



# INVESTING IN FOOD SECURITY





## THE AGRICULTURE AND CONSUMER PROTECTION DEPARTMENT

**strives to strengthen  
the role of agriculture  
in food security,  
poverty reduction,  
food safety, economic  
development and trade  
while safeguarding the  
natural resource base,  
ecosystem services and  
the environment.**

The Agriculture and Consumer Protection Department works with its partners and relevant stakeholders in the design and negotiation of agricultural sector policy and strategies. This includes development of institutional instruments to create an enabling environment for

technological progress and for achieving the multiple goals of the sector. Working in a holistic manner to address the range of issues that affect the world's food chain, the Department is responsible for FAO's programmes on the improved production, management and conservation of crops and livestock; transboundary plant pests and animal diseases; and the production, processing, distribution and consumption of nutritionally adequate and safe food.

The Department hosts FAO's Secretariat of the Committee on Agriculture (COAG) and is responsible for action to support member countries in ensuring institutional collaboration in the global governance of threats to the food chain. It also hosts the Secretariats of two of the three standard-setting bodies of the WTO/SPS Agreement – the International Plant Protection Convention and the Codex Alimentarius Commission – plus several international legal instruments, such as the International Treaty on Plant Genetic Resources for Food and Agriculture, the Rotterdam Convention and the Desert Locust Control Committee.



# INVESTING IN FOOD SECURITY

With global population expected to reach more than nine billion by 2050, FAO estimates that agricultural production will need to grow by 70 percent if it is to keep the world's population fed and healthy. Only about 10 percent of this growth will come from availability of new lands which means that 90 percent will need to come from intensification of current production. Ensuring that this intensification is sustainable will require enormous investments for primary agriculture and storage and processing infrastructure – just to stay abreast of the population growth.

Considering that 70 percent of the world's hungry live in rural areas and that smallholder farmers also tend to be food insecure worldwide – with intermittent or inadequate access to food – FAO members have put stress in the new Strategic Framework on the need to improve smallholder productivity by promoting more effective public and private investment in agriculture and rural development.

If these smallholders can be more productive and efficient in their farming operations and manage to make a profit, they can feed their families but also invest in their own farms by purchasing better quality seeds, fertilizer inputs and farming equipment. So to start, investment in appropriate research and ensuring farmers' access to new innovations is essential. Yet, in addition

to the ever present constraints of climate variability and plant and animal pests and diseases, these smallholders face obstacles such as lack of credit, insecure land tenure, poor roads and transportation and lack of market opportunities. Diverse but well targeted investments, coupled with sound policies and strategies are needed to ensure the kinds of returns that will allow smallholders as well as larger producers to continue investing in their farming operations.

Looking to the future, most investments in primary agriculture, storage and processing sectors will have to come from producers, processors and traders. The role of the public sector will be to enact and enforce regulations that create the kind of safe environment that will attract investors. This includes



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enabling smallholders to meet food quality standards through the adoption of good practices, backed up by certification and inspection, supporting local research and extension, improving transportation and market infrastructure, and providing the kind of training and capacity-building opportunities that will ensure that human resources are there to enforce and operate the agricultural support systems. Within this scenario, investments by the international and donor communities and the commercial private sector can boost private sector farmers and governments through support of agricultural development programmes that improve production and market opportunities.

The FAO Agriculture and Consumer Protection Department has produced this series of briefs in the interest of guiding investments. They highlight

12 aspects of agricultural production, processing and food quality to illustrate where investments can have big returns in terms of improving productivity and livelihoods while protecting the natural resource base so essential for sustainability.

Investors set their priorities based on situations that vary from country to country or even within countries. A country's investment needs depend on factors such as its size, population and level of economic and infrastructural development and the development level of its agricultural sector and agri-businesses.

However, there also are "limiting factors" that must be factored into any investment plan. These may be water resources in one area, but in another they will be quality of seed, prevalence

of transboundary diseases or pests, or lack of post-harvest storage facilities. That is why it is critical to look at the big picture – and to seek a combination of answers. Those with water still need fertilizer, and fertilizer gives its full benefits if applied to appropriate seeds. Knowledge generation and transfer are not cost free and best practices are not fixed in time. All factors and players must be considered to pinpoint targets and realize the full benefit of the investment.

As awareness of the critical importance of agriculture and agricultural production has grown, so has the interest of the international community and the political will to target investments to agriculture. The briefs included in this folder are meant to provide stakeholders at all levels with a new view of investment choices.

### **Modibo T. Traoré**

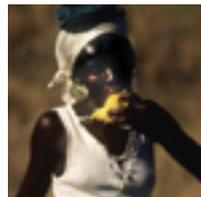
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**WHAT IS NEEDED:**

agro-processing capacity to meet increasing food demand and quality requirements

**HOW TO GET THERE:**

investment in increasing local processing capacity and a requisite infrastructure support base



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## AGRO-PROCESSING EXTENDS MARKETS TO MEET INCREASING FOOD DEMANDS

Agro-processing operations such as milling cereals, extracting edible oils and ginning cotton have significant implications for poverty reduction, food security and economic development. They are carried out at three levels: household processing for home consumption and or local markets; small and medium enterprises (SMEs) which serve local and national markets, with a select few able to compete in cross-border trade; and large agro-processors who are associated with large-scale production systems, such as cotton, sugar and groundnuts.

Processing allows agricultural products to be conveniently stored, transported and presented in forms demanded by consumers. This greatly extends the markets in which they can be sold, and permits sales at higher prices and in larger quantities. Successful processing enterprises can generate foreign exchange, provide employment, contribute to food security by preserving food, and represent a stable and profitable source of income for processors and for the farmers who provide raw materials.

Immense opportunities for diversification are possible through processing and utilization of residues and by-products, such as molasses, rice husks and press cake, which are generated in processing operations further upstream in the value chain. The creation of employment through agro-processing also serves to reduce migration from rural areas into crowded cities, especially of unskilled young people. It is also noteworthy that women have a marked involvement in small-scale agro-processing and related marketing activities.

Urbanization will play an important role in determining investment needs for agro-processing. For example, FAO projects that 50 percent of Africa's population will live in urban areas by 2030, rising to 62 percent by 2050.

This trend, combined with rising per capita incomes and growing predominance of supermarkets, will mean increased demand for processed products, as well as very stringent quality and consumer safety requirements.

### AGRO-PROCESSING TO 2050

Cumulative investments required by region over 2005/07 to 2050 in billion USD

Region	Net	Depreciation	Gross
Sub-Saharan Africa	79	129	208
Latin America & Caribbean	207	447	654
North Africa & Near East	62	158	220
South Asia	103	364	467
East Asia	119	563	682
<b>Total</b>	<b>570</b>	<b>1 661</b>	<b>2 231</b>

Population growth projected for all developing regions requires parallel increases in capacity to process agricultural materials. This table shows the investment needs for first-stage processing. Gross investment is the sum of the net addition to existing stocks plus replacement of existing stocks to account for depreciation.



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## Investments in agro-processing support areas

Any effort to expand capacity to process agricultural materials must be accompanied by investments in the following areas:

### Upgrading processing technologies –

Investments are required in research and development (R&D) to upgrade traditional small-scale processing technologies. In sub-Saharan Africa, the use of rudimentary technologies for processing millet, sorghum and other local cereals has led to increased dependence of the growing urban population on imported wheat and rice. For the medium- and large-scale agro-processing sectors, local and foreign direct investment (FDI) have to be promoted to facilitate acquisition of the technologies required. Current trends show growing South-South FDI flows, such as Indonesian and Thai firms investing in neighbouring Southeast Asian countries, while sub-Saharan African countries increasingly receive FDI from China, Brazil, India and South Africa.



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### Access to raw materials, inputs and markets –

Agro-processing operations first need access to sufficient raw materials and other inputs such as packaging materials and machinery parts, and then they must have channels to market their finished products. Strong links and adequate information flows are required between producers and agro-processors to ensure adequate supplies of raw materials. For small-scale enterprises and farmers, this may mean organizing into groups to facilitate meeting the quantity, quality and timing requirements of their customers. Farmers also need capacity strengthening on which varieties to grow, good agricultural practices and production planning.

**Infrastructure** – Support to input supply, processing and output marketing operations must have commensurate investments in rural roads, logistics systems, potable water, electricity, information and communication technologies and waste disposal facilities. Infrastructure is also required for storing processed food meant for rapid emergency aid, working stocks for regular distribution and buffer stocks to stabilize domestic prices. Processing facilities must comply with quality and safety standards and therefore must be equipped with the requisite quality assurance infrastructure.

**Human resources** – A qualified human resource base is critical for successful use of the processing investments. Thus, investment also is needed to train persons to operate and manage processing systems, and to design, fabricate, repair and maintain processing equipment and related infrastructure.

