

A global strategy for cassava research and development in the 21st century

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Summary

A number of national and international organisations have been actively collaborating over the past years in the formulation of a global cassava research and development strategy. The need for such a strategy was discussed several years ago during a meeting convened by IFAD at its Rome headquarters. The meeting, attended by representatives of donor agencies, international and regional organisations and selected NAR's from Africa, Asia and Latin America, recognised cassava as a food security and commercial crop that lends itself to a commodity approach for poverty alleviation. The meeting also recognised the important role of cassava in income generation and in reducing the risk of food shortage in developing countries where poverty is widespread.

Based on these considerations, a global cassava research and development strategy was considered necessary to identify opportunities for private investments, for public intervention in response to situations of market failure and for food security purposes. The strategy should also define constraints as a basis for determining and prioritising a research agenda and to define more cost-effective institutional mechanisms to help rationalise the allocation of public and private resources for research. Furthermore, the development of a framework for technical co-operation in research and technology transfer at international level that would reflect regional/national specificity and institutional comparative advantages was thought to be important if cassava was to make a future impact on global food and income security. Finally, the scene should be set for future debates on global issues that may affect cassava development.

A global cassava development strategy requires a correlation of stakeholders including cassava producers and their organisations, governments, donors, technical and research institutions and their networks, NGOs and their networks, and the private sector, in order to achieve the objectives listed above.

This strategy is now being developed from a number of country case studies and regional reviews as well as from thematic contributions. Country case studies for Benin, Brazil, Colombia, Ghana, Nigeria, Tanzania, Thailand and Uganda, highlight the importance of the crop as a source of income for farmers and its traditional role as a staple food crop in the case of Africa, as well as its potential as an industrial crop. The case studies have demonstrated the importance of private sector involvement and macro-economic policy support in the development of the cassava sector particularly in Brazil, Nigeria and Thailand. Regional reviews for Africa, Asia and Latin America as well as theme-oriented global considerations focus on important aspects of cassava's sub-sectors such as markets, environmental issues and gender implications.

A further review organised by IFAD in June 1997 established a schedule for completion of the strategy. The plans covered the preparation of a draft strategy document that would be distributed to regional and international bodies and individuals for comments and modification. In addition, a series of regional consultation meetings were organised bringing forth ideas and suggestions to strengthen the strategy and to agree on the approach proposed in the draft strategy document. The regional consultations also provided an opportunity to ascertain the role and contribution of cassava for food security and poverty alleviation and the opportunities for cassava development. The consultation meetings for specific regions and groups were held during 1998: for eastern and southern Africa in March 1998, for Latin America and the Caribbean in April 1998, for Africa as a whole in October 1998, for Asia in December 1998 and again for West- and Central Africa in June 1999.

With these preparatory activities completed a definite global cassava research and development strategy is now being developed and made available to all global stakeholders.

1. Introduction

1.1 Modern agriculture and agricultural transformation

The most dramatic agricultural transformation in human history took place during the 20th century. Some of the lessons and observations learnt from this experience are that:

- Sustained economic growth, in all but a few countries, has been preceded by success in agriculture.

- Technological change in agriculture depends greatly on a constant flow of new technologies to farmers and allowing them a wide range of options.
- Science-based agriculture has brought about rapid change on the farm and has sped the transformation from subsistence agriculture to a more productive and profitable modern agriculture.
- As science-based agriculture moves ahead, private sector involvement emerges in off-farm food processing, mercantile operations including supply of inputs and other materials, transportation, marketing and other services.
- As agricultural production improves and farmers succeed, some begin to specialise in certain crops or products. This too results in the growth of private enterprises established and led by farmers or former farmers. Thus farmers themselves often lead the way in building the non-farm private sector in rural areas.
- Agriculture has as much potential as industrialisation to contribute to economic growth and development.

1.2 A vision for cassava

Cassava provides the livelihood of up to 500 million farmers and countless processors and traders around the world. It is the basic staple for hundreds of millions of people in the tropical and sub-tropical belt, as well as being a feedstock for numerous industrial applications, including food, feed and starch. Cassava production is closely allied with, but not the cause of, poorer farm households. This relationship exists because poorer households are marginalized and often live in marginalized areas – the same areas where cassava performs well.

