ASTI Agricultural Science & Technology Indicators
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Malaysian Agricultural Research and Development Institute

MALAYSIA

RECENT DEVELOPMENTS IN AGRICULTURAL RESEARCH

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Country Note • May 2013

LONG-TERM INVESTMENT AND CAPACITY TRENDS IN AGRICULTURAL R&D

Relatively high and increasing research and development (R&D) investment in Malaysia has strengthened agricultural productivity, particularly in terms of export commodities such as oil palm and rubber. In 2010, public investment in agricultural R&D in Malaysia totaled 696 million ringgit or 401 million purchasing power parity (PPP) dollars, both in 2005 constant prices (Figure 1; Table 1). As of 2010, spending—while more volatile in recent years due to fluctuating government funding—had doubled since the 1980s. As part of this growth, public agricultural research capacity reached 1,609 full-time equivalent (FTE) researchers in 2010. This growth occurred across all institutional categories (Figure 2).

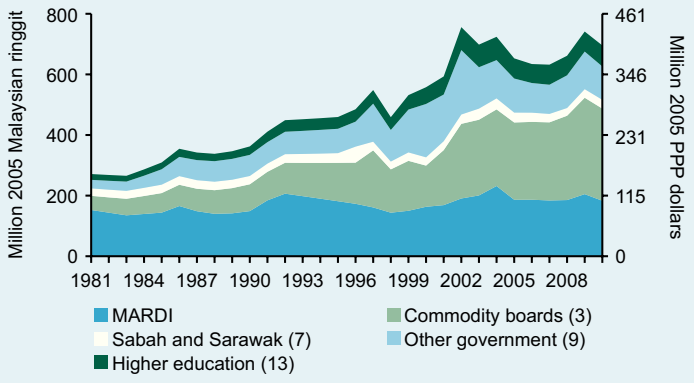
Note that, unless otherwise stated, all dollar values presented have been calculated using PPP exchange rates, which reflect the purchasing power of currencies more effectively than do standard exchange rates because they compare the prices of a broader range of local, as opposed to internationally traded, goods and services.[1]

The Malaysian Agricultural Research and Development Institute (MARDI) is the country's main agricultural R&D agency, accounting for more than a quarter of national agricultural research investments and 36 percent of human resource capacity in 2010. MARDI, administered by the Ministry of Agriculture and Agro-Based Industry, encompasses three branches (Research,

Key Trends Since 2002

- Agricultural research and development (R&D) investment in Malaysia has remained high compared with many other developing countries, although spending has become more volatile in recent years due to fluctuations in government funding levels.
- Public agricultural research capacity reached 1,609 full-time equivalent (FTE) researchers in 2010, with growth occurring across all institutional categories.
- The country's main public agricultural R&D agency, the Malaysian Agricultural Research and Development Institute (MARDI) accounted for a quarter of national agricultural research investments and 36 percent of human resource capacity in 2010.
- Research investment by commodity boards accounted for almost half of total public agricultural R&D spending in 2010.

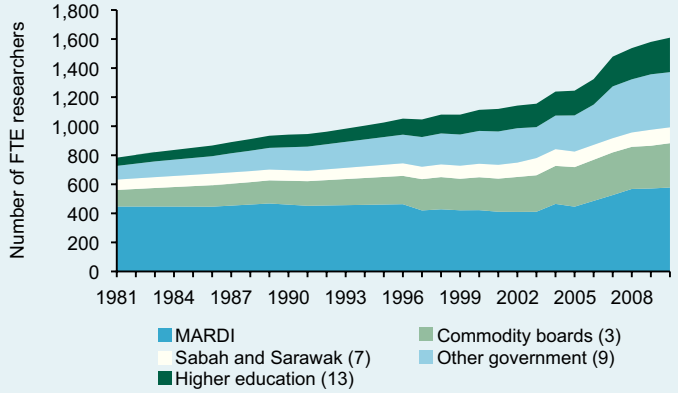
Figure 1—Public agricultural R&D spending adjusted for inflation, 1981–2010



Sources: Calculated by authors from ASTI–MARDI 2011–12 and Stads, Tawang, and Beintema 2005.

