

A WIDER CANVAS FOR INTERNATIONAL AGRICULTURAL RESEARCH

A series of briefs on
emerging trends in world food security



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BRIEF: Food from thought – Bread from stones

BY Dr Gabrielle Persley AM

Current world food situation

Trends in world food prices and implications for food security

On the eve of World Food Day 2012, one billion people will go to bed hungry. A further 200 million, mainly women and children, will suffer from the 'hidden hunger' of malnutrition. A diet lacking in sufficient protein, vitamins and minerals stunts growth and impairs learning ability in children. After a decade of positive trends, now more people are falling back into poverty and food insecurity. Since the dramatic food price rises in 2008 (and after a modest price fall in 2009) the global food security situation has deteriorated, with further price spikes in international markets, principally maize, rice and wheat, in 2010 and 2012.

Why is this so? And what can be done to reverse these trends to improve food security?

Food insecurity is most pressing in Africa and South Asia. The highest *proportion* of rural poor live in sub-Saharan Africa, and most are smallholder farmers and livestock keepers. The highest *absolute numbers* of poor people live in South Asia. The highest proportions of the populations unable

to access sufficient nutritious food at affordable prices live and work in Africa and South Asia.

Africa is more vulnerable to changing world food prices than Asia. Millions of people in Africa have moved back into food insecurity since the 2007/08 world food price crisis. The economic growth that has been lifting millions of people out of poverty in Asia has slowed, and the numbers of food insecure people in the region has levelled out rather than continued to decline (FAO 2011, Minot 2012).

Moreover, there remain millions of poor people in South Asia who do not have access to sufficient nutritious food at affordable prices, largely as a result of poverty. Reducing poverty and increasing food security are inextricably linked.

Whilst millions remain hungry and malnourished, there is also increasing demand for better quality food and more diverse diets as people move out of poverty. This is illustrated by the rising demand for animal-sourced foods (meat, milk, and eggs) and for fruits and vegetables as incomes increase.

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This rising demand, especially in the emerging economies of Asia, coupled with growing world population leads to the need to increase total global food production by 70% by 2050. Is this achievable?

The first 'Green Revolution' was based on the successful combination of technology, policies and investments, which led to the increases in agricultural productivity that boosted food production, mainly in Asia, from the 1960s onwards. These increases were largely the result of the widespread cultivation of high yielding varieties of rice and wheat, combined with pro-poor policies and the supply of credit, inputs (fertiliser, pesticides and seeds) and investments in infrastructure, especially irrigation and roads. In India, the political leadership of Prime Minister Indira Gandhi combined with the scientific leadership of Dr M.S. Swaminathan and his colleagues in the Indian and international scientific communities, and the policy and investment advice of Sir John Crawford and his colleagues at the World Bank and the Asian Development Bank led to the 'Green Revolution'. These efforts in policy, science and technology and investments turned India from the famines of the 1950s and 1960s to the food surpluses of the

1980s and beyond. The agricultural sector became the driver of economic development in India, China and elsewhere in Southeast Asia.

A second 'Doubly Green Revolution' in food and agriculture, primarily in the countries of Africa, could be achieved by combining new technologies with environmentally sustainable economic policies, investments in infrastructure and the development of a robust private sector to deliver new knowledge and agricultural goods and services to small-scale farmers and livestock keepers.

Emerging issues in ensuring food security

Emerging issues that will affect the likelihood of improving food security and reducing poverty in emerging economies include:

- the growing role of the private sector in food and agriculture;
- the intersections between agriculture and mining; and
- the implications of food security challenges for public policies, including investments in international agricultural research.

ELEMENTS OF FOOD SECURITY – AVAILABILITY, ACCESS, AND USE OF NUTRITIOUS FOOD

Food security is defined by the United Nations Food and Agricultural Organization (FAO) as "all people at all times having access to sufficient nutritious food at affordable prices".

There are three interrelated elements of food security:

- **Food Availability** through improving **productivity** and **policies**.
- **Food Access** through enabling better **market access** and increasing **incomes**.
- **Food Utilisation** through better **nutritional quality** of food, reducing postharvest **waste**, improving **food safety**, and **value-added** food products.