### Areas for investment identified by region

*In 2008, FAO co-organized the Global Agro-Industries Forum (GAIF) where key action areas for agro-industries were identified by region.*

- **Africa:** Provide infrastructure, especially rural roads and power; improve the business environment; facilitate access to raw materials, technologies and to funding sources.
- **Asia-Pacific:** Invest in R&D and in infrastructure; harmonize food safety standards; develop human resource capacity and business models to facilitate formalization of the informal sector.
- **Latin America & the Caribbean:** Improve infrastructure; support research, technology development and transfer; develop economic zones to promote SMEs in rural areas.
- **Near East:** Strengthen producer associations; enhance access to information and to finance; improve technical skills; support R&D and innovation for traditional and ethnic foods.

FAO assists member countries in developing appropriate policies, institutions and services to promote investment in the agro-processing sector. It also assists agro-processors in developing managerial and technical skills to improve efficiency, competitiveness and profitability of the investments.



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**WHAT IS NEEDED:**

storage facilities to reduce food losses and increase food safety

**HOW TO GET THERE:**

investment in storage infrastructure

## STORAGE FACILITIES SOLVE LOGISTICAL, FOOD SAFETY AND MARKETING PROBLEMS

In developing countries, some 30 percent of the food consumed is perishable, yet only 20 percent of that food has access to refrigeration. As a result, high losses occur following harvest, slaughter, fishing and milking, during transportation and at markets. Adequate storage is a condition for both efficient marketing by the private sector and for holding public reserves that may be necessary to guarantee food security. Increased access to refrigerated storage in developing countries could be significant in reducing post-harvest losses, improving food safety and adding value to agricultural food products. For this to be achieved, important issues related to management of the facilities will have to be addressed.

**Logistics** – In developing countries, most food comes to consumers from small- and medium-scale agricultural operations and from imports. The fact that most consumers now reside in urban areas means that food produced in rural areas must find its way from the farms to consumers. Increasingly, a significant percentage of this produce will need to be stored for reasons of logistics and distribution, and because of the simple fact that production is seasonal while demand, particularly for staples, is throughout the year.



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**Marketing** – Continued provision of safe and nutritious food at affordable prices will require increased food production, effective rural-to-urban market linkages and efficient support services. Achieving this will depend on significant investments in the rural infrastructure and support services. This includes operation and management of dry storage facilities, mainly for cereals, beans, pulses and oilseeds, and of cold storage facilities, mainly for fruits and vegetables, livestock products and fish. Smart management of food storage and warehousing allows producers and traders to obtain credit through the warehouse receipt system, which is a powerful marketing tool.

### Programmes to reduce post-harvest losses based on practical experiences

The importance of grain storage as part of global marketing, distribution and food security systems is well recognized. The Group for Assistance on Systems relating to Grain After-Harvest (GASGA) was established in 1971 to bring together experts and coordinate activities on research and development. It continued in 1999 as the Global Post-Harvest Forum PhAction which focuses on a wide range of agricultural products. The Special Action Programme for Prevention of Food Losses (PFL), launched in 1978, has implemented more than 250 projects worldwide to introduce new technologies aimed at improving preservation of agricultural products and reducing losses. In 2006, rural infrastructure was added as development target to focus on infrastructure to increase farmers' access to inputs and markets, cold chains



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to reduce fresh product losses, and warehouse and storage infrastructure to reduce loss of staples, both on-farm and within the marketing system.

### Investments must consider the entire food-storage sector

Efforts to increase food production in developing countries require parallel efforts to increase investments in storage and processing facilities. These range from investments in small-scale, on-farm storage to medium- and large-scale facilities of 1 000 tonnes or more. Traditional village stores need to be improved within the means of smallholders, to ease a gradual transition to larger and more modern storage systems. In some cases, this

will require new construction, in others, there will be scope for rehabilitation of unused facilities. However, the entire storage sector infrastructure must be considered. This means that in addition to handling, conditioning and packaging facilities, there must also be improvements in road networks, transportation, power supply and communication systems.

Storage requirements are not static. Greater attention needs to be paid to the other factors that are likely to affect investments in storage infrastructure. Apart from population growth, other factors such as changing consumer preferences, climate change, new road and communications infrastructure and human migration determine where investments are required.

**Long term planning** – Government planners, financial institutions and the private sector need a framework for assessing the best ways to approach development of storage facilities plus medium- and long-term estimates of the magnitude of the investment. With this information, they will be able to carry out the forward planning essential for dealing with costly investments that require development spanning many years. Governments should aim to create the investment climate necessary for the private sector to make the required investments. Public-private partnerships also should be explored and, where necessary, governments may be required to invest directly in storage infrastructure, such as for national strategic grain reserves.

**Training and capacity building** – Investment in structures should be accompanied by training in the design and proper management of storage facilities. This will build the capacity of farmers, traders and others in the various chains and increase understanding of the technical and economic factors that impact the safety, quality and value of the products stored. Properly functioning storage facilities will benefit both rural producers and urban consumers in terms of increased incomes and reduced food prices as well as overall food security and safety.



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### COLD AND DRY STORAGE TO 2050

Cumulative investments required by region over 2005/07 to 2050 in USD billion

Region	Net	Depreciation	Gross
Sub-Saharan Africa	41	37	78
Latin America & the Caribbean	96	88	184
North Africa & Near East	20	46	66
South Asia	55	109	164
East Asia	65	240	305
<b>Total</b>	<b>277</b>	<b>520</b>	<b>797</b>

FAO estimates of the investments needed in cold and dry storage to accommodate projected 2050 crop and livestock production levels in developing countries.



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**WHAT IS NEEDED:**

locally focused learning opportunities for smallholders

**HOW TO GET THERE:**

investment in expanding the Farmer Field Schools approach into new regions

## FARMER FIELD SCHOOLS APPROACHES SUPPORT SUSTAINABLE, INTENSIFIED PRODUCTION

The Farmer Field School (FFS) approach was developed by FAO in Asia in the late 1980s. It emerged as a direct response to a widespread crisis in irrigated rice, in which misuse of toxic chemical pesticides had led to explosive outbreaks of secondary pests, health risks from pesticides and massive yield losses that threatened to undermine the production gains of the Asian Green Revolution. The solution required farmers to adopt alternative methods to toxic chemical pesticide use. However, this required a knowledge-intensive and local observation-driven management approach, which was beyond the scope of conventional extension systems of the time.

Since it was introduced, the FFS approach has evolved and spread widely, proving highly successful in agriculture and resource management settings where a complex or constantly evolving local context requires that knowledge-intensive practices be understood and adopted by farmers.

A typical FFS brings together roughly 25 smallholder farmers in a local field for half-day sessions once each week throughout a cropping season. With

the guidance of a training facilitator, farmers observe, experiment, discuss and jointly decide on how to manage their test plots in order to compare and evaluate conventional with new management methods.

The curriculum and training follow the production stages and growth phases of a crop, from soil preparation through harvest and post-harvest processes. Core training introduces basic soil fertility management techniques, improved crop-specific agronomic methods and integrated pest management (IPM).

Cropping systems include rice, vegetables, cassava, cotton, tea, mango, sesame and others, as well as non-crop applications such as pond-based aquaculture. FFS programmes around the world provide new training curricula yearly.

### **FFS integrates focus on farmers, research and future challenges**

**Multiple benefits to farmers and communities:** FFS farmers gain practical, “hands-on” understanding of fundamental agronomic, ecological and economic mechanisms underlying their production systems. Through training and post-training follow-on programmes, farmers gain the self-confidence to make improved management decisions and to build strong groups who continue to explore and develop new topics in subsequent seasons. Resulting drastic reductions in agrochemical pollution leads to subsequent improvements in environment and human health and, statistics show, farmers substantially increase production and profit.

**Improved value to research:** achieving successful outcomes from agricultural research ultimately requires that farmers understand, modify, validate and finally



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adopt improved practices based on their own context and determination. The FFS approach integrates farmers as key participants in the research-extension system and, thereby, feeds their important insights back into the research process. The adoption of improved practices through FFS is not an endpoint, but rather the beginning of a dynamic social learning process, leading to more resilient ecological and economic farming systems – a key aspect of sustainability.

#### **Preparing for future challenges:**

recognizing the need to increase food production while working to build sustainable farming systems, FAO has made sustainable intensification of crop production one of its strategic objectives. It has incorporated the following strategies to achieving that objective – putting FFS at the core of field-level implementation.