Notes: Figures in parentheses indicate the number of agencies in each category. Due to lack of available data, estimates have been made for the period 2003–06.

Figure 2—Public agricultural research staff in full-time equivalents, 1981–2010



Sources: Calculated by authors from ASTI–MARDI 2011–12; Stads, Tawang, and Beintema 2005; and Universiti Malaysia Sarawak 2012.

Notes: Figures in parentheses indicate the number of agencies in each category. Figure excludes technicians with degrees but without official researcher status. Due to lack of available data, estimates were made for the period 2003–06.

Table 1—Overview of public agricultural R&D spending and research staff levels, 2010

Type of agency	Total spending			Total staffing	
	Malaysian ringgit	PPP dollars	Shares	Number	Shares
	(million 2005 prices)		(%)	(FTEs)	(%)
MARDI	183.0	105.5	26.3	578.0	35.9
Commodity boards (3)	304.3	175.5	43.7	305.0	19.0
Sabah and Sarawak (7)	28.9	16.7	4.2	109.4	6.8
Other government (9)	110.1	63.5	15.8	379.8	23.6
Subtotal government (20)	*626.3*	*361.2*	*90.0*	*1,372.2*	*85.3*
Higher education (13)	69.4	40.0	10.0	237.3	14.7
Total (33)	**695.6**	**401.2**	**100**	**1,609.4**	**100**

Sources: Calculated by authors from ASTI–MARDI 2011–12; Stads, Tawang, and Beintema 2005; and Universiti Malaysia Sarawak 2012.

Notes: Figures in parentheses indicate the number of agencies in each category. Data exclude degree-qualified technicians lacking official researcher status.

Technology Transfer and Commercialization, and Operations) and oversees 29 regional research stations. Year-to-year spending levels fluctuated moderately at MARDI throughout the past three decades. In 2010, MARDI's expenditures totaled 183 million ringgit or 106 million PPP dollars (both in 2005 constant prices). Research capacity levels remained fairly stable throughout the 1980s and early 1990s, but declined slightly in the late 1990s. In 2004, staffing levels began to increase, although inconsistently, and reached 578 FTEs in 2010.

Despite MARDI's central role in agricultural R&D, the commodity-based research agencies spent twice as much on agricultural research, representing almost half the national total. The centers include the Malaysian Palm Oil Board (MPOB), the Malaysian Cocoa Board (MCB), and the Malaysian Rubber Board (MRB). Given the high value of export crops and related commodity-based resources (such as cesses), these agencies are better funded than MARDI, but they employ fewer researchers (a combined 305 FTEs in 2010). Employing 207 FTE researchers in 2010, MPOB is the largest of the three agencies; MCB and MRB are similarly sized, employing 53 and 45 FTE researchers in 2010, respectively.

Two of Malaysia's states, Sabah and Sarawak, exercise a greater degree of autonomy and, as such, operate their own research agencies. Sarawak's public agencies include the Department of Agriculture (14 FTEs), the Forest Research Centre (6 FTEs), the Fisheries Research Institute–Sarawak (10 FTEs), and an autonomous nonprofit agency, the Sarawak Biodiversity Centre (32 FTEs), established to advise the government on policy. Research activities in Sabah are conducted at the Department of Agriculture (27 FTEs), and the Department of Fisheries (2 FTEs).

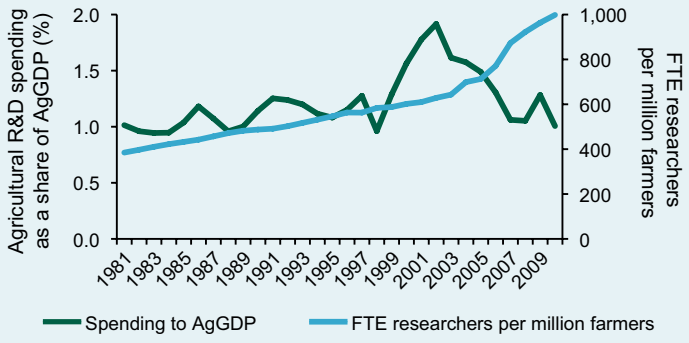
A number of other government research agencies operate in Malaysia, the largest being the Forestry Research Institute Malaysia (FRIM), which employed 202 FTE researchers in 2010. Other agencies include the Department of Veterinary Services (44 FTEs) and the Malaysian Institute for Nuclear Technology Research (22 FTEs). Given Malaysia's long coastline, fisheries are an important natural resource. Fisheries and marine research are primarily conducted at the Fisheries Research Institute (FRI) located in Pulau Pinang. A number of other, more specialized fisheries agencies also operate, including the Center for Turtle and Marine Ecosystem, the Freshwater Fisheries Research Centre, the Marine Fish Production and Research Centre, the Brackish Water Culture Research Centre, and the National Prawn Fry Production and Research Centre, all located across the country.

