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The Forgotten Importance of R&D for Agriculture and Food Security

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Agricultural Research and Development (Ag R&D) is the heartbeat of progress in agriculture, driving the breakthroughs that shape how we grow, sustain, and secure our food systems. It is the science behind every healthier crop, every more resilient farming practice, and every drop of water used wisely. From enhancing soil health to revolutionising pest control and livestock genetics, Ag R&D is not just a field of study—it is the foundation of humanity's fight against hunger and environmental challenges.

Yet, in Malaysia, investment in agricultural research has been declining. Spending on Ag R&D as a percentage of agricultural GDP has decreased from 1.9% in 2002 to 0.85% in 2017, with most of this expenditure coming from the public sector[1]. This decline in public sector investment is not unique to Malaysia; it reflects a global trend observed in many high- and low-income countries. However, some upper-middle-income countries, such as China and Brazil, have bucked this trend with

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[1] ASTI (2020)

significant public investment[2]. In regions where public sector spending has waned, private sector investment has increasingly stepped in to fill the gap[3].

Malaysia has a network of Ag R&D institutes, with approximately 26 public research institutes operating under ministries or universities, as noted by the Association of Science, Technology, and Innovation (ASTI). However, much of Malaysia's Ag R&D has been commodity-focused. A significant portion of funding is allocated to research on export-driven crops like palm oil and rubber, while research on staple crops such as rice, though present, remains inconsistent. The extent of research dedicated to other food crops is unclear, raising concerns about the balance and breadth of Ag R&D efforts in supporting Malaysia's overall food security.

This paper argues that addressing these challenges requires a comprehensive assessment of the Ag R&D ecosystem, targeted and data-driven interventions across the food system, and strategic partnerships that align public and private sector efforts to maximise impact.

Why Ag R&D Matters

One of the key contributions of Ag R&D has been its role in enhancing Total Factor Productivity (TFP). TFP measures the agricultural output generated from the combined inputs of land, labour, capital, and material resources[4]. Ag R&D is critical in addressing environmental challenges such as soil degradation, water pollution and depletion, and the impacts of climate change, all of which pose serious threats to productivity growth in the coming years[5].

Beyond environmental concerns, Ag R&D may also help navigate the issue of growing competition for agricultural resources. The rising demand for biofuels, which divert crops and arable land from food production, exacerbates pressure on food supply chains[6]. Simultaneously, global population growth and increasing incomes are driving higher demand for diverse and nutritious food sources[7]. Without continuous innovation, meeting these challenges sustainably will be difficult.

Another contribution of Ag R&D is the development of improved seed varieties. These innovations have resulted in high-yielding crops with enhanced tolerance to water scarcity, resistance to diseases, and resilience to climate variability, which further enable farmers to achieve higher productivity and greater returns under constrained conditions[8].

Ag R&D also plays a role in advancing agricultural technology, particularly through innovations like the Internet of Things (IoT), smart sensors, and precision farming tools. These technological advancements enable farmers to monitor and manage their crops more effectively, optimising

[2] Jaruzelski, Staack, and Johnson (2017)
[3] Ibid.
[4] USDA (2023)
[5] Kristkova, Van Dijk, and Van Meijl (2017)
[6] OECD (2012)
[7] Ibid.
[8] World Economic Forum (2024)

resource use, and boosting productivity[9]. Moreover, Ag R&D fosters the development of new technologies that not only improve yields but also promote sustainable farming practices.

Beyond its role on the production side, Ag R&D drives innovation across the entire agricultural supply chain. This includes advancements in post-harvest technologies that reduce food waste, improved storage solutions to maintain quality, and efficient logistics systems to enhance market access for farmers[10]. R&D also supports the development of value-added products and sustainable packaging, enabling farmers and producers to capture higher value from their outputs[11]. By addressing challenges across the supply chain, Ag R&D ensures that the benefits of innovation extend beyond the farm, contributing to a more resilient and efficient global food system.

On-the-Ground Observation: A Visit to an Aquaculture Farm

During a recent visit to a shrimp aquaculture farm in Malaysia, I witnessed firsthand the pressing need to strengthen R&D, not just in aquaculture but across the entire agricultural sector. The farm visit highlighted a critical challenge: disease outbreaks, which have caused the closure of many aquaculture farms in Malaysia[12].

Malaysia lacks the capacity to conduct locally relevant research. This is due to its reliance on imported shrimp broodstock, primarily from countries like the United States. This dependency restricts the country's capacity to conduct locally relevant research and address specific aquaculture challenges.