This relationship suggests that development of market opportunities for cassava can increase household food security, especially for resource-constrained households; and can contribute substantially to poverty alleviation.

Thus the vision is:

Cassava can spur rural industrial development and raise incomes for producers, processors and traders. Cassava can also contribute to the food security status of its producing and consuming households.

2. The strategy

2.1 Cassava's place in the world

In general, cassava is not well regarded as a food, and in fact there is often a considerable stigma against it. The stigma is partly due to the presence in some cassava varieties of cyanogenic glucosides, compounds that can be toxic unless removed or detoxified by food preparation processes. 'Sweet' varieties -- those with low cyanogenic glucoside levels that can be eaten raw or boiled like potatoes -- are often susceptible to attack by pests and diseases.

A crop of the poor -- particularly of small, resource-poor farmers -- until about two decades ago cassava was neglected by research and its knowledge base was meager.

Processed cassava products must compete in markets with grain products, so lowering costs of production is essential to its survival as an industrial crop. Also there tends to be less research and development devoted to developing and improving cassava-based products than there is for the competing grain based products. This lack of research and development also contributes to variable production and processing methods, and cassava products that often are of poor or uneven quality.

2.2 The past 30 years for cassava

Regional consumption of cassava has changed since 1961 as indicated in Figure 1¹. Human food is its dominant use market in Africa and Asia, and the second most important market in Latin America. During the

¹ Excluded from this figure are all processing amounts and North America and Oceania consumption levels because they all are generally of much smaller magnitude than those shown in the figure.

nearly 35 year period depicted in Figure 1, cassava for food has doubled in Africa and increased by seventy and fifty percent in Asia and Latin America, respectively. The other growth area has been its use as an animal feed, and there the greatest increases have been in Europe, Latin America and Asia. What is a little troubling is the consistently high levels of cassava waste observed in Africa, Asia and Latin America. In terms of waste as a percentage of food consumption, Latin America appears to have the highest level. The other interesting observation is the growth in other usage in Asia, and what is not shown in the figure is the North American growth in other usage, which in 1995 exceeded that of Europe.

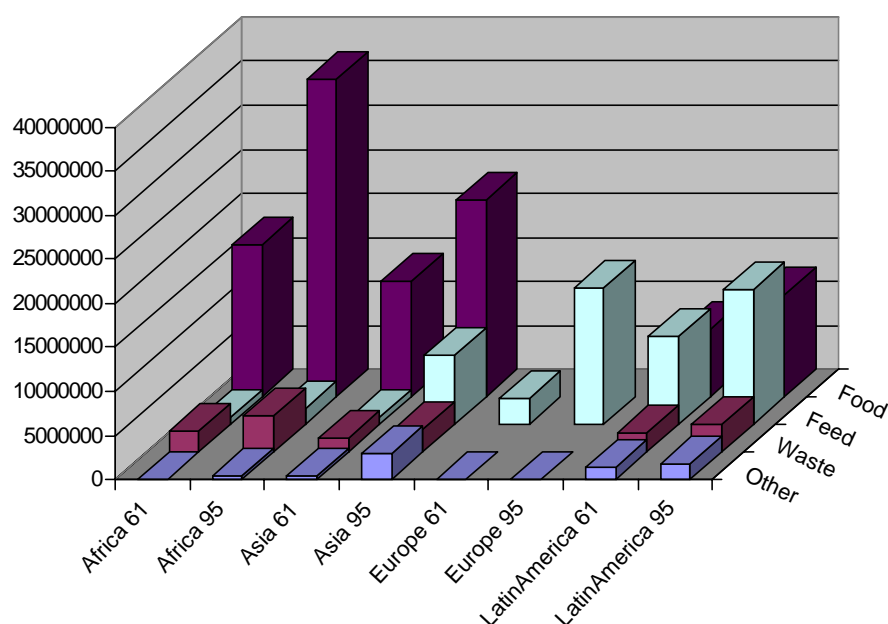


Figure 1 Regional Consumption of Cassava 1961 and 1995 (MT)

Hidden in Figure 1 is the fact that in 1961, with the exception of some Latin American countries, more than 80% of cassava was consumed in the country of production. Outside cassava producing countries, cassava was primarily known as tapioca.