The higher education sector accounted for 15 percent of total agricultural research capacity in Malaysia in 2010. Universiti Putra Malaysia (UPM) accounts for more than half of that capacity and comprises four related faculties—Agriculture, Veterinary Medicine, Forestry, and Food Sciences and Technology—as well as the Institute of Agricultural and Food Policy Studies. Other large higher education agencies include the Universiti Kebangsaan Malaysia's Faculty of Science and Technology (44 FTEs) and the Universiti Malaysia Terengganu's[2] Faculty of Agro-technology and Food Science (21 FTEs). Malaysia has a number of smaller higher education agencies, each employing 2 to 10 FTE researchers.

Private-sector agricultural research investment appears to be growing quickly. Unfortunately, complete data were not available for all companies previously surveyed, but investment and capacity levels clearly increased at five of the seven companies for which both 2002 and 2010 data were available. Three large companies, Sime Darby Berhad, Golden Hope Plantations Berhad, and Kumpulan Guthrie Berhad were merged in 2007 to form Sime Darby Plantation, a major oil palm producer. With seven research centers in Malaysia and a further four in other countries, the company employs almost as many researchers as MPOB. Felda Agricultural Services also primarily conducts oil palm research and in 2010 employed 125 FTE researchers, a 500 percent increase since 2002. Craun Research, corporatized in 1994 by the Sarawak state government, focuses mainly on sago palm and employed 27 FTE researchers in 2010.

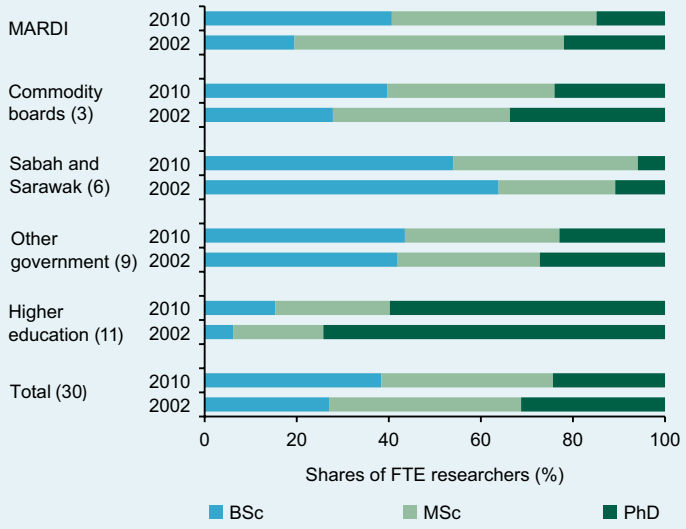
A common indicator used to compare agricultural R&D investment across countries is the research intensity ratio, which measures total spending on agricultural research as a percentage of agricultural output (AgGDP). In 2010, for every $100 of agricultural output, Malaysia invested $1.01 in public agricultural R&D (Figure 3). The 2002 ratio was much higher in comparison—$1.92 for every $100 of agricultural output, but this stemmed from lower AgGDP due to the falling price of oil

Figure 3—Intensity of public agricultural research spending and capacity, 1981–2010



Sources: Calculated by authors from ASTI–MARDI 2011–12; Stads, Tawang, and Beintema 2005; Universiti Malaysia Sarawak 2012; FAO 2012; and World Bank 2012