Growing role of the private sector in food and agriculture in emerging economies

“Millions of small farmers are reached commercially every day as they buy seeds, crop protection products, mobile phones ... taking advantage of the science and research embodied in these products ... ”

DR MARCO FERRONI, EXECUTIVE DIRECTOR,
SYNGENTA FOUNDATION FOR SUSTAINABLE AGRICULTURE

Growing markets in emerging economies for agricultural products and food

The increasing attractiveness of emerging economies in Africa to the private sector is because this is where economies and markets for various goods and services are growing. While countries in Europe and North America are barely growing in terms of gross national income (GNI), several countries in sub-Saharan Africa have annual GNI growth of 5-10% (for example, Botswana, Ethiopia, Kenya, Tanzania and Uganda). The African Union's New Partnership for Africa's Development (NEPAD) has set a target of 6% annual growth in gross domestic agricultural production for countries that sign onto NEPAD's Comprehensive Africa Agricultural Development Program. Several African countries are close to meeting this target in 2012 (www.nepad-caadp.net).

A successful 'Green Revolution' in Africa will require viable private sector participants in the emerging economies of Africa. These participants will be indigenous African private companies, including small and medium scale enterprises (SMEs), and multinational companies, including those who partner with African SME companies in various joint ventures.

For example, the successful, widespread adoption of mobile phone technology and other information and communications technologies (ICTs) across Africa has led to the development of African national ICT companies

and the entry of multinational ICT companies into Africa's markets. These investments also open up opportunities for new ventures between ICT companies and agricultural enterprises and for small-scale producers to access information to guide their decisions on markets, input purchases and the like (for example market prices on tradable commodities, extension services to improve crop and livestock productivity and weather forecasts, including predicting extreme weather events).

The rapid emergence of African economies means that the emerging economies now termed the 'BRICS' (Brazil, Russia, India, China, and South Africa) may soon be joined by several more booming African countries.

Public/private partnerships to stimulate growth in markets

As the private sector expands in emerging economies, there is also a role for 'not-for-profit' private enterprises that are delivering products and services for small-scale producers in Africa. Public/private partnerships seek to deliver 'scalable solutions' for small-scale farmers, whereby a pilot project in one country and/or a few locations can be scaled out across many locations. The Syngenta Foundation for Sustainable Agriculture (SFSA) has invested in several such partnerships, deriving some lessons on what creates a successful public/private partnership (www.syngentafoundation.org).

'PLANTWISE': AN INNOVATIVE MANAGEMENT SYSTEM FOR PLANT PESTS AND DISEASES

Plantwise is a global partnership, led by CABI, seeking to improve food security through strengthened national systems of plant health. Plantwise connects farmers to the information they need to help them to lose less, grow more and improve crop quality. The approach is based on three inter-linked components: **Local plant clinics**; **national plant health systems**; and a **global knowledge bank**. The spearhead is a network of local plant clinics, where plant specialists give advice on any problem and any crop. Farmers are given a diagnosis and recommendations on disease management. Looking forward, CABI is developing mobile-based agri-advisory services in India, in a business partnership which utilises a country-specific database to deliver advice to over four million farmers. Further information: www.cabi.org.

Several commercial companies, including the Syngenta company, have committed themselves to making substantial investments in agribusiness in Africa under a G8 initiative developed by President Barack Obama at the G8 meeting in Chicago in 2012 (www.whitehouse.gov/the-press-office/2012/05/18/fact-sheet-g-8-food-security-and-nutrition).

Some examples of public/private partnerships include:

- **micro-insurance:** index-linked insurance of crops and livestock;
- **Plantwise:** biosecurity for pest and disease control;
- **One Acre Fund:** delivery of agricultural inputs to small-scale producers; and
- **value chains:** for cash crops such as cocoa.

Role of private enterprise in reducing food loss

The private sector also has an important role in reducing food losses. Indeed, a concerted effort to reduce food loss in developing countries would have a major impact on the amount of additional food needed by 2050. Rather than requiring 70% more food production this could become 50% more food needing to be produced if postharvest losses are better managed. Private-public partnerships could build infrastructure to store and preserve food. This would include grain storage facilities that exclude

vermin and solar-powered, controlled-temperature facilities for other food commodities including animal-sourced foods.

Private enterprise will also contribute to reducing food loss by developing new technology to determine the optimal time of harvest and for the efficient recovery and handling of food. Nutritional security is an essential component of food security and private enterprise will have an important role in developing crops rich in micronutrients and fortified food with essential micronutrients.