With the advent of the European Economic Community and its common agricultural policy cassava became a *traded* commodity that found its way into the European animal feed market. The benefit of cassava was

that it was a non-levied energy source that could be mixed with soybeans and other high protein feedstuff. In the 'sixties and early 'seventies European traders encouraged a number of cassava producing countries to produce for the EEC. From as early as 1961 Thailand was the leading supplier of cassava to Europe. By 1972 Thailand was the major source of increases in world supply, while Indonesia remained a distant second (Phillips 1974).

Table 1 Regional Cassava Imports (MT Fresh equivalence)

Region	1961	1970	1980	1990	1995
Africa	75	1,744	3,935	10,760	18,926
Asia	45,234	251,119	733,910	7,822,419	4,914,245
Europe	1,493,462	4,467,809	16,499,999	26,012,876	8,651,648
Latin America	4,902	6,106	4,811	199,192	63,575
North America	496,900	376,143	106,148	680,098	193,157
Oceania	15	252	1,104	36,580	48,351
Formerly Russia				2,815,154	
Totals	2,040,588	5,103,173	17,349,907	37,577,079	13,889,902

In 1961 only 7 countries (5 European plus Japan and the US) were importing more than 10,000 tonnes of cassava. By 1990 more than 26 countries were importing more than 10,000 tonnes of cassava. Thus there has been both a growth in the demand for cassava as well as increased diversity of its markets. In the same time period the number of exporting countries grew from 8 to 14. In 1990 Thailand accounted for almost 76% of the total exports.

2.3 The strategy course to follow

This strategy will be based on a demand-driven approach that consists of identifying the opportunities and constraints at each stage of the commodity development cycle. Concepts of business development and management as well as international economic co-operation will be important tools in implementing the strategy. Scientific support will be essential to help overcome important problems within the production-processing-marketing continuum. Adaptive research is essential to ensure that existing and evolving knowledge is applied in an appropriate and useful fashion. The overall aim is to achieve a demand-driven approach to technical change and economic growth.

Guiding principles:

The global cassava development strategy cannot be 'business as usual' in approach. Instead it must:

- Have an overall goal of agricultural transformation using cassava as its commodity and product base.
- Place emphasis on production/processing/marketing 'priority products' *Priority products* are farm and off-farm raw, intermediate, and consumer products that have the greatest potential to contribute to agricultural transformation and economic growth,
- Place emphasis on adding value to cassava products to achieve greater returns to both producers and processors,
- Recognise the central role of the processing of fresh roots to produce unique products with high market demand, including secondary products derived from primary products such as starch, chips and pellets.
- Rely on dynamic and innovative private/public partnerships between producers, processors, marketing people, financiers, and government leaders,
- Improve institutional capacity in R&D support, processing, financing, and marketing.
- Finally, realise there is no free ride to a productive, profitable cassava industry. To achieve this will require commitment of funds, development of human resources, and building of capacity, especially at national level, in research and development, management.

3. Elements of the global strategy

3.1 Steps towards developing a global development strategy for cassava

A *raison d'être* for developing a global cassava marketing strategy is the belief that it will contribute to the economic development of processing communities and wellbeing of numerous disadvantaged individuals in the world. It is suggested that necessary condition for the implementation of this strategy is the existence of a **growing demand** for cassava.

Markets which grow at the rate of population increase (primarily the human food market in producing countries) have served the cassava industry well, but have rarely been the major source of improved wellbeing of producers and processors.

For cassava to be a contributor to development, the market must grow more rapidly than population. There are several sources of market growth.

- a) Market growth can occur when the number of producers decreases but the total demand remains fairly constant. An example is increasing urbanisation accompanied by continued consumption of cassava by the new urban dwellers.
- b) Market growth occurs because cassava is found to have unique characteristics suitable for a new market. Such a case might be the use of cassava for the production of monosodium glutamate, or the production of non-allergenic foods.
- c) Market growth occurs because cassava become economically more attractive for a particular use than do competing products. This has certainly been the case for cassava as an animal feed ingredient in Europe.

