



A Global Development Strategy for Cassava: Transforming a Traditional Tropical Root Crop

*Spurring Rural Industrial Development and
Raising Incomes for the Rural Poor.*



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Introduction

The 20th century saw the most dramatic agricultural transformation in human history. Science-based agriculture brought about rapid changes on the farm and sped the transformation from subsistence agriculture to a more productive and profitable modern agriculture. As agricultural production improved and farmers succeeded, some began to specialize in certain crops or products. This resulted in the growth of farmer-led private enterprises and the building of non-farm private sectors in rural areas. As science-based agriculture moved ahead, private sector involvement emerged in off-farm food processing, mercantile operations including the supply of inputs and other materials, transportation, marketing and other services. Sustained economic growth, in all but a few countries, was preceded by success in agriculture. Agriculture has as much potential as industrialisation to contribute to economic growth and development. Technological change in agriculture however requires a constant flow of new technologies to farmers and a wide range of options.

This strategy document addresses two questions: Can cassava, a traditional subsistence food crop, become the raw material base for an array of processed products and industrial development that will effectively increase the demand for cassava and thereby contribute to agricultural transformation and economic growth in developing countries? If so, how?

These questions are an outgrowth of a two-year effort led by the IFAD to (1) determine the status of the cassava industry around the world;

(2) understand the potentials and limitations of cassava as a food and industrial crop; and (3) draw up plans to ensure that cassava can and will play an important role in development and economic growth in developing countries.

Thailand provides an example of the contributions of an expanding cassava industry to economic growth and the well-being of those associated with the industry. A country with no history of producing cassava as a human staple food, Thailand in a few short years in the 1960s and 1970s developed a dynamic cassava export industry shipping cassava-based animal feeds to the European Community. [See Box]

What is wanted is a practical global vision for cassava that can be translated into actions and building of capabilities at national, regional, continental and global levels.

The Vision

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.

Cassava is a source of food security, not only because it can be grown on less productive land, but because it is a source of income for producers and generally a low cost source of food. These relationships suggest that the development of market opportunities for cassava can contribute substantially to poverty alleviation, especially for resource-constrained households, and can increase household food security. Thus our vision is:

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

The Strategy

To achieve this vision the Global Cassava Strategy is proposed. The essence of the Global Cassava Strategy is

to promote and develop cassava-based industries with the assistance of a coalition of groups and individuals interested in developing the cassava industry; producers, processors and consumers of cassava, as well as associated national, international and non-governmental organisations.

The strategy is demand-driven and consists of identifying, in a systematic manner, the opportunities and constraints of cassava at each stage of the commodity development cycle. Concepts of business development and management as well as international economic cooperation are important tools in implementing the strategy. Scientific support is also essential to help overcome important problems within the production-processing-marketing continuum. Adaptive research is essential to ensure that existing and evolving knowledge is harnessed in an appropriate and useful fashion. The overall aim is to achieve demand-driven technical change and economic growth.

Guiding principles

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

- Be based on a practical, long-term vision,
- Have an overall goal of agricultural transformation using cassava as its commodity and product base. [*Agricultural transformation* is the process of moving from subsistence agriculture to a modernized system based on improved techniques and information, specialization, market transactions, and greater profitability for producers and related industries],
- Build on past and present experience, knowledge and capability,
- Be based on careful and insightful ‘industry analysis’ of the production/processing/marketing system that is demand- and market- driven and includes both private and public sectors,
- 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,
- Promote cassava and cassava based products,
- 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; likewise, to recognise the central role of processing at the interface between supply-side and demand-side interventions,
- Rely on dynamic and innovative private/public partnerships between producers, processors, marketing people, financiers, and government leaders,
- Recognise the need for actions relating to both demand for, and supply of, cassava products,
- Be science-based,
- Be both knowledge and management-intensive.
- Improve institutional capacity in R&D support, processing, financing, and marketing.
- 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, processing excellence and marketing skills and ingenuity, including innovative and willing public support.

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.

Thailand's early success with cassava starch led to a problem that became an

opportunity. Wastes from starch manufacture, which could have been viewed as a problem, became the basis for future market expansion. 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 starch based products. New opportunities for cassava, both within and outside of Thailand, 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. 1997b). Other key references are (Ratanawaraha, Senanarong, and Suriyaphan 1997), (Titapiwatanakun 1997).