Role of private enterprise in water management and distribution

Another role for private enterprise is in building infrastructure for water management and water distribution schemes (also linked with mining enterprises). The efficient utilisation of water for food production will become increasingly more important given the projections for climate change, particularly in sub-Saharan Africa. Private enterprise further contributes to water use efficiency by developing and distributing crops that have improved water and nutrient efficiency within a framework for well-established and equitable water resource governance.

ONE ACRE FUND is a not-for-profit organization that works with farmers in Kenya, Rwanda and Burundi. The Fund invests in farmers to help them grow their business. It provides micro credit and agricultural inputs to help generate gains in farm income. The One Acre Fund facilitates transactions along the farming value chain, from organising farmer groups to negotiating with export markets to sell surplus produce. Every year, One Acre Fund weighs thousands of harvests and measures more than 100% average gain in farm income per acre. The approach of supporting small-scale farmers as businesses is receiving considerable attention. The One Acre Fund won the global Financial Times/International Finance Corporation (IFC) award for 'basic needs financing' in 2010 and 2011. Further information: www.oneacrefund.org and www.syngentafoundation.org.

What is required to enhance business in emerging economies?

The beneficial growth of the private sector in emerging economies depends on the following:

- Peace and political stability in the country concerned.
- Macroeconomic policies that encourage stability, investment and economic growth.
- Market policies that encourage growth in local and regional markets, and international trade.
- A transparent legal and regulatory framework to govern the food and agriculture sector (for example release of new plant varieties, licencing of veterinary medicines and vaccines, and regulation of genetically modified organisms for experimental and commercial use).
- Clear definition of titles to or rights to access land and access to environmental resources such as water.
- A seed system to enable the distribution of quality seeds of improved plant varieties.
- A veterinary regulatory system to enable the production and distribution of veterinary products that protect animal health (for example diagnostics and vaccines).
- Investments in infrastructure
 - to enable public and private investments in roads, hospitals, schools, regional centres and telecommunications. Such infrastructure can be shared by different productive sectors in-country including agriculture and mining.
- Investments in people
 - to allow an educated and skilled workforce, which is critical for economic development, requiring investments in education at all levels and training.

MICRO-INSURANCE OF CROPS

A promising new product to reduce the risk of farming in Africa is micro-insurance of crops. This enables small-scale farmers to insure their crops against loss due to drought at an affordable cost. This reduces the risks for those who farm in areas of variable weather and increasing frequency of droughts. The insurance is marketed through mobile phones, whereby the farmers pay the insurance premiums and the insurance pays out when rainfall is less than expected according to a previously determined index. This insurance enables farmers to buy new seeds when crops are lost such as for maize, the rain-fed staple food in east Africa. SFSa is developing micro-insurance of crops as a public private partnership with pilot projects in Kenya and Rwanda. Further information: www.syngentafoundation.org.

INSURING AFRICAN LIVESTOCK

The Index-Based Livestock Insurance (IBLI) designed by the International Livestock Research Institute (ILRI) in Nairobi, Kenya, enable pastoralists in arid and semi-arid regions to insure their livestock assets against livestock losses due to severe drought. This novel micro-insurance product comes at a time when residents of northern Kenya, as well as millions more pastoralists in the Horn of Africa, are grappling with drought.

Pastoralists can now insure their cows, sheep, goats and camels at a premium per head. The insurance pays out according to a satellite-determined index of feed availability which is linked in turn to rainfall and likelihood of livestock stock losses. The insurance is marketed via mobile phones, whereby pastoralists pay their premium and collect any insurance payouts (as during the 2011 drought). Further information: <http://livestockinsurance.wordpress.com>.

Interface of agriculture and mining – friends or foes?

Revenue from mining (and other resource extraction industries) is an important source of national income for emerging economies, including in Africa. Mining attracts private investment in emerging economies from large international mining companies. Some of the challenges and opportunities in the intersections between agriculture and mining, some of which relate to food security, are outlined below.

Challenges:

- Competition between agriculture and mining for natural resources (especially land and water).
- Competition between agriculture and mining for skilled workers.
- Impact on local communities, including the impact of mining on indigenous communities that may be asked to resettle away from proposed mining sites.