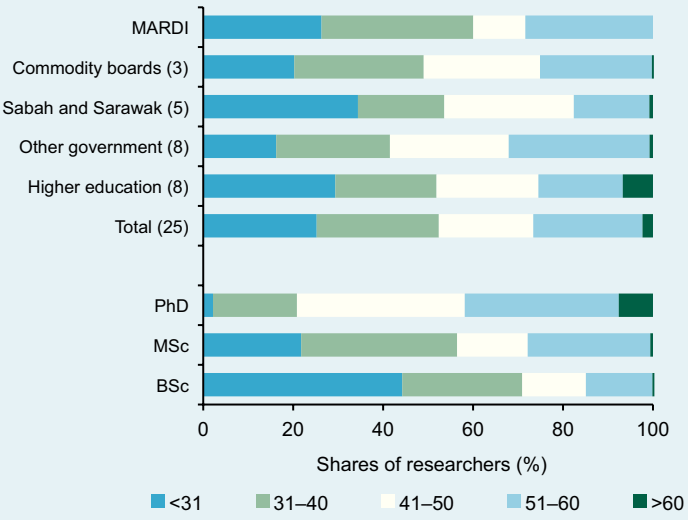
Figure 4—Qualifications of researchers by institutional category, 2002 and 2010



Sources: Calculated by authors from ASTI–MARDI 2011–12 and Stads, Tawang, and Beintema 2005.

Notes: Figures in parentheses indicate the number of agencies in each category. Degree share data account for 97 percent of total researchers. For more information on coverage and estimation procedures, see the Malaysia country page on the ASTI website at http://asti.cgiar.org/malaysia. Based on lack of official researcher status, the data exclude 8 FTE technicians with PhD degrees, 9 with MSc degrees, and 41 with BSc degrees.

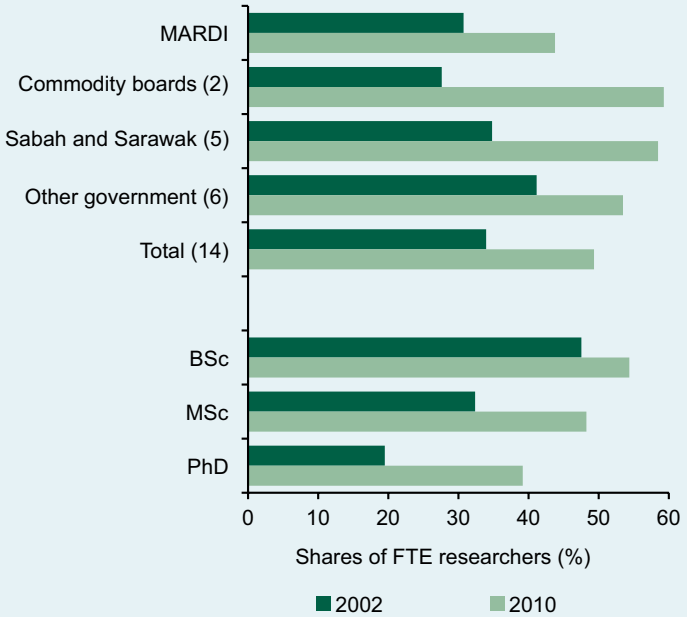
Figure 5—Age distribution of researchers by institutional category and degree, 2010



Source: Calculated by authors from ASTI–MARDI 2011–12.

Notes: Figures in parentheses indicate the number of agencies in each category. Age data are based on headcounts, not FTEs, and account for 80 percent of total researchers. For more information on coverage and estimation procedures, see the Malaysia country page on the ASTI website at http://asti.cgiar.org/malaysia.

Figure 6—Female share of researchers by institutional category and degree, 2002 and 2010



Sources: Calculated by authors from ASTI–MARDI 2011–12 and Stads, Tawang, and Beintema 2005.

Notes: Figures in parentheses indicate the number of agencies in each category. Gender data account for 82 percent of total government researchers and 70 percent of total researchers. Higher education data for gender was incomplete. For more information on coverage and estimation procedures, see the Malaysia country page on the ASTI website at http://asti.cgiar.org/malaysia.

palm on the world market at that time. When oil palm prices rose again, Malaysia's AgGDP rebounded and the country's intensity ratio returned to previous levels. Another indicator, the number of agricultural researchers per million farmers, improved from 628 FTEs in 2002 to 998 FTEs in 2010, attributable both to growth in research capacity and a decline in the number of farmers.