How we got here

The International Fund for Agricultural Development (IFAD) has been the initiating institution in this strategy planning exercise. At a brainstorming meeting in May 1996 the need for a global strategy was discussed; following that meeting a Task Force to develop the strategy was appointed.

In February 1997, the Intergovernmental Group on Grains urged FAO to cooperate closely with the IFAD global cassava strategy task force. At the same meeting the Group on Grains agreed to extend its Terms of Reference to include roots, tubers and pulses, with the following modification statement:

“The Group shall include in its field of competence roots, tubers and pulses, exclusively for securing funding for commodity development purposes from the Common Fund for Commodities and, possibly, other financing agencies”. The Group also endorsed five new project ideas, including three for cassava: Integrated Research and Development Project for the Development and Value- adding of Cassava Products in China and South Asia Region; Cassava Market Information and Promotion Service; and Expanding Cassava Utilization for Food, Feed and Industrial Applications in Africa. The Group also endorsed the commodity development strategy for cassava as an essential prerequisite for the Fund’s giving consideration to projects for any commodity. (Working Group on International Agricultural Research 1997)

Major impetus was given to the effort at the IFAD-sponsored Global Cassava Development Strategy Progress Review Workshop in Rome. At this June 10-11, 1997 meeting, the following topics were discussed: formulation of the global strategy, a prospective implementation plan, design and scope of relevant cassava-related R & D projects, and confirmation of the relevance of roots and tubers, especially cassava, as a possible entry point in developing a country or regional strategy, with special reference to specific ecological zones or socio-geographic communities, either from the viewpoint of food security or income generation and economic diversification.

The comprehensive global, regional and national reports presented at the Rome Workshop set the context in which the Global Cassava Strategy should be formed.

As the Asian report notes:

...cassava is emerging as a fully commercial crop entering diversified markets. This status defines an evolving and dynamic role in development for the region. Roots are converted into an array of products – human food as fresh or processed roots, starch and flour for food and industry, and animal feed...In this context, cassava serves as an ideal focus to achieve several development goals. Improving this crop is a way to direct various benefits toward the poorest of rural populations. (Hershey et al. 1997b, p. 4)

The Latin American and Caribbean Report notes:

Research and development activities in Latin America and the Caribbean have a special dual status –as a catalyst for regional development, and as a resource for contributing to cassava’s development role in Asia and Africa.

The cassava sector is at a cross roads in the Americas. Traditional processing and markets continue to dominate in the region. Traditional processing and markets continue to dominate in the region. These are best suited to largely rural societies... But three quarters of Latin Americans now live in cities....the crop retains the basic features that reinforce its role as an appropriate vehicle for development:” a crop of small, resource-poor farmers; adaptation to marginal environments where other crops are far more risky; high potential energy production per unit land area; high flexibility in management; and ability to enter diverse markets. With focused and sustained research and development support, this crop can make substantial contributions to the broad goals of food security, poverty alleviation, equity, and protection of the environment. (Hershey et al. 1997a, p. 4)

The African report reconfirmed the importance of cassava in traditional markets, as well as emerging markets that use processed cassava. The report points out:

Industrialists and entrepreneurs often shy away from using cassava in their applications because of the absence of a local example to follow and the uncertainty of success. Therefore, product development research needs to be strongly promoted and the private sector should be encouraged to participate. Issues that need to be addressed include raw material import substitution; promotion of a positive image for cassava development of products for existing and new markets; identification of the functional characteristics of cassava genotypes in relation to various end uses; utilisation of cassava plant parts (e.g., leaves, peel, etc.) for livestock feeding; suitability of cassava leaves as vegetable; and determination of foliage yield and digestibility for human and animal nutrition. The impact of pathogens and saprophytes on the quality of stored cassava products, including contamination with mycotoxins, should be investigated. (Spenser and Associates 1997)

Finally the FAO provided an overview of the trends in cassava production and utilization. The FAO notes that:

By 2005, world cassava production is projected to increase to 209 million tons (fresh weight) or 2.2 percent annually as in the past, reflecting both yield improvements and area expansion....World utilisation is projected to increase by 2.3 percent annually to 209 million tons. Sixty percent of the total demand is for food, the remainder for feed and other uses. ..By 2005, global cassava trade is projected to increase by 1.6 percent to 5.8 million tons (dry weight from 4.8 in 1993-95, reflecting moderate growth in import demand for cassava feed and other novel cassava food and non-food products. However, cassava for feed is projected to continue to account for over three-quarters of the world cassava trade and flours and starches for food and industrial uses for the remainder.(FAO 1999, para. 36-38)

The individual country studies highlighted the potential benefits of developing new market opportunities as well as the difficulties that may be encountered when trying to develop cassava based products with value added processing, packaging and marketing.