For easy of presentation these three sources of growth will be referred to as **concentration, innovation, and competition**. Any one of the above three sources of market growth can be the basis upon which to develop a marketing strategy.

It follows that a necessary and perhaps **first step** in the development of a global cassava marketing strategy is the identification of markets that are growing or could potentially grow.

It is unlikely that any of the three market opportunities above will be realised without a concerted effort by many of the cassava system stakeholders. It is also unlikely that the producers of cassava will spearhead many of the market development opportunities, although the development of a high volume **gari** production and marketing scheme in Nigeria appears to have been initiated by producers [See Box].

A **second step** in the development of a cassava marketing strategy is provision of a consistent supply of a relatively uniform product. In the early years of cassava shipments to Europe the Thais and Europeans had a number of disputes over the quality of the Thai product. Indonesia's hand cut chips were preferred because of low moisture content and much less dust. But Thailand rapidly became the consistent supplier of large volumes of cassava, and began using improved pelleting equipment, which greatly reduced the dust problem. In the end, the new pellets and large volume shipments gave Thailand an advantage in the European market that no one has been able to duplicate.

A **third step**, related to step two, is to provide the market with a competitively priced product that meets the consumers' requirements. For example, it is suggested that one of the growth markets in producing countries is for convenience foods. Clearly traditional methods of pounding cassava do not meet this need. But pre-processed or partially-processed foods, such as *foo-foo* or cassava leaves, attractively wrapped in appropriate size packages might provide a growth market for cassava.

3.2 Implementation of a global development strategy for cassava – catalysts and champions

Methods of implementing the above three steps may change according to the nature of the growth market.

It is because of the expectation that the free market will not always make greatest use of the potential of cassava, nor necessarily use it in a way best suited to promote development, that the initiation of a ***Global Development Strategy for Cassava*** has a role to play.

The initiation of this Strategy will often times require a catalyst capable of identifying marketing opportunities, and bringing these to the attention of stakeholders. Also, cassava needs a champion, or champions, at every level to keep the needs of the industry before the public and decision-makers. Even if the stakeholders agree that there is a growth market for cassava, there may still be need, for research and development, provision of infrastructure and investments, and changes in policies to grasp the new opportunity.

In the first instance it would appear that the tasks of catalyst and champion are well suited for donors, international research institutions, non-governmental organisations and national governments. These agencies can bring together producers, processors, trader and consumers to help identify the course of action which will best contribute to the Global Development Strategy for cassava. These agencies, in concert with producers, processors and traders can initiate and undertake the necessary activities to develop the potential market.

The development path for cassava will be ***case, country*** and ***time*** specific. Nevertheless, it would appear that if the market growth potential exists because of a structural change in the economy (e.g., decreasing number of farmers and increasing number of urban consumers of cassava products, resulting in market growth) one would expect that NGOs and national governments would be in the best position to act as champions and catalysts.

If on the other hand the market growth exists because cassava is price competitive then both national and international agencies may act as champions and catalysts. Finally, in the case where cassava has a unique advantage the catalyst or champion may not be a national or international agency, but instead be an industry or corporation that has proprietary interest in cassava.

The bottom line for a catalytic role is the need for someone to identify the growth market and then to commit the resources and energies necessary to realise the potential. On the other hand, a champion would be expected to seek constantly an improving market and economic situation for cassava and its stakeholders.

3.3 Product options for the future

Because cassava roots are perishable, most cassava requires some form of processing before it can be sold. While some cassava is sold as fresh roots, even those must usually receive some special post-harvest handling or treatment before they reach the markets. For this reason, processing becomes of central importance in the future of the crop.

The major categories of cassava products must be considered separately, for each has particular strengths and weaknesses relating to the production/processing/marketing continuum, and require different strategies to improve their performance in the continuum. Major categories include (1) fresh roots and leaves, (2) home or village-level processing, (3) starch, (4) flour, (5) animal feeds.