#### **Improving agronomic skills –**

improvements in basic agronomic skills make a large difference to yields and profitability for smallholders. Across a 500 ha rice polder in northern Benin, for example, adopting improved techniques for soil fertility and seedling management recently led FFS farmers to reduce chemical fertilizer inputs by almost 66 percent, reduce seed use by 80 percent and increase their yields by 266 percent (from 2.1 tonne/ha to 5.6 tonne/ha).

#### **Managing soil fertility and diversifying production systems through**

#### **conservation agriculture (CA) –**

reversing the downward trend in soil fertility is a global challenge. A new initiative is underway in West Africa to introduce a suite of CA methods through

FFS – including leguminous cover crops, interplanting, crop rotations, living fences and new sources of forage for ruminants. This provides multiple benefits to farmers, including increasing soil fertility and yields, decreasing input costs from chemical pesticides, better integrating livestock in the production system and providing a larger diversity of crops to sell, barter or consume.

**Introducing IPM** – ecological pest management is the historical core of the FFS approach. In a recent West African regional programme, statistics for some 30 000 FFS farmers across multiple crops show median pesticide use down by 75 percent, while yields are up 23 percent and net margins up 41 percent.

**Preparing for climate change** – improved and sustainable farming practices and the locally focused experiment-based approach embodied in FFS can help farmers adapt to the greater uncertainty associated with future climate changes. A FFS-based pilot project in Mali will soon introduce new drought- and heat-tolerant crops and varieties as well as new cropping systems and management practices for climate change adaptation.

### **FAO recognizes need for expanding role of FFS**

FAO continues to lead development of new forms and applications of the FFS approach and to promote adoption by government agencies. Future investment to support successful long-term adoption of these improved extension methodologies will include:

- designing and managing significantly scaled pilot projects that demonstrate the feasibility and utility of an FFS approach and expand the experience into new production systems,
- mobilizing experienced FFS trainers and managers across countries, regions and continents to ensure establishment of high-quality programmes in new countries,
- convening regional and international meetings to share experiences and new training curricula among countries,
- experimenting with more cost effective training-of-trainer methods and developing approaches to self-financing of FFS, through farmer associations and cooperatives,
- connecting existing networks of trainers and FFSs to other development initiatives that seek effective decentralized access to farming communities,
- helping FFS groups develop business management skills to link to local credit systems and improve access to local, regional and international market opportunities,
- working with governments to explore adoption of FFS training to address a diversity of national and international agricultural and environmental policy commitments.



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**WHAT IS NEEDED:**

access to and judicious use of fertilizer to increase yields

**HOW TO GET THERE:**

investment to increase production, distribution and access

## FERTILIZER INPUT CRITICAL TO MEETING FOOD DEMAND

It is inconceivable that the world can meet the growing demand for food, feed and fibre without judicious use of inputs, especially fertilizers. At the present level of crop production technology, about 160 million tonnes of fertilizer nutrients are consumed each year. By 2050, an estimated 215 million tonnes will be required per year to meet agricultural production needs.

The dramatic increase in food production in the 1960s and 1970s that resulted from the use of high-yielding seeds and mineral fertilizers in the Asian “Green Revolution” gave a clear signal that providing adequate plant nutrition through mineral and organic fertilizers would be key to the future development of agriculture, food security, poverty reduction and nutritional security, especially in the Low Income Food Deficit Countries (LIFDCs). In fact, there has been a food production increase of about 50 percent since the Green Revolution which has been credited to mineral fertilizer use.

Fertilizer use in the majority of food insecure countries is low. For example, the average application rate in all of Africa is less than ten percent of the rate in either North America or East Asia. As a result, inadequate plant nutrition with continuous mining of soil nutrients is limiting productivity. Serious efforts are required at the national and regional levels to develop appropriate policies, technologies and capacities to address this challenge. In addition to establishing

policies to ensure that soil fertility is not depleted in low-input systems, it is also critical to recognize the potential negative environmental impacts of fertilizers.

Policies are needed to curb overuse of fertilizers that, in some cases, can cause serious ecosystem damage.

### Promotion of fertilizers based on decades of experience

Fertilizer management is a broad agronomic issue. In addition to the technical aspects of fertilizer use, the logistical and financial aspects must be considered.

From the 1960s to the 1980s, FAO spearheaded a promotion for optimum use of fertilizers in Africa through its *Programme Engrais*, which was started with the help of the fertilizer industry. This programme included:

- presenting large-scale on-farm demonstrations,

- supporting educational programmes for farmers,
- training of trainers and input retailers,
- establishing group credit with revolving fund management mechanisms,
- creating units for fertilizer sector development and policies in appropriate ministries.

These initiatives, along with those of development partners, contributed to the success of the Green Revolution in Asia. However, the impact was much lower in Africa mainly due to insufficient control of water resources and lack of adequate fertilizers at affordable prices.

In response to the need for making fertilizers available to African farmers, an African Fertilizer Financing Mechanism (AFFM) was established pursuant to the Abuja Declaration by the Summit of African Ministers of Agriculture



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in June 2006. With the African Development Bank as the AFFM host, African states have committed to work together in boosting the production and availability of fertilizers throughout the continent, and in increasing farmers' awareness of fertilizers' importance. Compared to the present application rate of about 10 kg/ha of plant nutrients on African cropped soils, the target is to achieve 50 kg/ha by 2015. The investment needed to make this happen is projected to reach about USD 6.8 billion by 2050.

Such positive action has been launched in Latin America too. In Bolivia, experiments conducted under the *Fertisuelos* project and supported by FAO have enabled farmer groups to develop a revolving fund through which farmers receive the amount of fertilizer they need at the beginning of the season which they pay back at harvest time, without any interest. In addition to the refund, they each make a payment to the farmer group's bank account in order to build enough capital to make bulk purchases of inputs.

FAO is actively involved with regional economic communities and other partners in facilitating the development of the fertilizer sector. As with other input strategies, fertilizer-related initiatives are needed beyond the national level. FAO supports and complements the AFFM effort and has been providing technical and policy assistance to other regional strategies for input, such as the Common Market for Eastern and Southern Africa (COMESA), and through a technical cooperation project aimed at alleviating the impact of soaring food prices on the most affected vulnerable farming population of Asia.

### Fertilizer development at three levels

Meeting the food production target of 2050 will require an estimated 230 million tonnes of fertilizer nutrients consumption per year, a 45 percent increase over current use. To achieve this goal, three specific aspects of development must be addressed.

**Supply** – Increase in fertilizer production requires heavy investments to build up new industrial capacities and enable fertilizers to be supplied largely through existing multi-country trading and commercial enterprises. Increasing and ensuring the efficiency of these operations will require governments to facilitate private sector participation and develop common transportation and storage hubs in order to achieve economies of scale in procurement and distribution – from appropriate regional fertilizer facilities to the farmgate. In addition, consistent efforts must be made to promote local fertilizer production whenever possible, taking advantage of the shorter distances required for distribution.

**Distribution** – Investments in increasing warehousing capacity and in improving road, rail and water transportation logistics are essential to overcoming distribution constraints. Government participation will be needed to facilitate private fertilizer sector participation in commercial supply and distribution structures. For example, governments should help the private sector set up inputs shops in villages where smallholders who cannot afford to buy fertilizer inputs at the beginning of the season can arrange to defer payment until harvest time.

**Use** – To be cost effective, fertilizers must be applied properly and used efficiently by the crop. Norman Borlaug, 1970 Nobel Laureate whose work in developing high-yielding crops enabled Asia's Green Revolution, felt farmers paid way too much for fertilizer products because "much of the nutrients in applied fertilizers are never used by the crop." This indicates the importance of promoting sustainable plant-nutrition management and focusing research on optimization of inputs according to crop rotation, paying attention to cash crops that provide a good return to the expense of the fertilizer which, at the same time, supports subsistence crops. However, this must be integrated with innovative ways to reach farm families with better farming approaches. Access to inputs and to markets for farmgate production output cannot be ignored.



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**WHAT IS NEEDED:**

increased investment in food safety infrastructure and human resources

**HOW TO GET THERE:**

Broad stakeholder participation in food safety investment planning

## INVESTING IN FOOD SAFETY SUPPORTS HEALTH AND TRADE

Illnesses due to unsafe foods place a tremendous burden on the public health systems of both developed and developing countries. The World Health Organization (WHO) estimates that each year foods contaminated with microbial pathogens cause millions of cases of acute diarrhea, particularly among the world's very young and elderly populations, and that numerous other chronic diseases worldwide, including cancers, may be linked to consumer exposure to foods with unsafe levels of chemical residues, environmental contaminants and other chemical hazards.

These illnesses result in tremendous personal suffering and hardships for those affected, including loss of productivity, earnings and educational opportunities and, in many cases, death. In addition, food safety incidents damage the reputations of the producers implicated or of the country as a whole. This can mean devastating financial losses if domestic food control authorities and international trading partners impose marketing and trade restrictions.