HUMAN RESOURCE TRENDS

In 2010, a quarter of Malaysia's agricultural researchers were PhD-qualified, 37 percent held MSc degrees, and 38 percent held BScs (Figure 4). On face value these shares appear to indicate that qualifications have deteriorated since 2002, but instead they reflect an increase in the absolute number of researchers across all degree levels. Higher levels of recruitment among researchers qualified to the BSc degree level have led to an increase in that grouping's overall share of researchers. Among government agencies, shares of researchers with PhD degrees are highest within the commodity boards (24 percent) and lowest at the Sabah and Sarawak agencies (6 percent). Universities worldwide generally have a higher share of staff qualified to the PhD level, and this is true for Malaysia as well; in 2010, 60 percent of researchers employed in the higher education agencies held PhD degrees.

Of the BSc-qualified researchers, 71 percent were under the age of 30 as of 2010 (Figure 5). Half of all researchers were under 40 years old, and 25 percent were more than 51 years old. The retirement age at many government agencies is 58, which is a concern given that 40 percent of PhD-qualified researchers are over the age of 50.

As is common in Southeast Asia, Malaysia employs a high share of female agricultural researchers. From 2002 to 2010, the number of female agricultural researchers at government agencies doubled (in FTEs), significantly increasing the overall share of women, from 34 to 49 percent (Figure 6). In particular, agencies in Sabah and Sarawak and at commodity boards

employed a high share of female researchers (58 and 59 percent, respectively). The share of female researchers was highest among those qualified to the BSc level (54 percent), followed by those qualified to the MSc level (48 percent), and finally those who held PhD degrees (39 percent).

Support staff numbers increased less rapidly compared with researcher numbers, resulting in a decrease of the average ratio of support staff per researcher from 4.6 in 2002 to 3.0 in 2010—comprising 0.3 technicians, 1.2 administrative staff, and 1.5 other support staff (Stads, Tawang, and Beintema 2005; ASTI–MARDI 2012). The commodity board agencies recorded the highest average ratio of support staff: 6.2 per researcher in 2010 compared with 2.4 for MARDI and 1.3 for the higher education agencies. Lower support-staff ratios at higher education agencies are common across countries given that research is not their primary mandate.

ASTI Website Interaction

- More details on investments and capacity in agricultural research in Malaysia are available in the 2005 country brief at www.asti.cgiar.org/pdf/Malaysia_CB30.pdf.
- Underlying datasets can be downloaded using ASTI's data tool at asti.cgiar.org/data.
- A list of the 20 government and 13 higher education agencies included in this brief is available at asti.cgiar.org/malaysia/agencies.

asti.cgiar.org/malaysia

INVESTMENT TRENDS

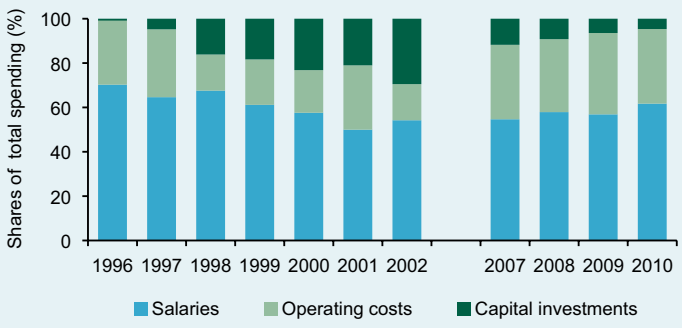
Expenditures

The allocation of research budgets across salaries, operating costs, and capital investments affects the efficiency of agricultural R&D, so detailed cost category data for government agencies were collected as part of this study. In 2010, salaries accounted for about half of total agricultural R&D spending at government agencies, while operating costs accounted for 34 percent, and capital investments for 14 percent. This distribution represents an increase in the cost of salaries resulting from growing numbers of researchers. Shares varied across agencies, however. Government funding cutbacks caused capital investments at MARDI to decline both in real terms and as a share of total spending (Figure 7). In comparison, the commodity board agencies spent much more on operating costs and capital investments than they did on salaries (Figure 8). While total expenditures at the Sabah and Sarawak agencies remained roughly constant from 2002 to 2010, salaries increased as a share of total spending, causing the shares of operating costs and capital costs investments to decline. At the other government agencies, because the cost of salaries doubled in real terms, while other costs fell precipitously during 2002–10 due to cutbacks, salaries grew to an 85 percent share of total spending in 2010, and operating costs and capital investments represented only 10 and 5 percent, respectively.