4. Longer range considerations in developing continental strategies

In considering continental approaches to the strategy, differences between the continents in production, processing and marketing of cassava must be taken into account. Therefore, each continent [or subcontinent or region in some cases] will have to develop a plan of its own. These continental plans should link with the bottom-up industry analyses and top-down plans emanating from the global review and strategy development.

4.1 Africa

Except for Nigeria and a few other countries, cassava is still grown mainly as a staple food accounting for up to 70% of output. Increased consumption for food is the combined result of droughts, increased population, and with civil strife, devaluation of the CFA in Franchophone countries and recent policies aimed at reducing cereal imports. *Gari* accounts for 70% of total cassava consumption in Nigeria, compared to 40-59% in Ghana, Cameroon and Cote d'Ivoire. Other forms include *gari* or *farinha* (made by grating roots, fermenting, drying in the sun, followed by heating over low heat) and *foo-foo* (a paste-like meal made from cooked fermented roots or flour). Young leaves can be eaten as a fresh vegetable, ground fresh and frozen in plastic bags, or dried and ground for sale in plastic bags, and being more nutritionally balanced than the roots, they help to prevent certain deficiency diseases.

Potential for the Future: There is a great potential for cassava for food particularly with increased population, recurrent droughts, disasters, and market opportunities and recent policies aimed at reducing cereal imports. FAO projections are that global area devoted to cassava by 2005 will be 18.6 million ha, with Africa accounting for about 11.9 million ha. Industry uses could expand, especially for starch and animal feeds.(FAO)

In Africa, it is estimated that the combined effect of alleviating pre- and post-harvest constraints could increase economic yield by 168 percent and controlling a relatively few damaging pests and diseases could produce large improvements in yield.

Major Strategy Concerns: In Africa, supporting and improving the status and performance of cassava as a food while expanding its potential commercial role should receive high priority, particularly with the rapid migration to urban centers and increasing income. This should involve public and private efforts, particularly various farmers groups who are major stakeholders, supported by infrastructural developments so as to reduce the current high production costs and make cassava more

competitive with grains. Continuing research and development efforts are needed in soil fertility, tissue culture and rapid multiplication of planting material crop protection and integrated pest management for the continent where cassava has been greatly affected by pest and disease attack.

4.2 Asia

Cassava is almost entirely a commercial crop in Asia, playing a role in agriculture, commerce and industry. A highly versatile crop, cassava historically gained importance in Asia as a food security crop in times of political unrest, wars and famine, particularly in parts of Dutch Indonesia and British India. Asia has few problems with pests and diseases, unlike Africa and LAC, Asia has little potential to increase yields by their control. Overcoming pre- and post harvest constraints is expected to increase economic yield by 116 percent, the lowest figure for the three continents. (Hershey, Henry, et al. 1997)

Use for feed in China represented 40% of 1992-94 total output. Also in China, India, Thailand, Indonesia and Vietnam, starches from fresh or chipped roots are important both for human and industrial use. China and Thailand for example make noodles and sodium glutamate from processed starch at household level. (Plucknett 1995)

Potential for the Future: Trade developments in such Asian countries as Japan and Republic of Korea as well as the EEC and improved domestic markets will continue to boost the Asian cassava industry.

Major Strategy Concerns: Increased population growth, limited options by some farmers for other crops besides cassava due to environmental constraints, poor soils on which cassava is grown, all indicate the need to increase on-farm efficiency productivity and expand processing and marketing opportunities.

4.3 Latin America and the Caribbean

Production in LAC has been stable for 25 years in a context of traditional production/processing systems and constrained markets. Over that time

LAC's share of the global production dropped from 35% in 1970 to 19% in 1996, because both African and Asian production doubled, while that of production of Brazil and Paraguay, the main producers, slightly decreased. The area harvested in LAC peaked at 2.85 M mt in 1977. About half of total production is used directly for human food, half for animal feed and industrial uses. Brazil and Paraguay are the region's largest producers. On-farm feeding of fresh or dried cassava has been practised for a long time, but their use in balanced rations is growing. Starch production in Brazil, Colombia and Paraguay is on the rise and is used mainly in paper processing, adhesives and paper and textiles whereas in Columbia, a powerful antiseptic known as *cassareep* and capable of preserving meat is a by-product of boiling the poisonous juice of bitter cassava varieties.