Opportunities that could be shared by agriculture and mining:

- **Access to new transport infrastructure:** New roads and railways that are built to move minerals to ports can also be used to improve market access for agricultural products, especially for small-scale producers in remote areas (where mines tend to be located).
- **Food distribution networks:** Improved roads can help move surplus food to areas where it is needed, thereby creating internal markets. Agriculture inputs can also be accessed more easily around the country, to increase food productivity. One of the main causes of recent price volatility in Africa is the inability to move surplus food from where it is grown to where it is needed by rural and urban consumers.
- **Modern energy and water technology:** Mine energy and water supply systems can be planned and designed to enable the sharing of infrastructure and technology by partnering with existing communities and agricultural producers. This could include efficient irrigation, fuel supplies and machinery at a lower cost.
- **Shared social infrastructure** for mining and agricultural communities (for example health services, schools and sports facilities).

- **Off-farm employment opportunities:** Income of small-scale producers can be increased by part-time employment in other sectors, including mining. Food security comes not only from producing food (availability) but also from people being able to buy sufficient food (access), thus addressing two of the key elements of food security.

Potential for productive coexistence of agriculture and mining

- **Agriculture and mining can co-exist.** For example, mining companies have shown that agricultural development opportunities, such as land for mining workers to grow their own food, can coexist with mining ventures (for example Shell Petroleum has supported improving cassava productivity in the Niger delta in Nigeria).
- **Rehabilitation of land** at mine sites is required by law and occurs in practice, during and after mineral extraction. A mining sector that is environmentally and socially responsible can help advance local public and private standards of production, business, governance and environmental protection in a country.
- **Mining entities can partner** to procure supplies from local producers. Local agricultural producers can be actively encouraged by a mining entity to improve production to meet mine procurement supply standards and volumes over time for mutual benefits.
- **Skill sharing of selected mine workers** to assist local producers to build and maintain public infrastructure as part of a corporate social responsibility program.
- **Local education and skills training** can be catalysed by a new mining activity. The demand for local skilled labour for mining production may inspire the establishment of appropriate higher education and training facilities. This would enable new service industries to develop, diversifying the local economy and creating alternative employment options.
- **Conservation and rehabilitation** of natural resources can be undertaken successfully (for example conservation and rehabilitation of flora and fauna, protection of water sources from contamination and land management practices that protect soil productive capacities).

Public policy implications

The challenges of the intersections between agriculture and mining in emerging economies are shared by industrial and developing countries where agriculture and mining are important sectors of the economy and where the two sectors are in competition for human and natural resources (especially land and water). There is also a public policy debate common to many countries as to how best to invest some of the profits of mining into long-term economic and social development. These issues are important to many countries in Africa including Angola, Cameroon, Liberia, Mozambique, Nigeria and South Africa. There are also other experiences to be shared with countries such as Australia, Canada, the Netherlands, Norway and the UK in terms of deriving long-term benefits from mining resources.

The potency of private sector investment is quite evident in the mining boom in some countries in Africa as well as in other developing countries. The value of private sector investment in mining in Africa is about equal to total flows of official development assistance to the continent. A successful mining industry can aid national economic growth, produce a healthy trade surplus and encourage an inflow of investment capital. Overall, a profitable mining industry generates broader economic growth

and prosperity for the whole country. On the other hand, a booming mining industry can have seemingly perverse consequences for other sectors of the economy. For example a strengthening national currency, which may be due at least in part to strong mineral exports, will make agricultural, manufacturing and services exports relatively more expensive (and competing imports cheaper); demand for skilled labour in the mining industry can place cost and supply pressures on other sectors; and infrastructure investment for mining investment regions may compete with demands for infrastructure support in cities and rural areas. Sound economic policy, good governance, good corporate behaviour and strong social responsibility programs and infrastructural investment are key to beneficial outcomes of any mining boom.

These issues are being pursued in depth by the Crawford Fund, which has chosen mining and agriculture as the focus for its 2013 Parliamentary Conference. This will be held in conjunction with the 2013 Africa Australia Research Forum in Perth, Western Australia, on the topic of 'Mining, agriculture and development – Bread from stones?' The Conference and Forum will address the interface between resources and agriculture in rural Africa (McHenry, 2011).

AUSTRALIAN MINING INVESTMENT IN AFRICA

As of July 2012, current investments are in the order of AU\$24 billion with more projects in the pipeline.