Governments and agrifood industries around the world must share responsibility for ensuring that all foods are safe. This can be accomplished only through development of strong and effective national food control systems in which the public and the private sectors contribute leadership, technical expertise and financial resources. Governments are called upon to ensure that there is adequate investment in food safety and its management at all stages of the food chain.

### Food safety investments needed from both public and private sectors

A large part of the required investment in food safety must be provided by the private sector, in particular farmers, food handlers, processors and distributors.

However, government also must make a substantial investment to support its role as provider of the enabling environment and protector of consumers' health and economic interests. Public investment in food safety includes:

- updating or restructuring institutional set-ups, including legislative frameworks,
- strengthening food inspection services, and recruiting and training necessary staff,
- upgrading laboratory analytical capabilities by establishing well-equipped and well-staffed central laboratories and an adequate number of satellite laboratories for routine checks,
- developing and implementing information and communication campaigns addressed to food handlers and other stakeholders on one side and to consumers on the other,
- commissioning relevant studies, including food contamination monitoring and diet studies, for use in developing appropriate food safety measures,
- participating in regional and international food safety intelligence networks to access and contribute information that is essential for early detection of food safety threats and the prevention of food safety emergencies,
- participating in international and regional food standard-setting bodies and other fora to ensure that these standards take each country's conditions into account.



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## Lessons in bringing safe food to the market

FAO, a leader in promoting effective food safety for the last two decades, has initiated several programmes that together form a strategy for ensuring safe food supplies worldwide. Most recently, FAO established EMPRES-Food Safety which coordinates global horizon-scanning to identify emerging food safety threats and provides guidance to countries on food safety emergency preparedness and prevention.

FAO's programmes have increased national awareness of the importance of food safety as a critical component of public health and agrifood trade. Most countries have made significant efforts to strengthen their national food control systems in line with international guidelines developed by FAO and WHO. Similarly, most food manufacturers around the world have become generally cognizant of their responsibilities to produce and bring only safe foods to market.

However, progress toward establishing credible and effective food control systems worldwide, particularly among the least developed countries, has been too slow. This largely has been due to poor integration of food safety issues into high-level government planning processes for national investment. This, in turn, is largely due to factors such as:

- ❑ lack of data to demonstrate the cost of food-borne illness,
- ❑ poor understanding of the impact of weak food control capacities on the trade sector,
- ❑ weak guidance from fragmented food control services to policy-makers as to what investments are required.

The result often has been tenuous funding for components of the food control system. In addition, a tendency to relegate food safety to a lower national priority where it is subject to discretionary funding reduction or elimination has had a disastrous effect on the sustainability and impact of food safety programmes.

## All stakeholders must participate in setting investment priorities

It has been demonstrated repeatedly that "one-time" investments in national food safety management systems seldom result in tangible improvements in social and economic conditions in the country. Long-term investment is required to build and sustain effective food control systems. Thus, there is a critical need to close the gap between the well-recognized and generally accepted principle of establishing national food control systems and the less recognized and frequently underestimated monetary and personnel investment requirements for establishing and sustaining such systems.

Public and private sector decision-makers need better information on establishment and maintenance costs of these systems, and the public health and trade benefits they offer. In addition, strong political will is needed to establish and support mechanisms that engage stakeholders from all concerned sectors. Stakeholders need to participate in identifying and analysing food safety and quality issues affecting social and economic development and also participate in the elaboration of strategies, including investment plans, for addressing them.

## Investment in Human Resources

*Government investment in the human resource skill sets needed to establish and sustain an effective food control system is critical, but often overlooked. A high level of scientific, technical, legal and management expertise is needed to address complex food safety issues effectively. No country can establish and maintain a strong national food control system or participate fully in the elaboration of international, risk-based food safety and quality standards unless its workforce – both public and private sector – has these specialized skills. Investing in science and education also paves the way for countries to be more resourceful in finding new solutions to food safety and other development problems.*



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**WHAT IS NEEDED:**

access to reliable water and good production practices

**HOW TO GET THERE:**

farmer-focused investment in water management

## FUTURE FOOD AND AGRICULTURAL NEEDS

To maintain global food security, the amount of land under irrigation will need to increase faster than land under rainfed agriculture, with virtually all expansion in developing countries. By 2050, harvested land under irrigation is expected to increase by 25 percent compared to 15 percent for rainfed agriculture. The growth in harvested irrigated areas will result primarily from increased cropping intensity.

The expansion of land equipped for irrigation will be most apparent in Latin America (about 34 percent) and sub-Saharan Africa (about 40 percent) where irrigated production has been limited. An increasing number of important food producing countries in the Near East, North Africa and Asia are reaching alarming levels of water scarcity. Key productive areas such as the Indus Basin and the North China Plain are at particular risk.

**Irrigated agriculture:**

- produces yields that are generally double or triple those of rainfed agriculture
- permits predictable cropping intensities (more than one crop per year) and generates year-round employment
- is used on only 20 percent of cultivated land but produces 40 percent of the world's food
- accounts for 70 percent of the world's freshwater use

**Increased use of resources is unavoidable**

Maintaining global food security will inevitably require more land and more water, but their availability will not be guaranteed. The anticipated impacts of climate change and demand for biofuels will increase competition for resources. As this competition intensifies and is coupled with demands for better environmental accountability from agriculture, irrigation schemes will need to devise innovative production methods that raise productivity and reduce their environmental impact.



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**Irrigation is the basis for intensification**

Irrigation may appear to be simply the controlled application of water to the root zone, but in fact it has much broader impact. It allows concentration of other inputs such as fertilizer, labour and mechanization, and the continuity of output from irrigated land raises overall productivity and rural incomes significantly. At the same time the production risk is buffered when the volatility associated with rainfed production can be eliminated.

Hence gaining economic advantage from irrigation in the future will require matching the irrigated subsector to the demand and to the local conditions.

Under these circumstances, by 2050 across developing countries, two-thirds of the area harvested under irrigation will come from increased cropping intensities and only one-third from physical expansion of land under irrigation.



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Developing countries will increase irrigated harvested area by 25 percent while withdrawals for irrigation will grow only 14 percent. This will be as a result of increased water-use efficiency through improved irrigation techniques and on-farm water management.

### Good production practices allow sustainable intensification

In spite of its enormous technical advantage in reducing stress on cultivated crops and concentrating inputs, irrigated production also brings a concentration of environmental impacts. Hence the need to integrate good production and water management practices into irrigation scheme development and operations. Practices such as conservation agriculture and integrated pest and nutrient management, and participatory experimental learning involving farmers and water associations all contribute to minimizing negative impacts of production intensification.

### Innovative investment required for design and delivery of irrigation services

Future efforts to respond to the needs for a more irrigated agriculture will depend on the quality of investment rather than quantity. While rehabilitation and upgrading of public irrigation schemes will continue to be important, private sector investment in effective farm irrigation systems also needs to be promoted. Preparation of investment

frameworks to guide and monitor public and private investment in irrigated agriculture is key. Attempts to promote artificially induced rainfall through cloud seeding cannot be considered a reliable investment initiative nor a substitute for conventional water control.

Already, innovative on-farm water control technologies for smallholder farmers are being adopted. Sub-soil drips for orchard crops, micro-dosing of nutrients through drip lines and modern mulching techniques are now common in developing countries – particularly when linked with on-demand groundwater irrigation.

Creative management techniques as well as upgrading and rehabilitating infrastructure can be achieved through:

- **service-oriented management** in large irrigation systems – farmers can schedule water deliveries, rather than as and when supplied, which enables them to respond to market opportunities and make smarter on-farm investment decisions that increase water use efficiency and raise incomes, and
- **multiple uses of water services** – large irrigation schemes are designed so they also derive value from allocations for domestic use, power generation, biodiversity and tourism in addition to crop irrigation.

Designing programmes that can increase agricultural productivity in a sustainable manner requires new financing mechanisms including

payment for environmental services, and participatory approaches in scheme and watershed management. This necessitates a well-structured public/private mix of regulation, management and implementation capacity.

At local and global scale, the volatility of rainfed production will continue. Although all attempts to enhance and manage rainfall have failed, there is still scope to increase crop yields and water productivity through improved irrigation practices. However, these are unlikely to be realized without establishing strategic public interventions to enable on-farm investments and protect public interests in water resource allocation and environmental goods and services. Through accelerated capacity building, participatory learning and agricultural research, water use in agriculture can become more responsible, accountable and productive.



