, India, supported by the M.S. Swaminathan Research Foundation, has established village information centers managed by villagers. Farmers have been willing to pay for extension and marketing information from these centers. In one village, four women are managing a center effectively. They send and receive emails and faxes and download daily news from the Internet and display it on a Bulletin Board outside the info office. The Info Centers are highly user-friendly, demand-driven, managed by local people, and cater to a variety of information needs.

Source: M.S. Swaminthan Research Foundation 2002

Recommendation for Practitioners

Extension systems can use mass media and ICTs in three inter-linked information subsystems for accessing and developing knowledge products, supporting intermediaries and service providers, and linking rural people directly to sources of information and knowledge. Investments are needed so that public extension services can:
- Develop extension strategies that identify available communications resources; assess needs for communications; and determine the type of communications support needed. Many traditional uses of ICTs in extension are proven technologies that still need to be piloted and adapted to specific countries.

- Analyze information needs through knowledge, attitude, and practice (KAP) surveys, including gender analysis, that can be conducted through participatory rapid appraisals and do not need to be costly or lengthy.

- Expand use of mass media, especially radio, to complement other extension services and integrate use of various media for distribution of information.

- Establish capacity in development communications to package information for use in extension and advisory service programs, including provision for building capacity for local input of content and for supply and distribution of local material.

- Build into programs strategies that promote equal access and opportunity for the poor and disadvantaged groups, including women, to use mass media and ICTs.

- Assess telecommunications policies and regulations that might constrain rural access to information and communication services.

- Promote use of the Internet and establishment of self-financed telecenters.

References


Contracting Extension Services

With the recognition of the limitations of public agencies in efficient and effective delivery of public services, a trend has developed toward increasing separation of functions of financing and delivery of public services. Governments typically must continue to finance many rural extension services, but provision of services is more commonly contracted to private advisory service firms, NGOs, universities, producer organizations, and other groups. Various options assign procurement responsibility to central or local government or to clients themselves. Competitive procedures can improve quality of services, make providers more accountable for results, and improve efficiency.

Contracting allows for specialization and selection of service providers according to their individual competitive advantage. Although the public sector will continue to finance the cost of extension programs, the increasing diversity of extension service providers will mean that delivery of services will often be contracted out rather than provided by civil servants (Box 1).

Contracting systems that separate responsibilities for financing, procuring, and delivering extension services rely on diverse contractual arrangements that underlie four types of contracting: private funding for private services, public funding of publicly provided services, private funding for public service provision, and public funding of private service provision (outsourcing) (Rivera, Zijp, and Alex 2000). Of these, public funding of private service provision is the most common strategy for reform. In such systems, the state usually retains responsibility for establishing criteria for use of funds, quality control, and M&E, while private entities provide services, define specific objectives for each locality, train extension staff, develop appropriate extension methods, and conduct M&E studies.

Public contracting of private extension service delivery can involve national agency contracting (i.e., Venezuela and Chile), local government contracting, and grants to client organizations to contract services (i.e., Uganda). Contracted extension services are likely to spread as agriculture becomes more commercialized and competitive and as public budgets for agricultural extension services demand greater accountability.

Box 1. Chile: evolution of contracted extension services

Chile’s extension system, based on contracting private service providers, has evolved since its introduction in 1978. Evaluation report positive results from contracted services, and there is no support for return to a system of government service provision. Until 1983, the Entrepreneur Technical Assistance Program provided vouchers for farmers with potential for commercial development to use in purchasing extension services. Problems with this system resulted in a series of reforms that have made the program more demand-driven, with farmer organizations proposing defined projects for commercialization and modernization of small-farm agriculture. Chile’s experience indicates the need for contracted extension programs to evolve over time and to:

- Design different programs to serve different categories of farmers and different program objectives.
- Decentralize program design and contracting to regional and municipal (district) levels to expand participation of farmers.
- Expand market orientation and marketing services within programs.
• Provide good technical support services and training to contracted extension agents.
• Establish good evaluation and monitoring systems at the national level.

Source: Beynon et al. 1998

Benefits

Government contracting recognizes that, even situations in which public financing of extension is justified, private service delivery is often more efficient in serving clients. Contracting defines responsibilities and encourages clarity in objectives and outputs. In addition, it exploits the comparative advantages of different institutions and, consequently, improves variety and quality of services. Contracting also provides opportunities for the development of the private sector in rural areas and offers other potential benefits. Extension programs implemented by the private sector are typically more operationally efficient, more accountable for their performance and results, and more flexible in promoting extension staff for good job performance and dismissing staff for poor performance.

Contracts make providers accountable for the quantity and quality of services to be delivered and introduce penalties or non-renewal of contract if these are not met. Provision of services by a wider set of suppliers makes it possible to draw on the best available expertise to provide services to farmers. Competition among potential providers keeps costs down and establishes a market for extension services that should be sustainable as public funding is withdrawn.

Policy and Implementation Issues

Procurement agent. Contracting mechanisms can involve different agents in procuring services, such as central, regional, or local governments. For example, Bangladesh experimented with a series of partnership funds for services as part of its extension innovation and reform process (Box 2). Alternatively, producer or community groups can procure services directly with funding provided by public extension programs. This arrangement helps ensure service provider accountability to clients. Selecting the service provider, awarding the contract, and approving work plans are procurement functions that can be shared by client groups and different levels of government. Contracting arrangements should increase farmer participation in three areas: selecting extension providers, deciding the content of work programs, and assessing performance of extension providers.