Actions proposed by the Workshop were: to engage a team of consultants to prepare this draft strategy; to have stakeholders review this document at regional meetings; and to present and discuss the revised Strategy at an International Forum.

Cassava and Its Place in the World

Cassava (*Manihot esculenta* Crantz) is a native of Brazil and during the 16th and 17th centuries it was dispersed widely by the Portuguese in tropical and sub-tropical areas of Africa, Asia and the Caribbean. It soon became a staple food in many of these places because of its tolerance to drought, poor soil conditions and generally difficult crop environments.

Cassava is produced mostly by smallholders on marginal or sub-marginal lands of the humid tropics and sub-humid tropics. Such smallholder agricultural systems as well as other aspects of its production and use often create problems, including: unreliability of supply, uneven quality of products, low producer prices, and an often costly marketing structure. The smallholder production system also implies that producers cannot bear much of the risk associated with development of new products and markets. Thus the challenge is to create a strategy that affects production, processing and marketing in such a way that it provides an array of high quality products at reasonable prices for the consumer, while still returning a good profit for the producers without requiring them to assume the largest part of the development risk.

Strengths of Cassava

Cassava can grow and produce dependable yields in places where cereals and other crops will not grow or produce well. It can tolerate drought and can be grown on soils with low nutrient capacity, but responds well to irrigation or higher rainfall conditions, and to use of fertilizers. Cassava is highly flexible in its management requirements, and has the potential of high-energy production per unit area of land. Once thought to be resistant to pests and diseases, the crop can be improved genetically to increase its resistance to damage from serious pests and diseases. Cassava yields can be quite high, as high as 25 to 40 metric t/ha, although national yields are often well below these levels. World average is about 10 mt/ha.

The crop has long been used as a famine reserve and food security crop. Because cassava has no definite maturation point, harvest may be delayed until market, processing or other conditions are more favorable; this flexibility means cassava may be field stored for several months or more.

Although it was long considered a smallholder subsistence crop, cassava can be grown in large plantations or in more favorable conditions to produce raw materials for industrial processing. Cassava

starch has some unique characteristics that favor its use in specialized market niches. In general, cassava has an ability to enter diverse markets.

Special Problems or Weaknesses of Cassava

As crop of resource-poor farmers and a food security crop, cassava was generally neglected by researchers. Until three decades ago the global knowledge base on cassava was meager. Only through the past three decades has an understanding of the crop been greatly advanced, however the knowledge base is still much smaller than that of most cereal crops. Gaps in our knowledge contribute to a number of the problems or weaknesses noted below.

Cassava is vegetatively propagated, using stem cutting taken at harvest of the previous crop. Stem cuttings are bulky, do not store well and are costly to cut and handle. Vegetative reproduction also means multiplication rates for new improved varieties are slow, retarding their adoption. There is need for a system to use true seed on the farm and for ways to cut costs of planting material.

As root crop, cassava requires considerable labor to harvest. Its roots are bulky and highly perishable and therefore must be processed into storable form soon after harvest. Cassava is labor intensive and costs of production can be quite high, compared to other carbohydrate sources.

Cassava is often relegated to marginal lands due to competition with higher-value and more respected crops. This trend is likely to continue as such crops are further improved to adapt them to marginal conditions. Hence, with time, cassava often winds up in hill-lands, lands with low soil fertility, or lands susceptible to periodic or seasonal drought or flooding. Cassava-producing areas typically lack infrastructure such as roads, communications, and input supply systems.

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.

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.

The Past 40 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 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 appears troubling is the consistently high levels of cassava waste observed in Africa, Asia and Latin America. Latin America waste exceeds the amount of cassava used for food consumption². Another 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. Other uses include the use of cassava for the production of starch, glues and alcohols.