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**WHAT IS NEEDED:**

increased farm power for the agriculture sector

**HOW TO GET THERE:**

include mechanization investment in development strategies

## MECHANIZATION BRINGS POWER TO AGRICULTURAL DEVELOPMENT

The power necessary for the entire crop production process may be provided by human labour, draught animals or engine-driven machinery but all three must be supported in order to achieve significant increases in productivity. Emphasis must be placed on encouraging transitional changes of power levels and hence increased use of tractor power. At the same time, environmental issues must be addressed through measures such as the practice of conservation agriculture. There is evidence that this can also mitigate climate change.

The demand for farm machinery is driven by increasing farm profitability coupled with labour shortages. The rate of mechanization change across the farm power spectrum depends on farmers being able to access appropriate farm machinery, credit facilities and spare parts as well as an effective demand and market for their produce.

### Sub-Saharan Africa lags behind in mechanization

In 1961, there were more tractors in sub-Saharan Africa than in either Asia or Latin America. However, by 2000, this number had decreased. In contrast, there was a fivefold increase in Latin America and the Caribbean, 13 times more in the Middle East and 50 times more in Asia. Projections regarding likely changes to farm power sources in these regions are shown overleaf. It is seen that the use of tractor power in sub-Saharan Africa will lag behind all other regions by some 50 percent. Such a critical shortage of farm power in sub-Saharan Africa will have a significant impact on agricultural production in the region.

### Investing in mechanization critical for rural development

Mechanization should be viewed as part of a long-term, broad-based economic development strategy aimed at rural economic growth and agro-industrialization. Farm power is a vitally important component of smallholders' assets, and acute power shortage is one of the major problems they face. If this major constraint of farm power is not addressed across the whole farm power spectrum, there cannot be an increase in agricultural productivity, resulting in stagnating farm incomes, hunger and less food security.

The role of government should be to provide the necessary rural infrastructure in support of economic growth and private sector initiatives.

These initiatives must address the profitability of farming, access to credit, land tenure and ownership, legal and regulatory frameworks and efficient and effective judiciary, and also create incentives for domestic and foreign private investment in agriculture.

The private sector also should be supported and encouraged to provide appropriate farm machinery and agricultural support services.

### Past experience: lessons from Asia - Key factors driving mechanization in Asia since the 1960s:

- *guaranteed markets and farm prices for key crops,*
- *favourable government policies including availability of credit,*
- *acute farm labour shortages and rising labour costs due to rapid urbanization and economic growth in the non-farming sectors,*
- *increased availability of appropriate and locally manufactured farm machinery, e.g. India is now the largest manufacturer of tractors in the world as a result of favourable government policy and farmer demand.*



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### Future mechanization needs and investment initiatives

Mechanization is the single largest investment item required for crop production, accounting for 25 percent of the total. A further 20 percent is required for expansion and improvement of irrigation. Comparative figures for regions of the world are shown beside.

FAO emphasizes that mechanization must be embedded in agricultural sector and rural development strategies.

FAO supports the private sector by encouraging member countries to create enabling environments for farmers to invest in mechanization and encourage the private sector to provide mechanization inputs and supply chains in the rural areas.

FAO also encourages member countries to promote tractor hire services by farmers in order to increase the availability of tractor power for agriculture, transport and road maintenance in rural areas.

FAO also supports and encourages the use of hand tool and animal traction technology in sub-Saharan Africa and promotes conservation agriculture and the use of appropriate hand, animal drawn and tractor powered implements throughout the world.

### ESTIMATED SOURCES OF FARM POWER BY REGION – 2009 AND 2050

REGION	Projected farm power sources for crop production (%)					
	Human labour		Draught animals		Tractors	
	2009	2050	2009	2050	2009	2050
Sub-Saharan Africa	70	30	20	20	10	50
North Africa / Near East	20	10	20	10	60	80
South Asia	20	10	40	15	40	75
East Asia (plus China & Pacific)	20	5	40	10	40	85
Latin America	20	5	20	10	60	85

### MECHANIZATION NEEDS AND INVESTMENT INITIATIVES BY REGION

REGION	Investment required for crop production mechanization	Investment required for other power sources and equipment
	2006/2050 (USD billion)	2006/2050 (USD billion)
Sub-Saharan Africa	59	115
South Asia	420	220
East Asia	241	114
Latin America & Caribbean	292	19
Near East & North Africa	300	14

### Challenges of mechanization in sub-Saharan Africa

*In sub-Saharan Africa, some 65 percent of the cropped land is prepared by hand, 25 percent with draught animals and less than 10 percent by tractor. Households relying solely on hand hoes can only cultivate about 1.5 ha per year which can provide enough food for the family. Using work animals allows cropping about 4 ha a year, giving enough food for six people. In contrast, a tractor can manage a much greater area, producing enough food for 24 people. In addition, tractor owners can hire out their services to neighbourhood farmers and for off-farm work such as transportation or maintenance of rural roads. Policy-makers will need to support all three sources of farm power with appropriate enabling environments in order to maximize farm productivity and reduce poverty.*



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**WHAT IS NEEDED:**

effective national seed systems to deliver quality seed to farmers

**HOW TO GET THERE:**

investments by government, donors and the private sector in national seed systems

## NATIONAL SEED SYSTEMS NEEDED TO MEET AGRICULTURAL CHALLENGES

Having sufficient amounts of high quality seed of improved crop varieties is critical for increasing food production and ensuring that farmers have marketable surpluses for urban consumers. The absence of conducive seed policy and seed regulations is the main constraint to farmers' sustainable access to quality seed. Urgent action is needed to increase the capacity of national seed systems to develop improved varieties and establish quality assurance systems and of the private sector to produce quality seed for farmers.

Well-targeted investments in sustainable seed multiplication systems have the potential to make a vital contribution to meeting current and future food production challenges in developing countries.

Efforts to develop national seed multiplication systems are more likely to have success if they are based on well-defined national seed policies, accompanied by seed regulation frameworks that guide investments in seed sector development. In turn, the national seed policies and regulations are more likely to have success if they are developed through collaboration of stakeholders from the public and private sectors, particularly research, extension, seed services, seed companies and farmers' groups. In the big picture, these policies and regulations should include measures to:

- outline strategies for assuring seed quality, germplasm management, research, capacity building, seed relief, extension, etc.,
- provide the environment for the development of small-scale seed enterprises and linking farmer organizations with markets to increase production and increase the demand for quality seed,
- develop strategies adapted to specific country conditions, including local crops and market opportunities,
- include strengthening of seed systems as part of sustainable production intensification strategies along with fertilizer and soil fertility management, integrated pest management and improved production practices.

### FAO offers strategic and practical support to improve national seed systems

FAO's comparative advantage as a neutral broker with technical expertise at all levels of the seed sector – from research and development through participation in multinational efforts to harmonize regulations – has put it in a position to facilitate the analysis and identify gaps that need to be addressed to strengthen the seed systems at national and regional levels. This information serves to ensure efficient targeting of investments by governments, donors and the private sector.

**National seed systems** – National seed systems encompass policy formulation and implementation, quality control and certification, research institutions, gene banks, extension services, and seed producers and sellers from both private and public sectors. FAO sees these systems as the frontline for the implementation of seed policies and



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regulations, especially in the developing, multiplying and distributing of improved varieties and seed quality control. In addition to supporting all stakeholders through investments in infrastructure and training, FAO promotes investments that ensure quality seed reaches the farmers, such as through developing and releasing new crop varieties, early generation seed production, quality assurance systems, seed production and seed distribution. FAO has national or subnational programmes underway for production of high-yielding seed varieties in Afghanistan, Cameroon, Côte d'Ivoire, the Gambia, Lesotho, Libya, Sierra Leone and South Sudan.

**Development of seed policy and seed regulation** – Investing in seed policy and seed regulation reform is the first step in helping countries develop more effective seed systems. In the last ten years, FAO has successfully implemented projects aimed at developing national seed policies and regulatory frameworks and coordination mechanisms for their execution in Afghanistan, Angola, Burkina Faso, Democratic Republic of Congo, the Gambia, Iraq and Sierra Leone. However, seed policies and seed regulatory frameworks still need to be developed in many countries and there continues to be a strong demand by member countries for FAO assistance in this matter.

**Enhanced use of plant genetic resources** – FAO and associated national universities and international agricultural research centres launched the Global Partnership Initiative for Plant Breeding Capacity Building (GIPB) in 2006, in an effort to strengthen capacities of developing countries and economies in transition to improve the sustainable use and breeding of Plant Genetic Resources

for Food and Agriculture (PGRFA). GIPB gathered information from 80 member countries on their plant breeding and related biotechnology capacities in order to identify gaps and opportunities at national and regional levels. These assessments have provided a foundation for strategic advice and actions on how national governments and the research and development communities can develop more improved varieties for seed production by the public and private sector. Continued donor support to this initiative will ensure development of adapted crop varieties that meet the needs of farmers based on the challenges of increasing food production and adapting to climate change.