Box 2. Bangladesh: extension partnership initiative funds

In support of its new agricultural extension policy, Bangladesh established three partnership funds at different levels under the Agricultural Services Innovation and Reform Project:

• A Upazilla (sub-district) partnership fund provided US$1,500 per year of flexible funding for each of the 640 sub-districts to use to promote the collaboration between public and private agencies in delivery of extension services through sub-district partnership projects. These funds supported on average four to five small-scale projects per sub-district.
• A competitive grants program in 12 districts financed district partnership projects implemented jointly by two or more service providers from the public or private sector.
• A national-level competitive grants program funded national partnership projects to build the capacity of smaller NGOs to provide quality extension services.

These partnership funds increased collaboration between service providers and increased acceptance of NGOs as legitimate extension service providers. Impacts and sustainability are yet to be determined.

Source: Authors
**Performance-based contracting.** Extension services are typically contracted on the basis of financing inputs needed for delivery of services. An alternative approach involves performance-based contracts that tie payment to outputs or delivery of services, such as the number of women farmers trained, the number of publications distributed or sold, or results and impacts, such as increased production, reduced irrigation water use, or improved product quality. These results-based contracting schemes provide incentives to improve efficiency and/or effectiveness of extension services, but they frequently encounter problems of measuring output and outcome quality, as well as problems with contract costing and negotiations. In these and other schemes, contract performance can also be evaluated by farmers who directly observe performance of service providers.

**Competitive contracting.** Contracts can be awarded on the basis of negotiations (often limited to contracts with client organizations or public sector agencies), or on the basis of competitive selection depending on the cost and quality of proposals. Competitive contracting procedures seek to improve efficiency and quality by instilling a private sector attitude of cost consciousness and results orientation, even in public institutions forced to compete to provide services. Program transparency and reputation are enhanced by fair and well-developed competitive procedures.

**Contracts vs. grants.** Contracting involves selection of a service provider to deliver defined services, whereas grant programs allocate resources on the basis of project proposals prepared by client groups or service providers. Either approach can use competitive or noncompetitive procedures. Competitive grants are often suited to research outreach programs (Box 3). But the communities that need extension services the most are less likely to be able to prepare competitive proposals, provide co-financing, demonstrate potential economic impact, and compete for projects.

**Transition issues.** Moving from public agency service delivery to contracted services frequently encounters problems, especially when there is opposition from extension staff worried about loss of employment or suspicious of private institutions’ motivation and capacity. Reforms must be sensitive to and deal with such concerns and opposition. Financing costs of staff retrenchment is often useful and may be combined with training and the reorientation of redundant extension agents to jobs with private service providers which usually offer better salaries, support, and job satisfaction.

**Box 3. Kenya: competitive grants for research outreach**

In 2000, the Kenyan Agricultural Research Institute, under pressure to ensure that its technologies reached farmers, embarked on the Agricultural Technology and Information Response Initiative to empower farmers to make technology and information demands on agricultural service providers. The initiative targets community-based organizations (CBOs) as beneficiaries or intermediaries (farmer organizations) facilitating member acquisition of appropriate technologies and information. Grants cover acquisition of technologies (for example, planting material), exchange visits to other farmers who have already adopted the technology, visits by the institute’s staff, and other costs of observing, learning, and adopting technologies. Smaller grants are given preference over larger ones to expand the number of beneficiaries. The average grant is about US$3,000. The initiative is now working with 178 CBOs to cover 11,835 farm families. Experience has been quite positive; an example of success is the Shaza Women’s Group in the Kwale district, which was able to multiply members’ assets four times in 18 months.

Source: Gustafson 2002

**Lessons Learned**

**Program/contract management.** Experience highlights the importance of developing capacity to prepare terms of reference, negotiate contracts, monitor contractor performance and compliance, and
exercise financial control. Program management skills are needed at the national level, but training and capacity building require even greater attention if contracting is done by local government or client groups. Contracting requires a collaborative relationship between agencies and government commitment to shift from controlling resources and programs to monitoring and supervising contracts.

**Contractor certification.** Contracting requires a minimum established capacity within service providers to compete for contracts and deliver services. It is a major problem in some countries and in remote areas of most countries. A registry of pre-qualified service providers expedites contracting under government-financed contracting systems. Such a registry is ideally maintained by the private sector in a trade association, farmers’ federation, NGO forum, agricultural extension society, or government agency. The registry must be managed in a fully transparent fashion and kept up-to-date.

**Quality enhancement.** Competition between service providers can discourage information sharing and good practice and can cause service providers to attempt to increase short-term profits by neglecting training and specialized technical support, both of which are necessary for enhancing quality of services. Institutional arrangements and program funding allocation to quality-enhancing support services (training, technical support, development communications) can exploit economies of scale to provide support to service providers and can emphasize national priority issues (gender equity, environmental conservation).

**Community contracting.** Contracted extension programs work best when community or producer organization (clients) are heavily involved in selecting extension agents, evaluating services, certifying agents, co-financing program costs, contracting services, determining program content, and deciding how services are allocated. Such contracting is facilitated for cases in which there have been previous community-managed projects; there is some degree of social cohesion; community organizations have legal status; communities are responsible for program operations and maintenance; and there is provision for capacity building for community organizations (deSilva 2000). For situations in which these factors are lacking, contracting on behalf of the community by an intermediary may be warranted. Experience in Africa indicates that a facilitating professional NGO is crucial to successful operation of user innovation funds for producer organizations (Collion 2001).

**References**