There are over 200 Australian Stock Exchange (ASX-listed) companies with more than 650 projects across 37 African countries.

[www.dfat.gov.au/
media/speeches/
department/120725-
Australia-Africa-Universities-
Network.html](http://www.dfat.gov.au/media/speeches/department/120725-Australia-Africa-Universities-Network.html)

Implications of food security challenges for public policy

There are public policy implications that flow from the growing role of the private sector in emerging economies. Some key issues that will influence future public and private investments are outlined below:

Where to invest?

The balance between short-term gains versus where needs are greatest:

- in emerging economies with market growth potential, political stability, and an enabling environment for agri-business; or
- in areas at risk of food insecurity including that caused by climate change and climate variability.

What to invest in?

There is a need for renewed analysis of 'market failures' where public investment is warranted.

- There is a balance to investing in 'global public goods' vs. private goods, as alternative means of generating and delivering new knowledge and technologies to increase agricultural productivity.
- Initial public investments can stimulate subsequent business development and public/private partnerships in delivery of services (seeds, inputs, insurance).
- There are some priority areas for investments in public goods, especially where private companies are unable to appropriate benefits from investments (conservation of natural resources such as land, water, ecosystems, biodiversity).
- Control of parasites, pests and diseases and invasive species are increasingly important in emerging economies for biosecurity and their impact on trade.
- Public investments in 'orphan crops' are warranted, as such crops are essential for food security but are rarely internationally traded commodities (for example Africa highland bananas, cassava, sweet potato, sorghum and millets).

- Control of the endemic, infectious diseases of livestock in regions where livestock are critical for food security, such as for pastoralists in arid and semi-arid lands.
- Capacity strengthening and training is an essential public good.

How to invest?

There are new ways for public investments of development funds to 'crowd in' rather than 'crowd out' the private sector in food and agriculture in emerging economies. Innovative approaches include:

- **'Ag Results'**, as a new market pull mechanism to encourage greater private sector participation in the food and agricultural sector in emerging economies (this is a new development initiative emerging from the G20, www.worldbank.org/cfp/agpm);
- **advance markets commitments**, as another mechanism to encourage private sector investments in R&D in order to develop medical, agricultural and veterinary products for emerging markets (as advocated by Hon. Bob McMullan in the Sir John Crawford Lecture 2009, www.crawfordfund.org);
- **the CGIAR Consortium Research Programs (CRPs)**, where these new programs of the consortium of international agricultural research centres (IARCs), are placing greater emphasis on the delivery of new knowledge along value chains, where the importance of the private sector is recognised (www.cgiar.org); and
- **public/private partnerships**, for example modern technology and communications to enable small-scale producers to access agricultural knowledge, goods and services, using mobile phones (www.syngentafoundation.org). Significant progress is also being made through initiatives such as the 'One Acre Fund' and 'Plantwise' that leverage the telecommunications industry to enable farmers to access technical advice through structured business relationships.

Conclusion – the end of aid?

The rapid economic progress made over the last 25 years by a number of developing countries, known now as the emerging economies (of which the so-called BRICS are exemplars but not the only examples), is turning the traditional economic order on its side, if not on its head. It also holds out the prospect of an end, eventually, of the era of development assistance as the dominant phenomenon it has been for the second half of the 20th century and the first decade of the 21st.

One radical interpretation of this re-ordering is that donor governments should start thinking about a longer-term goal of reducing the target official development assistance (ODA) to GDP ratio from 0.7%, as is the United Nations goal today, to a future ODA target of zero as all developing countries and their people emerge from poverty and food insecurity.

This goal may seem a distant prospect today with over one billion poor and hungry people in the world, concentrated in South Asia and sub-Saharan Africa. But when we reflect on the achievements of the many countries in Asia (especially China and India) and Latin America (notably Brazil and Argentina), in moving millions of people out of poverty within the past 50 years, it is by no means an unobtainable goal.

In considering this long-term goal, there are issues of immediate interest.

- Should there be changes in how aid funds are directed so as to accelerate economic development in emerging economies?
- Are there lessons to be learned from the experiences in Asia and Latin America that would guide investments in the countries of Africa?
- How can safeguards be put in place by governments to protect the more vulnerable sections of society – those most at risk from shocks (from example from extreme weather events or food price volatility) – which can cause people to fall back into poverty?
- How can we invest in international agricultural research to serve both emerging economies and vulnerable communities within both emerging economies and least developed countries?