**Preparation for agricultural emergencies** – FAO has made preparedness for and response to food and agricultural emergencies one of its strategic objectives, with a primary focus on the need to strengthen seed system-related responses. Recognizing the inevitability of increasing natural disasters such as droughts and floods as well as civil wars and ethnic conflicts, and looking toward the potential challenges of climate change, FAO has integrated seed system analysis into its emergency needs assessment guidelines and developed a code of conduct for emergency seed distribution and support to local seed systems. FAO also supports further investments in disaster risk management at the national and local levels to enable countries to respond to emergencies and rehabilitate seed systems more effectively.

**Assistance in subregional harmonization of African seed enterprises** – Harmonization of seed laws across subregions facilitates cross-border

movement of seeds, which is important for the private sector since it provides a broader market for seed enterprises and the development of the seed sector. FAO works with donors to support investments in regional initiatives to harmonize regulations and build capacity. Already, with FAO support, the Southern African Development Community (SADC), the Economic and Monetary Union of West Africa (UEMOA) and the Economic Community of West African States (ECOWAS) have undertaken the harmonization of seed regulatory frameworks among their respective members. The Common Market for Eastern and Southern Africa (COMESA) and the Central African Economic and Monetary Community (CEMAC) are working with FAO to harmonize seed regulation among their members. The African Union has requested FAO to assist in developing the African Seeds and Biotechnology Programme (ASBP) for the African seed sector.

### FAO sees essential role for private sector in seed programmes

National seed programmes that rely solely on the public sector have not proven sustainable. New strategies stress seed sector privatization and commercialization, with governments adopting policies and legislation that support and encourage the private seed sector. Governments support the seed industry through research and variety development, quality assurance and extension, and working with other stakeholders in oversight, coordination and variety release. In the private sector, there is need for investment to develop small-scale seed enterprises for the production of varieties appropriate to the needs of smallholders.



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**WHAT IS NEEDED:**

focus on nutritional quality of food in addition to energy adequacy

**HOW TO GET THERE:**

invest in crop and dietary diversity to narrow the “nutrition gap”

## LINKING AGRICULTURE TO NUTRITION SECURITY

Agricultural development programmes that aim to increase production of staple crops are essential for food security, yet they are insufficient for alleviating hunger and malnutrition. Effective efforts to improve food security must occur in conjunction with efforts to improve nutrition security.

Nutrition security refers to the “quality” aspect of food, its consumption and satisfactory use and utilization by all individuals of a household. While food security may increase the total *quantity* of energy consumed – typically via increased production and consumption of staple foods – only nutrition security can guarantee the *quality* and *diversity* of food necessary for good health and nutritional status.

Programmes aimed solely at increasing production, raising incomes and increasing energy intake will not reduce malnutrition as effectively as programmes that also recognize the importance of diet quality and diversity. For instance, animal source foods, legumes, fruits and vegetables are important components of nutrition security. Thus, the agricultural sector can contribute to nutrition security through small livestock and poultry ventures, aquaculture and horticulture. In addition, to maximize the efficiency of nutrition security initiatives, agricultural interventions should include strategies to increase nutrition education, empower women and optimize household use of resources.

### Making nutrition security a priority area for investment

In developing countries, 178 million or one in three children under age five is stunted due to chronic malnutrition, and 148 million children are underweight. Moreover, according to UNICEF (2009), micronutrient malnutrition affects approximately 2 billion people, over 30 percent of the world’s population. Malnutrition is accompanied by serious physical incapacity, impairment, illness, disease and death. In addition to incalculable social losses, malnutrition also incurs considerable economic costs:

- direct costs – lost productivity, lost earnings and the medical care required to treat those suffering from malnutrition and associated diseases, including those related to excess consumption (overweight and obesity, heart disease, diabetes and stroke) and,
- indirect costs – compromised cognitive and physical development – FAO attributes up to 14 percent lost productivity and earnings in adulthood to stunting in childhood.

This shows that making nutrition security a priority area for investment is not only a moral imperative, it is integral to sustained economic growth and national development.

### Agriculture-based interventions to improve nutrition security

Agricultural advances are typically measured in terms of how successfully they narrow the gap between current and potential production yields. Achieving success in nutrition security as well as food security also requires narrowing the “nutrition gap”. Narrowing this gap first requires increasing availability and access to the foods necessary for a healthy diet and, second, ensuring that intake of those foods actually increases. The following proposed investment options have been developed with both yield and nutrition goals in mind. Each aims to boost production or consumption of a diversity of high quality foods.

While none of these interventions will narrow the nutrition gap on its own, each represents an important initial step:

- agricultural extension services offer communities information and improved inputs, including seed and cultivars for better crop diversity, small livestock and poultry ventures, marine fisheries and aquaculture for improved dietary diversity,



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- agricultural extension services provide nutrition education at the community level,
- research and development (R&D) programmes breed plants and livestock selectively to enhance nutritional quality,
- subsidy programmes increase availability of fertilizers supplemented with micronutrients, R&D reduces post-harvest losses via improved handling, preservation, storage, preparation and processing techniques.

In addition to being compatible with traditional development objectives, each intervention category can be adapted to a wide range of countries, agro-ecological zones and food typologies.

**Warm arid and semi-arid tropics** – introduction of drought-tolerant cultivars that have been bred to include high levels of micronutrients should be a priority. These zones also are good candidates for agricultural extension services that increase awareness and consumption of existing local or indigenous plants and animals to improve nutrition. For example, intercropping cereal crops with drought-resistant legumes such as cowpea or pigeonpea improves both nutrition and food security, the former via increased protein intake, the latter via increased nitrogen fixation and subsequent increased yield.

**Warm sub-humid tropics** – a common problem in this zone is inability of farmers to invest in fertilizers needed to overcome soil acidity, due to both lack of availability

and purchasing power. Although fertilizer use is typically associated with production potential and food security, enhancing the micronutrient and trace element (iodine, zinc, iron) content of crops by applying enriched fertilizers to the soil also may improve nutrition security. Although this measure alone is insufficient to address dietary deficiencies, it can be used in conjunction with other nutrition-based interventions to maximize efficacy. Micronutrient-enriched fertilizers have particular potential where input subsidy schemes already reach large numbers of farmers.

**Warm humid tropics** – production may be sufficient in terms of calories but diets often remain nutritionally deficient. In Ghana, for example, dietary energy supply meets population energy requirements but shares of protein and lipids are lower than recommended. This is the case for a number of reasons, including challenges beyond the reach of direct agricultural interventions such as constrained access to markets due to poor infrastructure. Yet there are many agriculture-based interventions that could improve nutrition outcomes in this zone, such as: small livestock production projects to provide an accessible source of fat, protein and essential micronutrients, provision of dietary diversification advice such as cereal-legume mixing to maximize protein availability, and horticultural training to improve availability of micronutrient-rich vegetables and fruit. Horticulture also has the potential to increase incomes via produce sales if there is market access. Further, selective breeding to increase the protein content of cassava, a central component of this zone's food typology, could increase macronutrient intake.

These interventions all represent excellent investment options and have the capacity to increase women's roles in managing productive assets and their access to services, technology and income generating opportunities. As shown by the World Bank (2007), the resources and income flows that women control wield disproportionately positive impacts on household health and nutrition.

### FAO expertise combines agricultural with nutritional goals

Agriculture has great potential to alleviate poverty and improve the food and nutrition situation in vulnerable rural communities. FAO is at the forefront of global efforts to incorporate nutrition objectives into agricultural development policies and programmes. Through its expertise in nutrition assessment, food-based nutrition programmes, nutrition education and policy advice, FAO has a strong comparative advantage in providing the knowledge and technical support required to narrow the nutrition gap in developing countries. Further, FAO is uniquely positioned to work closely with technical experts in agricultural R&D, agricultural extension, fisheries and livestock to increase crop and dietary diversity for improved nutrition outcomes.

Simply put, nutrition security should be a priority in all areas where food security is a challenge. Doing so requires explicit incorporation of nutrition objectives into the design and implementation of agriculture development initiatives to ensure they are i) not detrimental to nutrition and that ii) potential opportunities to improve nutrition are identified and fully utilized.



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**WHAT IS NEEDED:**

providing safe meat for consumers

**HOW TO GET THERE:**

invest in modern facilities and capacity in meat safety

## MEAT DEMAND EXPECTED TO DOUBLE BY 2050

Meat consumption has remained relatively static in the developed world while, in developing countries, its annual per capita consumption has doubled since 1980. However, consumption remains low in some regions. Africa, the lowest, has an annual consumption of less than 14 kg per person compared with 80 kg per person in developed countries.