Funding Sources

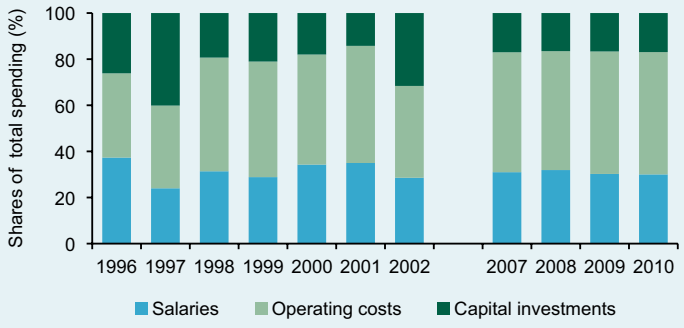
The Malaysian government provides the majority of the country's funding for agricultural R&D. MARDI is entirely government-funded with the exception of minimal donor funding for joint research activities with international and regional partners. Intensification of Research in Priority Areas (IRPA), a program administered by the Ministry of Science, Technology and Innovation (MOSTI), has provided significant

Figure 7—Cost category shares of MARDI, 1996–2002 and 2007–10



Sources: Calculated by authors from ASTI–MARDI 2011–12 and Stads, Tawang, and Beintema 2005.

Figure 8—Cost category shares of commodity boards, 1996–2002 and 2007–10



Sources: Calculated by authors from ASTI–MARDI 2011–12 and Stads, Tawang, and Beintema 2005.

Note: The three commodity boards are the Malaysian Palm Oil Board (MPOB), the Malaysian Cocoa Board (MCB), and the Malaysian Rubber Board (MRB).

funding for R&D since its inception in 1988, both for MARDI and other government and higher education agencies. MPOB and MRB continue to receive funding through commodity cesses on rubber and oil palm (Figure 9). These cesses vary from year to year but in 2010 accounted for 78 and 27 percent of these two agencies' funding, respectively. No cess is collected for cocoa research, but MCB receives additional funding from the Common Fund for Commodities and the World Cocoa Foundation.

ALLOCATION OF RESEARCH

Given that the allocation of resources across various lines of research is a significant policy decision, detailed information was collected on the number of researchers working in specific commodity and thematic areas (in FTEs). In 2010, the predominant focus of agricultural research in Malaysia was crops: 42 percent of researchers were involved in crop research (Figure 10). The remaining researchers focused on natural resources (14 percent), livestock (13 percent), fisheries (8 percent), and forestry (7 percent). Other areas of research include postharvest, agricultural engineering, and socioeconomics. The predominant crop under research in Malaysia in 2010 was oil palm—the focus of one-third of all crop researchers—followed in importance by fruits, rice, and vegetables. Livestock research focused on beef cattle, sheep and goats, and poultry.

In 2010, the government initiated the Economic Transformation Program (ETP) with the goal that Malaysia will achieve high-income status by 2020. This program outlines 12 key economic areas to be strengthened, including agriculture, to advance national economic growth. Agricultural subsectors identified as having high-growth potential include aquaculture, seaweed farming, swiftlet nests, herbal products, fruits and vegetables, and food processing. Food security is a high priority, so the paddy and livestock subsectors are also important areas of research. Related R&D activities at MARDI and other agencies focus on the development and improvement of new varieties, biodiversity, and downstream activities.