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.

² A comprehensive effort is needed to ensure the accuracy of the waste figures. Waste may reflect poor data recording for other uses of cassava.

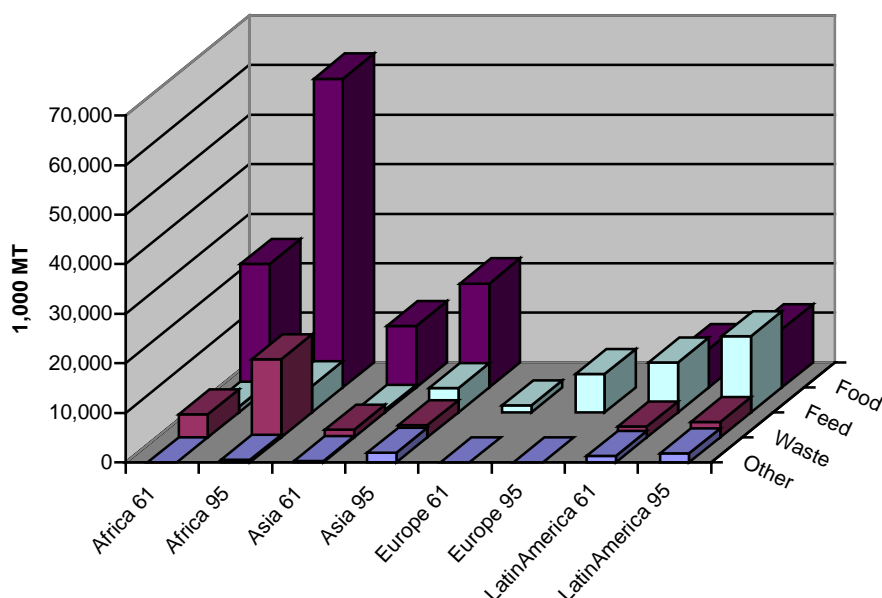


Figure 1 Regional Consumption of Cassava 1961 and 1995 (MT)

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	1,845	3,975	10,760	18,926
Asia	50,334	257,283	428,877	4,891,944	2,574,110
Europe	1,493,616	4,467,809	16,499,999	26,012,876	8,651,648
Latin America	4,902	6,106	4,811	199,188	63,547
North America	496,900	376,143	106,140	680,098	193,157

Region	1961	1970	1980	1990	1995
Oceania	15	252	1,104	36,580	48,351
Formerly Russia				2,815,154	
Totals	2,045,842	5,109,438	17,044,906	34,646,600	11,549,739

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.

The Strategy

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 the well-being of numerous disadvantaged individuals in the world. It is suggested that a necessary condition for the implementation of this strategy is the existence of a **growing demand** for cassava.

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

1. **Concentration:** 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.
2. **Innovation:** 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.

3. **Competition:** Market growth occurs because cassava becomes 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.

Industry Analysis

The global cassava development strategy requires “industry analysis”. Industry analysis involves stakeholders in a participatory effort to identify strengths and weaknesses in every phase of cassava production/processing/marketing and to find ways to capitalize on the system’s strengths and to overcome its weaknesses. Industry analysis is a demand-driven approach to technical change through (1) explicitly considering stakeholders as equal partners in determining the needs and future plans for a dynamic cassava industry, (2) building a practical, shared vision for cassava development, (3) helping make action plans for the industry, including the who, what, why, and how, plus the question, with whose money? (4) building better linkages with private sector organizations, (5) making better links with and among public-sector institutions, (6) co-stewardship of research and service outputs with users, and (7) rapid introduction of high-impact technologies through public and private sector partnerships.

Analyses of market opportunities suggest that industry analysis should center on an array of priority products that exist or appear to have potential as growth products. The industry analysis should reveal which of these products will require special attention in the production/processing/marketing system continuum.

Principles and goals of industry analysis:

- Sound economic and technical analysis within a participatory process,
- Vertical integration of cassava production/processing/marketing,
- Employ a demand-driven initiative of analysis and action in the production/processing/marketing continuum,
- Lay out courses of action to solve problems ranging from farm production to the marketed product,
- Aim for rapid adoption and impact of appropriate technologies,

- Balance on-farm and off-farm innovation within the context of consumer needs and wants,
- Achieve sustainable agricultural intensification through on-farm and off-farm technical innovation,
- Increase cassava productivity to accelerate economic growth and agricultural transformation,
- Identify priority marketable products both for food and industrial use.