Practical soil and crop management can raise yields in LAC more than 50 percent and adding improvements in yield potential and pest and disease control could more than double yields. The combined effect of alleviating pre- and post-harvest constraints could increase economic yield by 133 percent, or the equivalent of 41 M mt.

Potential for the Future: IFPRI projects cassava production growth in LAC to come about by increased yields (0.85% per year) and a 1.3% increase in use of cassava for animal feeds. LAC food preferences are shifting away from basic staples and more towards convenience foods, and diversified diets.

Considerable potential exists for improving additional revenues [within a range of 60-130%] from post-harvest handling and processing, the estimates being lowest for fresh roots, highest for animal feed, and intermediate for starch and flour.

Major Strategy Concerns: Increasing markets by developing convenience foods for urban dwellers, use of cassava feedstuffs, and new uses for starch and flour may be important. Moves to support industrial growth of cassava and to increase value added are needed.

5. Future strategies for world-wide research and development

The global agricultural research system provides an additive or multiplicative effect to national research efforts -- it serves as a source of new genetic materials, new methodologies, training in advanced research techniques, and provides a bridge to technical advances elsewhere. Each NARS should set aside resources to make sure their own scientists are active in the process of international problem-solving to ensure it is pertinent to the needs of the country.

5.1 Genetic improvement and tailoring for final uses

Genetic resources of cassava comprise a major element of the global cassava development strategy and deserve international support and cooperation in their conservation, study and use. The Centro Internacional de Agricultura Tropical (CIAT) in Colombia holds a large collection of cassava germplasm, as does the International Institute of Tropical Agriculture (IITA) in Nigeria. Brazil's National Center for Genetic Resources and Biotechnology holds both cassava and wild *Manihot* species, while its National Cassava and Fruit Research Center (CNPMPF) in Bahia holds the world's largest national collection of cassava germplasm.

Many of the major pests and diseases of cassava are endemic in Colombia, making this country a key location in providing 'hotspot' environments to find test genotypes for their resistance or susceptibility to those pest and disease problems.

Cassava breeding and development should follow even more closely a tailoring approach to suit final uses. Thus cassava bound for fresh food is likely to contain less hydrocyanic glucosides than varieties slated for processing. Also, varieties destined for processing for starch should have high levels of starch and have peel and root forms suitable for ease of processing.

5.2 Production and processing strategies: possible R & D needs

Varietal development is needed focusing on value added traits, e. g., for high insect and/or disease resistance along with high starch content and recoverability as well biotechnology research to help speed development of new varieties, improve integrated pest management practices, identify needed genes and speed up genetic enhancement and plant breeding.

Production systems have to be further improved in order to produce more per unit of land, reduce costs of production, and increase product value, while keeping cost of production the same or lower.

Processing research has to be carried out on new products, new methods and techniques modified starches, more advanced techniques of modification, including use of biotechnology, and small scale processing

Environmental concerns have also to be reflected to a greater degree in future R & D activities with the aim to reduce soil erosion, to reduce pollution, especially in the production/processing for starch sector, and prevent destruction of ecosystems, forests, shifting cultivation.

Finally, institutional support has to be improved through public/private sector partnerships, e.g., for herbicide resistance, response to plant nutrition practices, research infrastructure, training of scientists, farmers, organizations, and cassava networks.

6. Conclusions

6.1 Potential for the future:

Cassava produces high yields on poor lands, benefiting resource-poor farmers. Traditional methods of production and local processing results in products that have acceptance in local markets as food, native starch and feed for small-scale livestock production. At the same time, cassava can be grown on a larger scale, even in plantation systems, mainly for starch or livestock feed.

Cassava can be expensive to grow and process, and hence care must be taken to reduce production costs to remain or become competitive with alternative sources of carbohydrates, mostly the grains. Cassava starch has certain unique characteristics that starches from other sources do not have. Such unique traits can be a basis for developing a growth market for cassava starch.