ASTI Website Interaction

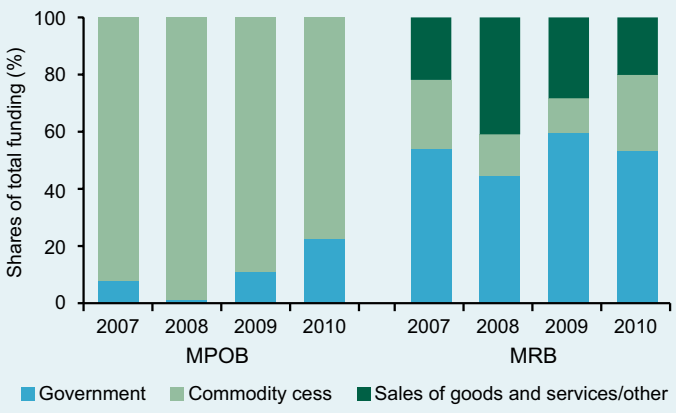
- Detailed definitions of PPPs, FTEs, and other methodologies employed by ASTI are available at asti.cgiar.org/methodology.
- The data in this brief are predominantly derived from surveys. Some data are from secondary sources or were estimated. More information on data coverage is available at asti.cgiar.org/malaysia/datacoverage.
- More relevant sources on agricultural R&D are available at asti.cgiar.org/malaysia.

asti.cgiar.org/malaysia

CONCLUSION

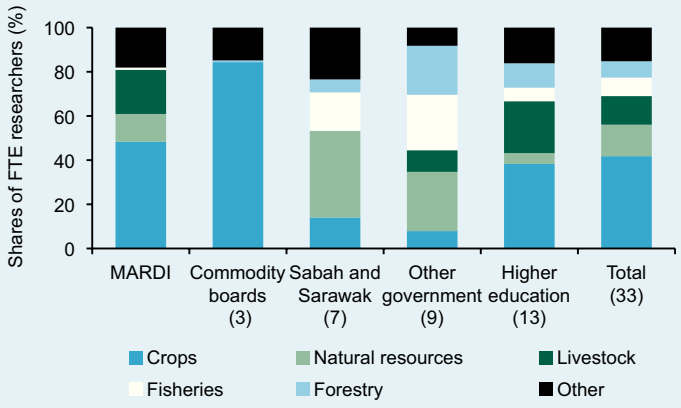
Despite year-to-year fluctuations, agricultural research investment in Malaysia remained roughly constant between 2002 and 2010. Capacity levels did increase, however, primarily reflecting the recruitment of younger, BSc-qualified researchers. The country's growing researcher capacity measured against a decreasing number of farmers led to a higher ratio of researchers to farmers. In comparison, research spending intensity fluctuated, largely in response to volatile AgGDP levels. For every $100 of agricultural output, Malaysia spent close to $1.00 on agricultural R&D in 2008 compared with an average of $0.54 for developing countries and $3.07 for high-income countries (Beintema et al 2012). The country's AgGDP levels accelerated from 2006 driven

Figure 9—Funding sources for the Malaysian Palm Oil Board (MPOB) and the Malaysian Rubber Board (MRB), 2007–10



Source: Calculated by authors from ASTI–MARDI 2011–12.

Figure 10—Research focus by major commodity area, 2010



Source: Calculated by authors from ASTI–MARDI 2011–12.

Note: Figures in parentheses indicate the number of agencies in each category.

by high-value export crops; as a result, agricultural research performed by the private sector increased. However, to build on agricultural sector gains, public research can still play a valuable supporting role, especially with regard to research on commodities that can boost household incomes and are essential for food security, such as those targeted by the new ETP. Issues of concern looking to the future include ongoing maintenance of capacity and infrastructure given government funding cuts, and the training and mentoring of junior staff needed to replace retiring senior staff over the coming decades.

NOTES

[1] Financial data are also available in current local currencies or constant 2005 U.S. dollars via ASTI's Data Tool, accessible at www.asti.cgiar.org/data.

[2] Formerly Kolej Universiti Sains dan Teknologi Malaysia.

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MARDI is the principal agricultural research institution in Malaysia. Established in 1969, it holds a broad mandate for crop, livestock, and natural resources research. To learn more about MARDI visit http://www.mardi.gov.my.

The Agricultural Science and Technology Indicators (ASTI) initiative compiles, analyzes, and publishes data on institutional developments, investments, and human resources in agricultural R&D in low- and middle-income countries. The ASTI initiative is managed by the International Food Policy Research Institute (IFPRI) and involves partnerships with many national and regional R&D agencies, as well as international institutions. The initiative is widely recognized as the most authoritative source of information on the support for and structure of agricultural R&D worldwide. (www.asti.cgiar.org)

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