Meat is the most valuable livestock product. In addition, it has a high nutritional value, providing high quality protein, all essential amino acids and readily absorbed minerals and vitamins. With its production projected to double again by 2050, mostly in developing countries, it presents a significant opportunity for developing country livestock farmers and meat processors, as well as for consumers.

However, increasing livestock production and the safe processing and marketing of hygienic meat and meat products represents a big challenge. Meat produced in poor quality facilities can deteriorate quickly because of the bacterial load and potentially cause food poisoning. Developing countries must deal with production and safety issues on several levels:

- provision of safe meat for both local and export markets requires good quality abattoirs, management and operations,

- export of live animals rather than finished quality meat products represents a significant lost opportunity for developing country producers to add value,
- lack of appropriate slaughtering facilities and poor slaughtering techniques cause unnecessary meat losses, reduce quality and may be a major constraint to stimulating investments in animal production,
- lack of quality control and inspection allows meat from sick or parasite-infested animals to enter the food chain and spread diseases that affect humans as well as animals,
- careless handling under unsanitary conditions in meat markets or food shops adversely affects meat quality,
- inadequate waste-handling facilities can be a serious source of water pollution.

### Meat value chain approach contributes to quality and safety

Maintaining a high level of meat production is critical for ensuring product quality and consumer safety and for stimulating investments in meat production.

FAO can call upon its wealth of global experience in abattoir development, meat handling and processing to support its Members in improving their meat production and value-addition sectors. This includes:

- expertise in abattoir design and investment, with assistance in organizing marketing and improving the meat value chain through selected national, regional and international partners,
- support to enhance skills and capacity in the smallholder sector through improving and upgrading small- and medium-scale meat production and processing techniques.



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This value chain approach includes adding value, improving safety, minimizing waste and providing policy and technical advice and assistance. In general, FAO provides support to its members through developing and disseminating technical information and food safety guidance and facilitating partnerships and investments.

**Technical information** – In response to member countries' requests, FAO provides information and advice on how to improve existing or plan new abattoir facilities. It has developed designs for modular slaughterhouses that are currently being updated and expanded, based on practical experiences and needs. These will help ensure the establishment of sufficiently high-standard slaughter facilities that are simple and cost-effective and easily adapted to specific local conditions. FAO publications provide technical information on animal welfare, slaughter techniques, meat processing and utilization of animal by-products. Botswana continues to be a good example of a country that has managed to maintain access to remunerative export markets. FAO facilitates sharing of these types of successful experiences that can be of great value to other countries in the region and beyond.

**Food safety advice** – Manufacturing guidelines and practices for improved productivity and safer, value-added meat products and processing facilities are needed by member countries. The Codex Alimentarius Commission develops meat and meat product standards and codes of practice. FAO also supports meat sector development with operation and management advice including meat inspection. It also provides independent technical advice to member countries including guidance on introducing and monitoring control mechanisms related to safe and hygienic meat production, processing and marketing. This serves to reduce post-slaughter and production losses and avoids consumer health risks by promoting and disseminating knowledge and skills in modern meat handling and preservation technologies. In addition, FAO organizes workshops, training programmes and awareness seminars, as needed, around the world.



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**Partnerships and investments** – Public-private partnerships (PPPs) are increasingly important in ensuring sustainability in the investment and operation of abattoirs. FAO is uniquely positioned to work with and facilitate PPPs in the meat sector. Based on its global experience, FAO promotes an integrated investment package that covers abattoirs and the corresponding capacities and resources needed to ensure meat is produced in suitable facilities that meet modern safety, hygiene and animal welfare requirements. For example, FAO provides technical support to the Government of Armenia in developing its abattoir sector through public-private partnerships with the financial support of the Government of Greece, and is working on a joint initiative on abattoir improvement with the World Bank and other partners. *Design options for small- and medium-scale abattoirs*, a new publication that covers the design of multi-species abattoirs, has been co-funded by FAO and the Animal Production and Health Commission for Asia and the Pacific.



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**WHAT IS NEEDED:**

small-scale dairy operations for family food security and income

**HOW TO GET THERE:**

investments that support farmer cooperatives and capacity building

## SMALL-SCALE DAIRIES PROVIDE NUTRITION, INCOME AND JOBS

Investing in small-scale dairying can make a significant difference to both food security and income generation. Milk is a balanced, nutritious food and demand is expanding quickly worldwide. FAO expects demand for milk and dairy products in the developing world to increase by some 50 percent by 2030. Since the bulk of milk produced in developing countries comes from smallholder farmers, they are in a position to benefit both nutritionally and economically from the increased demand. Small-scale dairying is key to promoting increased dairy production in developing countries. It generates regular income to facilitate access to support services and contributes significantly to increased and regular incomes for poor producers. Smallholders form the backbone of dairying in India – now the largest milk producer in the world. Yet, in spite of the benefits that small-scale dairy operations could provide to farmers, there are inherent constraints in the developing world that limit entry.

### Benefits

**Improved household food security –**

Small-scale dairy operators meet their family food needs first, but then can market any surplus. Growing children receive nutritional benefits from the milk which is high in calcium and other nutrients needed for healthy diets.

**Regular income –** Lack of regular income is one dominant cause of poverty. Dairy operations, even on a very small scale, can provide modest but consistent daily or weekly returns.

**Income for women –** Women in developing countries play a key role in dairying. They often make the decisions on the amount of milk marketed and decide how to use income from the sale of milk at the household level.

**Off-farm employment –** Every 30 litres of milk produced in a small-scale dairy operation represents one job, and every 100 litres of milk collected, processed and marketed can lead to creation of up to seven jobs.

**Urban-rural cash transfer –** Milk is mainly produced in rural areas and marketed or sold in urban centres.

**Support services –** Dairying, as a cash-rich activity, can support the sustainable introduction of essential services in areas such as animal health, credit and artificial insemination.

### Constraints

**Capital investment –** the cost of dairy animals, feed and equipment is high, although the outlay can be reduced by starting dairying with small ruminants.

**Markets –** lack of market access is a major issue for rural producers that can be addressed by establishing effective local organizations for dairy value chain development.

**Knowledge of animal husbandry, particularly nutrition –** fodder/feed typically constitute the largest part of the production cost for smallholder farmers keeping dairy animals.

**Sufficient water and power –** water is needed for the animals to drink but also for ensuring hygienic, value-adding processing.

**Access to support services –** feed supply, animal health services, credit and artificial insemination may not be available in remote rural settings.



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### Tailoring technical and policy expertise to small-scale needs

According to FAO, the best entry point into small-scale dairying is through farmer groups. Groups can substantially reduce individual members' costs and empower communities to manage their businesses. In addition, milk collection, processing and marketing organizations are attractive cash-rich enterprises that offer good returns to all stakeholders in the dairy value chain, if they are well designed.

FAO's 40 years' experience in small-scale dairy activities plus its unique access to relevant public and private sector entities gives it a comparative advantage in providing independent technical assistance and tailoring dairy development and investment programmes for countries and organizations facing all levels of challenges. FAO provides support ranging from facilitating national assessments and strategies to identifying the investment needed for infrastructure and increasing national capacities in dairy safety and hygiene. FAO also supports consensus building, brokers partnerships and assists in developing enabling environments conducive to small-scale dairy development.

In India, FAO provided technical support to set-up a national dairy development programme under Operation Flood that has become the second largest milk producer in the world. Now, at the request of 15 Asian countries, FAO is leading efforts to raise USD 250 million for the "Strategy and Investment Plan for Smallholder Dairy Development in Asia" that has set a goal of "a glass of milk a day for every Asian child".

### Small-scale dairy operations take advantage of opportunities

The growing demand for milk products offers a major opportunity for small-scale milk producers if they can organize themselves to develop and maintain market access.

FAO's dairy programme can assist in exploiting these opportunities through promoting investment in safe and efficient production, processing and marketing of milk and dairy products.

Priorities include enhancing skills and capacity building, investing in small-scale processing and organizing milk collection and marketing.

Active collaboration with national and international institutions in conducting case studies and assessments and designing tailored strategies is key to ensuring local participation and ownership.