Additionally, Malaysia lacks comprehensive R&D programmes to further develop and adapt shrimp genetic traits for local conditions[13]. Even with identical genetic stock, outcomes vary significantly based on local conditions and the level of research readiness[14]. This explains why shrimp with the same genetic profile can perform differently in Malaysia, Thailand, and Indonesia, as the disparity lies in the ability to tailor practices to local environments through targeted R&D efforts.

The country's aquaculture research infrastructure also trails behind regional leaders such as Thailand and Indonesia. These nations have invested heavily in R&D, allowing them to fine-tune breeding practices, optimise water quality, and mitigate disease risks, giving them a competitive edge[15]. In contrast, Malaysia's research ecosystem remains underdeveloped, limiting its ability to achieve similar outcomes.

Despite these obstacles, the visit revealed an encouraging trend toward greater awareness and interest in advancing research. However, progress is hindered by weak collaboration between the aquaculture industry and local research institutions. For instance, while imported broodstock

[9] Khan et al. (2021)
[10] Jagtap et al. (2020)
[11] Cristofoli et al. (2023)
[12] Based on stakeholder engagement
[13] Ibid.
[14] Ibid.
[15] Ibid.

is widely available, there has been little effort to use it as a springboard for domestic innovation and research advancements.

The Importance of Public-Private-International Partnership in Ag R&D

In Malaysia, Ag R&D is primarily driven by the public sector, with government agencies and research institutions playing a key role. While the private sector also contributes to Ag R&D, its involvement is less well-defined and mainly concentrated on industrial crops[16]. In contrast, countries such as Thailand and China have developed a robust Ag R&D sector, supported by significant contributions from the private sector[17]. These successes are further supported by collaboration with international institutions, which facilitate the transfer of knowledge, technology, and practices crucial for advancing agricultural innovation.

Ag R&D partnerships offer numerous benefits, such as reducing research costs, pooling resources, and fostering innovation. For example, partnerships can make high-cost research feasible, secure alternative funding, or provide access to private sector networks and expertise[18]. However, challenges such as transaction costs and partner commitment must be addressed to maximise their impact[19].

Take Thailand's corn industry as an example. Its success was built on strong public-private partnerships and international collaboration. Starting in the 1950s, the government promoted corn cultivation through subsidies, improved seeds, and price guarantees. By the 1960s, organisations like the Rockefeller Foundation and U.S. Agency for International Development (USAID) helped establish research centres such as the National Corn and Sorghum Research Center, driving R&D advancements[20]. Initially led by the public sector, hybrid seed production was later scaled nationwide by private companies. This collaboration culminated in innovations like the high-yielding, disease-resistant "Suwan-1" variety, showcasing how partnerships can transform agricultural industries[21].

At Its Core: Not Just About Funding

The need for comprehensive assessment: The success of Ag R&D hinges on understanding and leveraging the broader ecosystem to strategically plan partnerships and initiatives. Effective R&D is not just about pouring money into projects but ensuring that resources are allocated where they will make the most impact. This requires a thorough needs assessment to identify gaps, strengths, and opportunities within the agricultural sector. Such an assessment provides the foundation for informed decision-making, helping stakeholders prioritise actions that address issues in production, food security, and sustainability.

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[16] ASTI (2020)
[17] Suphannachart and Warr (2011); The Chinese Academy of Agricultural Science (2023)
[18] Spielman, Hartwich, and Grebmer, n.d.
[19] Ibid.
[20] Nik Syafiah Anis (2023)
[21] Ibid.

Targeted Interventions Across the Food System: Interventions must be precise and data-driven to address the most critical needs within the food system, whether it's improving production processes, reducing food waste, or enhancing supply chain resilience. Prioritisation should focus on crops, livestock, or aquaculture sectors that are pivotal to boosting food security and ensuring long-term agricultural sustainability. For example, targeted investments in technologies for precision farming or supply chain digitalisation can yield transformative impacts in addressing specific bottlenecks.

Strategic Partnerships and Funding: Strategic partnerships play a role in advancing Ag R&D by pooling resources, expertise, and innovation. Identifying opportunities for public-private partnerships (PPPs) is needed, as they can effectively combine public-sector priorities with private-sector innovation. The public sector should lead funding initiatives in foundational research and areas with limited commercial appeal, such as staple crop resilience or smallholder support. In contrast, the private sector can drive innovation in areas like advanced technologies, market-driven crops, and high-value commodities. Emulating strategic models, such as Thailand's focus on leveraging existing strengths while targeting growth areas, can help Malaysia ensure that collaborations and investments align with national priorities and deliver maximum impact.

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