Feedstuffs from cassava face increasing competition from coarse grains, particularly in export markets in Europe and Asia. Use of cassava feedstuffs in balanced rations for poultry and swine may provide a way to increase market share in relation to the grains.

6.2 Major strategy concerns:

It is essential to build an effective institutional base for a productive, profitable cassava industry in each country, by developing strong regional, continental and global support and constituency to help implement the global strategy. Enlist the support of the World Bank, Asian Development Bank, Interamerican Development Bank and African Development Bank in the collaborative effort. Develop a global forum for cassava to pursue market opportunities, identify source of capital, and ensure a strong base of research support for global genetic resource and enhancement studies, including biotechnology, at CIAT, IITA, and CENARGEN, in particular. Work through national fora in each of the three producing continents - Africa, Asia, and Latin America and the Caribbean - to implement continental or regional strategies. Obtain commitments from cassava-growing nations that they will develop and support - on a long-term basis - relevant research and development efforts to support national cassava development and economic growth.

Reference list

1. FAO. Draft Working notes on selected chapters of "The World Cassava Economy: Recent trends and medium-term outlook". *Global Cassava Development Strategy* IFAD.
2. Hershey, Clair, and Guy Henry. Cassava in Latin America & Asia: A regional Review (Summary). *Global Cassava Development Strategy* International Fund for Agricultural Development.
3. Hershey, Clair, Guy Henry, Rupert Best, Kazuo Kawano, Reinhardt Howeler, and Carlos Iglesias. 1997. *Cassava in Asia*.
4. Phillips, Truman. 1974. *Cassava Utilization and Potential Markets*. IDRC-20e ed. Ottawa, Canada: International Development Research Centre.
5. Plucknett, Donald. 1995. *Cassava Research in China*, Washington DC.

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Annex: Cassava success stories

Export of Cassava-based Feeds From Thailand to Europe: A Success Story

Thailand's success in marketing cassava chips and pellets in Europe for use as livestock feeds provides a model for transforming a traditional crop through an industry-wide approach. Thailand during about a 25-year period through effective public/private partnerships and wise government policies developed a dynamic cassava industry mostly from scratch.

Historically, Thailand's agricultural economy has been driven by exports. Until World War II rice exports led the way. After the War, upland development in the North and Northeast brought agricultural diversification during which cassava, kenaf, maize and sugarcane were added to the national crop list. About the same time, modern cassava starch processing was introduced in the Chonburi region in the east, and soon Thai starch exports supplanted those of Indonesia and Malaysia.

Despite Thailand's early success with cassava starch; wastes from starch manufacture became the basis for future expansion when in 1956 an enterprising West German importer successfully introduced cassava starch wastes as a substitute for expensive German grains. During the post-war period, high support prices for grains caused the European animal feed industry to seek cheaper carbohydrates. Cassava from Thailand and Indonesia filled the need, and cassava meal exports doubled from 1955 to 1960.

From about 1960 a new industry based on cassava meal began to grow, with Thailand as its principal supplier. In the early 1960s, as a result of artificially set floors and ceilings, the implementation of Europe's Common Agricultural Policy (CAP) insulated European feed grain prices from world market prices. In its tariff structure the EU created a window for import of cassava meal and chips because these were treated differently from grains. Thailand's public and private sector responded quickly to the new market opportunity by supporting a vertically integrated system of cassava production, processing, and marketing, based on tens of thousands of small producers. Small-scale production and processing (chipping and drying) were integrated with village-level coordination of supply to middlemen who delivered the chips to ports for shipment to Europe.

In the late 1960s, in order to reduce shipping volume and to deal with European concerns about dust pollution, Thailand shifted its product lines from meal and chips to pellets and chips by changing its processing systems. Chipping and drying are done on-farm or close to the farm; starch processing is done mostly in large factories. Processing into pellets depends on middlemen who consolidate chips from thousands of small farms into processing and marketing channels. From near zero in 1960, Thailand's chip and pellet exports grew to 8 million mt annually in 1992-94.