Proposed outcomes of industry analysis

- Increased use of profitable techniques,
- Increased availability and access to profitable technology,
- Strengthened human and institutional capacity for agricultural and farm-to-market systems,
- Favorable policy and market environments for a dynamic global cassava industry,
- Increased availability of a wide range of high quality products at reasonable prices to consumers and good profits for producers,
- Increased domestic and international political and financial support for cassava industry development.

Product Options for the Future

Cassava is the basis of a multitude of products, including: food, flour, animal feed, alcohol, starches for sizing paper and textiles, sweeteners, prepared foods and bio-degradable products. The products are derived from a number of forms of cassava, ranging from fresh leaves and roots to modified cassava starch. The degree of processing and the technical requirements tends to increase from the fresh form to the modified starch form.

All of the above products represent potential market development opportunities for cassava. While some cassava is sold as fresh roots or leaves, even these products usually receive some special post-harvest handling or treatment before they are consumed. As cassava normally requires some form of processing before it can be consumed or sold, processing becomes of central importance in the future of the crop.

While the market potentials are great, it must be remembered that these opportunities are location and time specific. Because of the specificity of market opportunities it is impossible to develop a list of priority markets opportunities.

The following section, however, does attempt to highlight some the benefits and challenges that might be encountered when attempting to develop different types of cassava markets.

Products from leaves and roots

Fresh roots and leaves are used primarily as human food. Because of their perishability, most roots are usually consumed or marketed close to the centers of production. Traditional methods for preserving fresh roots include packing roots in moist mulch or by removing leaves two weeks prior to harvest to prolong root shelf life to two weeks. In Colombia, CIAT researchers found that preservative treatments such as dipping in wax or paraffin of fresh roots followed by storage in plastic bags reduced vascular streak and extended storage for 3 to 4 weeks. Roots can be peeled, chopped into chunks and frozen for specialized markets.

Cassava leaves can be eaten as a fresh vegetable, ground fresh and frozen in plastic bags, or dried and ground for sale in plastic bags. Leaves are more nutritionally balanced than the roots and can help to prevent certain deficiency diseases. Leaves, however, may be high in hydrocyanic acid, but the HCN can be reduced to safe levels in most cases when the liquid is squeezed out after grinding and through evaporation during cooking.

Potential for fresh cassava: Higher incomes and urbanization are associated with greater consumption of convenience foods and foods that are perceived as more desirable foods. Urbanization, in cassava producing countries, represents an opportunity for producers to produce cassava for a larger consuming population. The implications are that cassava markets for fresh cassava can grow if the cassava products are convenient and in more a desirable form. Costa Rica has demonstrated that there is a growing export market for fresh cassava - if it is packaged in an attractive and useful manner.

The potential for fresh cassava in producing countries represents growth firstly through **concentration** although **competition** and **innovation** are important factors as well. The potential for fresh cassava in non-producing countries represents growth through **concentration** and **innovation**.

Major Strategy Concerns: Growth through concentration often times suggests needs to improve production, storage and processing

technology, and improved infrastructure. In this regard reducing pest and disease attack, particularly on sweet varieties, IPM, reducing HCN levels in roots and leaves, lowering costs of production, weed control, and lowering overall costs of production and processing are priority needs.

Growth through competition and innovation requires input from various sectors in the supply chain. There will be need to develop and adopt new processing techniques to maintain the freshness of cassava and promote the convenience of the product. In many instances the need for promotion will be a key component to developing these markets. Finally, when developing and promoting markets for fresh cassava it will be necessary to factor in information on tradition and familiarity product characteristics, such as, root form, colour of skin and flesh, ease of peeling, cooking time, aroma and taste.

Products from dried roots

In many countries of Africa and Latin America, cassava is processed at home or at village level to produce toasted flour (*farinha* in Brazil, *gari* in West Africa), or to make flat bread (*casabe* in the Caribbean). *Farinha* and *gari* etc. can be produced in both small and large-scale operations,.