In regard to the future funding of international agricultural research, there may be, for example, a progressive shift away from funds coming mainly from OECD public sector donors to funding of international agricultural research by an array of national governments in emerging economies, private sector investors (including farming cooperatives), philanthropic organisations and more public/private partnerships. These new types of investors would commission international research institutes and programs, such as the new CGIAR Consortium Research Programs (CRPs), to produce new knowledge and deliver scientific discoveries and new technologies to meet the development needs of the various investors.

If we are to encourage greater private sector investment in international agricultural research, we must address concerns that the private sector legitimately has on a return on its investment and a belief that protection of intellectual property is essential to delivering these returns. It was argued at the Crawford Fund Parliamentary Conference in 2010 that many of the scientists working for major agrochemical companies were at least in part motivated by delivering benefits to the poor or “doing well by doing good” as the Crawford Fund would put it. Similarly, as we see in the mining sector, the willingness of developing country governments to encourage private sector investment is sometimes linked to social responsibility requirements. These twinned sentiments are sometimes reflected in social responsibility programs. Some companies have gone further and have established philanthropic arms to work on humanitarian issues and not-for-profit activities. However, the companies have a duty to their shareholders to deliver a commercial return on their investments and so will only engage in markets where cost recovery and profit are possible.

A resolution of this conundrum will require a reexamination of the efficacy of ‘international public goods’ as a means for ensuring future food security, in comparison with investing in and managing intellectual property rights for the benefit of small-scale producers and poor consumers in emerging economies, and encouraging greater private sector participation in international agricultural research.

Other emerging issues in food security

These issues on the future financing of international agricultural research, in the context of the future of official development assistance for emerging economies, are the subject of a forthcoming discussion brief on 'The End of Aid?' in this series of *A Wider Canvas for International Agricultural Research*. Another forthcoming topic in the series will be the interface between food security and the environment, including the interface between biosecurity and biodiversity.

Our aims in commissioning the briefs are to encourage new thinking in the design and conduct of international agricultural research and development; to identify emerging trends in world food security that will affect the future research and policy agenda; and to demonstrate the benefits to the public and private sectors of investment in agricultural R&D. Over the next two years, we wish to contribute to a reorientation of mainstream thinking on issues such as the role of the private sector in ensuring global food security; the scope for synergistic investments in the agriculture and mining sectors; and the potential for mutually supportive policies and programs in biosecurity and biodiversity. In the longer run, we want to set the studies in the context of a revised set of development goals in the light of the substantial but mixed progress toward the achievement of the millennium development goals agreed by governments, and which are coming towards their target deadlines in 2015.

The series is available online via www.crawfordfund.org, www.syngentafoundation.org, www.doylefoundation.org, and www.qci.uq.edu.au.

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The co-sponsors of this series of policy briefs are: The Crawford Fund, Australia; the Doyle Foundation, Scotland; the Syngenta Foundation for Sustainable Agriculture, Switzerland; and the University of Queensland Global Change Institute. These organisations have indicated a willingness to explore new territory in identifying issues that will affect future world food security and to enter into conversations on different ways of tackling these issues.

The co-sponsors have established a Steering Committee to oversee the development of the series, consisting of Drs Denis Blight (Crawford Fund), Andrew Bennett (Doyle Foundation), Marco Ferroni (Syngenta Foundation for Sustainable Agriculture) and Professor Michael D'Occhio of the University of Queensland Global Change Institute. Their guidance and support for the overall development of the series and in developing the content of this brief are much appreciated.

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Dr Gabrielle Persley AM
Brisbane, October 2012

Disclaimer: The views expressed in this brief are those of the author and do not necessarily reflect the views of the co-sponsors of the series *A Wider Canvas for International Agricultural Research*.

“Who among you,
if your children
ask for bread, will
give them stones?”
MATTHEW 7:9

• This brief is part of a study initiated by the Crawford Fund, and involving other like-minded foundations to analyse the effect of emerging trends in world food security, their implication for the international research agenda and potential new funding streams for such research. The study will also seek to demonstrate the benefits of investments in international agricultural research. The research study director is Dr Gabrielle Persley, chair of the Doyle Foundation, Scotland.

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