Because of budget strains caused by its CAP grain policy, the EU sought ways to reduce cassava imports by seeking voluntary restrictions from Thailand. A 1986 agreement specified a maximum volume of 21 million mt for the period 1986-89. The EU set a quota of 5.25 million mt for 1995-96, but hinted possible future reductions. Within the quota, cassava enters the EU at a preferential 6% tariff, but beyond the quota a 30% tariff applies. Even at preferential rates, Thailand has not met its quota since 1994, owing to competition with grains. By 1995, of the 3.3 million mt of chips and pellets exported from Thailand, 93% went to Europe.

Gradual withdrawal of cassava's special treatment in the EU has caused the industry to diversify both products and markets. New markets in Asia were sought aggressively. Japan, Korea and Taiwan began to import pellets for animal feed; however, competition with grains has cut into these markets.

To reduce dependence on the EU feed market, Thailand is working hard to reduce costs and keep its products competitive, seek new markets, develop internal feed markets, and diversify into starch and flour. New opportunities for cassava depend on increasing efficiency in production, processing and marketing. Today Thailand is leading the way in Asia in cassava starch manufacture.

Process, product and internal market development are mostly handled by the private sector. The government has given strong help in export development. Most research has come from public sector institutions. Important institutions include: Kasetsart University, the Department of Agriculture [Rayong Research Institute] and the five Thai trade associations who work mostly in industry promotion and trade.

In the words of the authors of the excellent report, *Cassava in Asia*, "Thailand has ... put cassava on the map, in Asia and the industrial world". (Hershey et al. 1997)

African Gari Story

On the road from Benin City to Lagos, Nigeria lies a village that provides an example of farmer lead development project based on gari, a cassava based food. The exact hows, whos and whys are not known but the outcome is clear. Cassava has been the driving force in transforming the life of this village.

Sometime during the '70s or early '80s cassava ceased to be produced in this area because of the yield loss owing to cassava mosaic and spider mites. Around 1986, IITA personnel ask some farmers to try out a new sweet potato propagation system. In one of their subsequent visits IITA personnel left some improved cassava stakes. Nothing more was done or recorded regarding the cassava, but follow-up visitations continued regarding the use of the sweet potato system. On a visit in 1988 a large white structure was noted behind the house of one of the villagers. Questions about this structure revealed that the

few cassava stakes that had been left behind had grown into a very profitable business.

The facts seem to be

1. The improved cassava grew very well, better than any previous cassava, and without problems of mosaic and spider bites.
2. The villagers marketed crops and processed food along the roadside.
3. The volume of traffic greatly increased with the completion of the new road from Benin City to Lagos.
4. Their gari was very popular

The latter observation led the villagers to think about producing more gari and selling it in Lagos, now that it was relatively easy to travel to Lagos. The exact sequence of events is not known but in the process of expanding the production and marketing of gari someone came up with the technique which greatly increased the batch size for cassava soaking and fermenting. The technique entailed sewing together large plasticised bags and placing the filled bag between 2 presses that were connected by giant bolts (approximately 2 to 2.5m in length). Nuts were tightened to squeeze the press and remove the water from the fermenting cassava. The capacity of this new technology was about 750kg. This volume of fermented gari presented problems of roasting and marketing. Roasting continues to be done the traditional way, perhaps using slightly larger skillets, but with no great change in efficiency. Marketing is now done in Lagos, with the gari being transported to Lagos and sold to wholesalers. The villagers do the transportation by the pickup truck that they purchase with help of a group credit program.

The impact on the villagers is tremendous; they now ship 750kg every day or every other day, as opposed to that amount over several weeks or longer. It would appear that the bottleneck is the roasting process. The initial solution was to increase roasting effort (done almost exclusively by women) in proportion to the increased amount sold to Lagos. There seemed to be little complaints about the additional land and effort required to produce the cassava.

The point of this story is that improved market access, improved disease resistant varieties, some ingenuity, credit and hard work have led to the development of a cassava based industry which has generally improved the wellbeing of the villagers. The villagers identified the opportunities and developed the approach. The solution may not be perfect, because of the roasting bottleneck, but the villagers may also find a way to overcome this problem.