Dried cassava as an animal feed ingredient has been a major success in Europe and as an export product for Thailand and Indonesia. Thailand, China, Brazil and Paraguay are also reported to use a substantial proportion of their cassava for the production of non-intensive swine, poultry and fish farming production. In most of the other countries of LAC, about 20 % is used for animal feeds. On-farm feeding of fresh or dried cassava has been practiced for a long time, and its use in balanced rations is gaining as it adds value and results in more marketable livestock products. Technical details for using dried cassava in rations are well established, both in terms of milling and blending and in animal nutrition.

FAO estimates that about 25% of world cassava output in 1992-94 was devoted to feed in the form of pellets and chips, representing a 2% increase over the 1970s. Trade development by the EEC at global level and in such non-cassava producing countries as Japan and the Republic of Korea are helping to promote the use of cassava as feed.

Potential for dried cassava: In general, urbanization and rising incomes have reduced the market for fresh roots. Housewives seek convenience foods that are easy to buy, store and prepare. Thus packaged cassava and cassava flour and breads are gaining greater acceptance in some markets. (Hershey and Henry 1997)

Farinha and *gari* in particular could be considered as convenience foods because they are easy to buy, store and prepare. These possibilities should be explored further, particularly with the increase in the African, Latin American and Caribbean population in the Western world.

Cassava flour has potential in many developing countries, particularly in Africa (and to a lesser extent in Asia) where there is a large consumption of bread made from 100 percent imported wheat. The degree of replacement can lead to different grades of breads and pastry products and prices for the consumer. Research will be needed to evaluate different proportions of cassava/wheat flour, working in partnership with the bakery industry.

Dried cassava in the form of meal, chips and pellets has been an important animal feed ingredient. As livestock production and consumption become more important in cassava producing countries the need for animal feed rations is expected to increase.

Finally dried and fresh cassava can be used to produce glues and alcohol (both hydrous and anhydrous). These markets, especially those for glue and anhydrous alcohol represent new opportunities for the use of cassava in many countries.

These potentials represent growth through **concentration**, **innovation**, and **competition**. The combination of the growth factors will be site specific.

Major Strategy Concerns: Given the variability of sources of growth, there will be need to pay attention to many different aspects of the cassava system.

As noted above growth through concentration often times requires improved production, storage, processing technology, and improved infrastructure. Growth through innovation suggests a need for R&D to help develop the new or refined products. Both Latin America and Africa can benefit from further commercialization and improvement of home, village-level and larger scale processing of *farinha* and *gari*. Other products from such processing efforts as manioc meal or *foo-foo* (a paste-like meal made from cooked fermented tubers or cassava flour) should be identified and improved.

Because animal feeds derived from cassava compete primarily with grain crops, lowering the costs of cassava production is of great importance. Main constraints for greater use for animal feeds are lack of constancy of supply of cassava feeds throughout the year, inconsistent quality, and price competitiveness with grains. Research

and Development is needed to help make cassava feeds competitive with cereal-based feeds.

Products from cassava starch

Cassava starch is used directly in different ways or as a raw material for further processing. Special features of cassava starch are its viscosity, resistance to shear stress and resistance to freezing. The main classes of starch-based products are: (1) unmodified or native starch; (2) modified (physical, chemical, biological) starches for industrial purposes; and (3) sweeteners, including high fructose syrup, glucose (dextrin, monosodium glutamate, pharmaceuticals, etc.).

Potential for the Future: Cassava starch has high potential for growth both for industrial and human uses. The unique properties of cassava starch suggest its use for speciality markets such as: baby foods, non-allergenic products and food for hospitalized persons. Cassava starch can be modified to provide characteristics that are required for more specialized food and industrial products. Modified cassava starch can compete with other starches for the production of: alcohol, starch for sizing paper and textiles, glues, MSG, sweeteners, bio-degradable products, butanol and acetone, manufacture of explosives, and coagulation of rubber latex.

This potential represents growth through *innovation* and *competition*.

Major Strategy Concerns: Growth through innovation requires R&D effort. Growth through competition may require improvements throughout the entire cassava production, processing and marketing continuum. Unmodified or native starches retain their identity as cassava-derived, and may receive unwanted trade or import restrictions based on crop of origin. Hence, native starches would be more competitive if their inherent special traits set them apart from competing starches (e.g. maize-derived, sweet potato-derived, etc.). It is important to determine and capitalize on the special traits of cassava starch that are not available in competing starches. There is need for cassava producing countries to develop their domestic market before entering into the export market.