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### Integrated dairy scheme boosts farm incomes in Afghanistan

*The incomes of 1 600 farming families in Afghanistan increased fivefold – from USD 130 to USD 650 a year – through a dairy project started by FAO. Women have most of the responsibility of this programme and, thus, keep 95 percent of the money. The project works to improve fodder quality, access to artificial insemination or breeding bulls and veterinary services, and developing local milk producers' organizations. With FAO support, farmers organized themselves into cooperatives that collect the milk and provide veterinary and animal husbandry services for their members. Those cooperatives now operate processing plants that pasteurize milk, process it into products such as yogurt and butter, and run retail outlets in the main cities. The project's success also has motivated farmers to grow fodder and seed, returning profits of up to USD 900 per hectare. In addition, more Afghans now have access to healthy milk products.*



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**WHAT IS NEEDED:**

long- and short-term focus on control of Transboundary Animal Diseases

**HOW TO GET THERE:**

investment in prevention, surveillance and control

## CONTROLLING TRANSBOUNDARY ANIMAL DISEASES TO PROTECT HEALTH, IMPROVE FOOD SECURITY AND TRADE

Production and trade in animals and animal products are important for the economic development of many countries and a key income source for the rural poor. The fast-growing livestock subsector represents 43 percent of the value of world agricultural output and supports food security and the livelihoods of over a billion people. Animal diseases, especially those that can easily cross borders, remain a major limiting factor for efficient production and safe trade of animals and animal products.

Transboundary Animal Diseases (TADs) are highly contagious with the potential for very rapid spread. They cause serious socio-economic consequences and, at times, public health threats, without respect for national borders. Investing in TAD prevention and timely control pays-off as the spread of TADs can have devastating effects not only on the livelihoods and health of people but on the economy as a whole. The number of emerging diseases has grown steadily for a decade because of several factors such as: globalization and the increase in the movement of humans, animals and animal products; changes in climate and ecosystems; and, demographic changes, including urbanization and intensification of production systems.

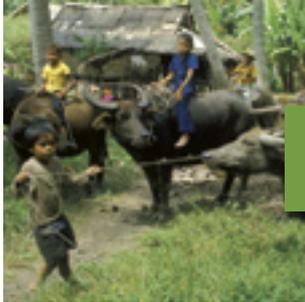
The Emergency Prevention System for Transboundary Animal and Plant Pests and Diseases (EMPRES) was established by FAO in 1994 to manage normative and operational activities for containment and progressive control of serious transboundary diseases.

### Selected diseases: lessons and achievements

**Rinderpest** – A devastating infectious viral disease of cattle, buffaloes and other ungulates, including wildlife, rinderpest wide distribution in Europe, sub-Saharan Africa, the Middle East, and Central and Southeast Asia caused significant loss of livestock and wildlife. FAO established the Global Rinderpest Eradication Programme (GREP) in 1994 as a coordination platform to promote global eradication of rinderpest by 2010 and to verify freedom of infection. Collaborative vaccination campaigns and a network of diagnostic laboratories drastically reduced rinderpest worldwide. Community animal health workers reached out to the rural areas, strengthening veterinary systems for controlling rinderpest and other diseases. The last known rinderpest outbreak was in 2001 in Kenya. The absence of new outbreaks and consistent epidemiological evidence suggest that global eradication has been achieved.

**Highly Pathogenic Avian Influenza (HPAI)** – Since it emerged in 2003 in Southeast Asia and spread to the rest of Asia, Africa and Europe, H5N1 HPAI has caused significant economic losses and continues to pose a threat of a global human pandemic. In early 2004, FAO combined the technical expertise of its Animal Production and Health Division and the operational capacities of its Emergency Operations and Rehabilitation Division to create the Emergency Centre for Transboundary Animal Disease Operations (ECTAD). ECTAD responds to animal health crises beyond HPAI through the planning and delivery of veterinary and associated assistance to FAO member countries.

**Rift Valley Fever (RVF)** – RVF is a potentially fatal, mosquito-borne viral disease of ruminants (sheep, cattle and goats) and humans. Periodic severe RVF epidemics on the African continent and the Arabian Peninsula cause substantial socio-economic and public health consequences. FAO supports regional surveillance, an early warning system



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for RVF, and is involved in emergency crisis management to strengthen prevention measures with public health and veterinary authorities, veterinary laboratory networks and communication systems to protect human and animal health.

**Foot-and-Mouth Disease (FMD)** – A highly contagious viral vesicular disease of cloven-hoofed animals that is endemic in parts of Asia, the Middle East, Africa and South America, FMD causes substantial production losses, adversely affecting the livelihoods of farming communities and limiting trade opportunities for many developing and developed economies. The FMD Progressive Control Pathway approach is developing regional roadmaps to control this disease in West Eurasia, Africa and the Middle East. Launched in 2009, it is being tested by regional groups and is expected to be implemented at various levels by national programmes under the Global Framework for the Progressive Control of Transboundary Animal Diseases (GF-TADs).

**African Trypanosomosis** – This vector-borne disease mainly transmitted by tsetse flies is commonly known as *sleeping sickness* in humans and *nagana* in animals. It is prevalent in 37 of the poorest countries in the world, threatening animal and human health, agricultural production, rural development and poverty alleviation in sub-Saharan Africa. In 1997, FAO established the Programme Against African Trypanosomosis (PAAT) as an alliance for concerted international strategic planning and actions, research, focused investments and cost-effective interventions, integrated vector and disease control, and the active participation of local communities.

### TAD control requires both prevention and emergency response measures

Addressing TADs requires finding a balance between long- and short-term strategies and interventions to strengthen emergency response capacities to rapidly and effectively respond to the emergence of new pathogens before a crisis develops. FAO's strategy is to support a sustainable global livestock sector that is healthy, robust, and free of major diseases. This will contribute significantly to the Millennium Development Goals, particularly through improved human nutrition, health and welfare.

Besides food security, the control of TADs also provides opportunities for income generation and trade. The protection of public health and farmers' livelihoods, especially of the most vulnerable, and the strengthening of trade security and rural development in poor countries are primary targets.

### FAO comparative advantage

FAO has extensive experience with animal health management and emergency prevention, and vast, multidisciplinary technical expertise. It brings together a wide range of knowledge and approaches with flexible operational capacities. This, coupled with FAO's global reach, can provide effective assistance to member countries on both classic and emerging animal health issues.

### Applying lessons learned from HPAI to other TADs

*Efforts to combat H5N1 HPAI have shown that efficient prevention and control strategies must be built on FAO and World Organisation for Animal Health (OIE) standards and guidelines and apply holistic and multidisciplinary approaches. They also must secure political commitments, strengthen public-private partnerships and enhance regional and international coordination. While essential that programmes include socio-economic aspects, foster open communication and develop strategies that can be implemented at the local level, it is equally important to increase investments in veterinary services, ensure adequate biosecurity measures in livestock farms and markets, and provide timely communication of animal health associated actions to pertinent stakeholders.*



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**THE ANIMAL PRODUCTION AND HEALTH DIVISION (AGA)**

focuses on the opportunities of the livestock sector to increase its role in food security and human nutrition, on poverty reduction in livestock dependent communities, animal-related public health risks and on environmental sustainability of natural resources used in livestock production.

**THE NUTRITION AND CONSUMER PROTECTION DIVISION (AGN)**

provides leadership, knowledge, policy advice and technical assistance for improving nutrition and protecting consumers, thus helping to ensure that agricultural development and improved food supplies translate into better health and nutritional well-being of populations, and enhanced access to markets.

**THE PLANT PRODUCTION AND PROTECTION DIVISION (AGP)**

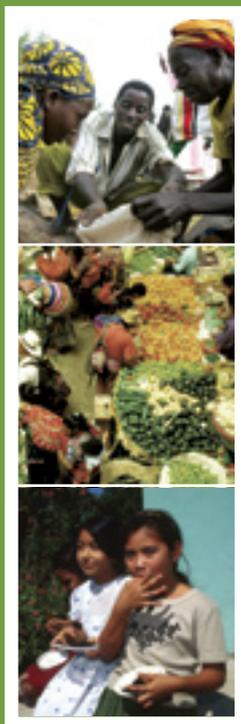
provides leadership in the sustainable intensification of crop production to improve food security and livelihoods with respect to natural resources and a sustainable use of fertilizers and plant genetic resources for food and agriculture, in reducing the risks of crop losses from transboundary plant pests and diseases; and in reducing the risks associated with pesticides through the full cycle from procurement to disposal.

**THE RURAL INFRASTRUCTURE AND AGRO-INDUSTRIES DIVISION (AGS)**

provides leadership for strengthening small farmer-market-agribusiness linkages, improving rural infrastructure, mechanization services, post harvest handling and agricultural processing for value addition. It plays a leading role in improving rural financial services and financing for value chain development thereby enhancing the contribution of the agricultural sector to increasing incomes and employment as well as overall rural development.

**THE JOINT FAO/IAEA DIVISION ON NUCLEAR TECHNIQUES  
IN FOOD AND AGRICULTURE (AGE)**

provides support to AGA, AGN and AGP programmes through the use of nuclear techniques combined with applications of modern bio- and molecular technologies. It coordinates, promotes, monitors and assesses the effective transfer of existing or improved nuclear techniques and expertise to developing countries to enhance the prospects for sustainably improving agricultural productivity.



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