Modified starches would not be expected to carry forward their cassava derivation, so they may be free from trade or import restrictions that might be imposed on cassava products. Starch modification usually adds value, so efforts should be made to identify and produce modified starches and their derived products with market potential. The modified starch market exhibits a great deal of vertical integration between the producers of raw material, especially maize and potatoes, the processors and the manufacturers of the final

products. Thus entry into this market may require the same type of vertical integration for modified cassava starch.

Additional thoughts on Potential Growth Markets

It must be remembered that the supply-chain for cassava products tends to begin with small-scale production units followed by small scale processing units for drying and/or milling of cassava. These steps are often done at the home and village/local level. As the product moves through the supply-chain activities like marketing, processing and packaging are done by fewer larger-scale units, which then distribute the final product to a larger number of consumers. This *hourglass* supply-chain differs from that of many established agricultural products. The existence of the *hourglass* supply-chain does suggest that growth and development of cassava product markets will benefit the large number of resource-poor farmers located on poor lands, and local processing units. The challenge is how to equip these farmers and processors with the knowledge and tools needed to provide the products that meet the requirements of growth markets. There is also the challenge of how to deal with growth markets that lead to an altered supply-chain - one with fewer large-scale producers. This means that when assessing market opportunities potential structural change of the supply-chain need to be evaluated.

Implementation Steps

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. This would be part of the industrial analysis.

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.

A **fourth step**, is to secure the cooperation of those associated with the market opportunity. It is unlikely that any market opportunities will be realised without a concerted effort by many of the cassava system stakeholders. It is also unlikely that the producers of cassava will be able to spearhead a demand-driven market expansion. Although the development of a high volume **gari** production and marketing scheme in Nigeria appears to demonstrate that producers can avail themselves of emerging growth market opportunities. [See Box].

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 lead 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 know but in the process of expanding the production and marketing of gari someone came up with the technique that greatly increased the batch size for cassava soaking and fermenting. The technique entailed sewing together large placticised bag 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 skilletts, 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 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 the demand for cassava greatly increased with improved market access. The ability of the villagers to respond to this opportunity was facilitated by the availability of improved disease resistant varieties, ingenuity, credit and hard work. This combination of factors lead to the development of a cassava based industry that has generally improved the well-being 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.

Catalysts and Champions

The Strategy requires **catalysts** capable of identifying marketing opportunities, and bringing these to the attention of stakeholders. It also needs **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 is likely a need, for research and development, provision of infrastructure and investments, and changes in policies to grasp the new opportunity.

It could be argued that entrepreneurs will seize the opportunity and develop new markets. This might be true in a perfect, risk free world, but the entrepreneur has many alternatives, and may have successful, ongoing ventures. In such cases the development of a new market, which relies on getting supplies from a large number of small producers, may seem to be too risky. Also the entrepreneur may not have the skills or information on how to develop a new cassava product, such as convenience foods. 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 **Global Strategy for Cassava** is proposed.

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 that 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, 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 **catalysts** is the identification of growth market and the commitment of resources and energies necessary to entice others to examine 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.

Implementation of the Strategy

The global strategy should be seen as comprising both bottom-up and top-down approaches. The bottom-up portion would be the formulation of national strategies, because national efforts will be the action-sites for implementing the global strategy. In a sense the global strategy should be seen as an amalgamation of national strategies and plans, augmented by continental and global efforts to identify and stimulate markets, obtain financing, and help provide needed changes in policies that constrain markets and production and identify and support global needs in research and development.

National Strategy

National strategies should evolve from a process of industry analysis. In this process, the relevance of roots and tubers, especially cassava, as a possible entry point in developing a national strategy should be explored. In particular, special reference should be given to the role of the cassava production-processing-marketing continuum in specific ecological zones or socio-geographic communities, from the viewpoint of food security or income generation and economic diversification.

The national strategy will be the nucleus for the cassava industry, and each country should formulate a long-term plan developed through industry analysis to encompass:

1. Finding and obtaining the commitment of a national champion or champions(s) for cassava.
2. A strong integrated R & D effort that includes financing (business not as usual --no more free ride) and addresses the minimum unique problems of the cassava industry in the country
3. Strong links with regional and continental efforts, including a clear definition of assistance needed so as to avoid duplication
4. Building and strengthening existing domestic markets as a basis for industrial or export growth
5. Building a sustained dynamic domestic cassava industry that is linked to cash/grain crops in order to reduce export risks.

Major Strategy Concerns: Each country has its own strengths and weaknesses in cassava production/processing/marketing. Each has its own dreams and aspirations for its citizens. Hence, each should develop its own strategy for the future, including how it wants to see the growth and future of cassava in reaching national goals. Perhaps a country has an advantage in traditional processing that it would like to exploit in its economic development. Perhaps it wishes to become partners with a neighboring country in improving its product lines and marketing channels. Some countries will want to establish clear lines of co-operation with potential partners in research and development activities. Bringing its main stakeholders together to plan the future of the cassava industry offers powerful potential to bring about needed change, increased support, ingenuity, and collaboration in setting and meeting national economic goals for cassava.

Regional Strategy

A continental strategy per se may not be practical, especially for Africa or Asia, where distances and differences in farming systems, processing and uses are so great. Here regional or sub-continental strategies may be more useful, especially where regional entities such as ASARECA in East and Central Africa, SACCAR in Southern Africa, or CORAF in West Africa are actively involved in agricultural development and could act as champions or catalysts for cassava.

Topics of concern for regional strategies would probably not differ much from continental strategies, except they would be tailored more to the particular sub-continent or region and its problems and

potentials. Once regional strategies are developed, they should be incorporated to the extent possible into continental strategies.

The regional strategy should build-on and augment national strategies. The regional strategy should include:

1. Finding and obtaining the commitment of a regional champion or champions for cassava.
2. Industry analysis at regional level indicating current status, strengths, weaknesses and issues for regional attention and action needed to resolve pressing constraints.
3. Dissemination of relevant materials and information through workshops, exchange visits, bulletins, Internet.
4. Development/strengthening/promotion of regional markets through the relevant organizations such as fora for R&D, finance, economic development, and agricultural development.

Continental Strategy

The continental strategy expands on national and regional strategies. The continental strategy highlights the needs and support that transcend national and regional concerns. The continental cassava includes:

1. Finding and obtaining the commitment of a continental champion or champions for cassava.
2. Obtaining financial support from international/development agencies such as the World Bank, African, Asian and Latin American development banks; roles of OAU, OAS, ASEAN, etc.
3. Formulation and implementation of plant protection systems for evaluation and monitoring of pests/diseases within the continent and that combine resistant varieties, biological control measures and plant materials sanitation and safe movement of improved cassava germplasm materials through public and private sector partnerships.

Continental and regional programs should include (1) R & D plans for cassava, especially in making sure that special problems of the continent are being handled effectively, (2) production and marketing of products that may be consumed in the region or may be exported

outside the continent, (3) plans for collaboration within the continent in developing the production/processing/marketing continuum, and (4) make use of advances in other parts of the world through exchange of visits, training, etc..

Global Strategy

The global strategy should be seen as an amalgamation of national, regional and continental strategies and plans, augmented by global efforts to identify and stimulate markets. The global effort assists with financing, changing policies that constrain markets and production, and identifying and supporting global research and development. The global strategy cassava includes:

1. The commitment of global champions and catalysts for cassava; e.g., CGIAR, CIAT, IFAD, World Bank, African Development Bank, Asian Development Bank, Interamerican Development Bank.
2. The promotion of global studies of potential new markets, including trade and policy issues that will help give cassava greater significance and economic presence.
3. The identification of global pest and disease problems requiring international solution, including genetic means, plant quarantine, biocontrols, and methods of solving such problems, including funding of such efforts.
4. The identification of potential areas for technology transfer that might benefit regions needing, but not yet using, such technology.
5. The involvement of international institutes/centers in training, development of new materials and technologies (including use of biotechnology), and collaboration between national and regional centers. The international centers, such as International. Institute of Tropical Agriculture. IITA- International. Center for Tropical Agriculture. CIAT International Laboratory for Tropical Biotechnology. ILTAB can provide post-graduate training to scientists from developing countries in cell and tissue culture, virology and molecular genetics; work on projects to create disease/pest resistant plants ...e.g. project on cassava mosaic virus.

Continental Strategic Considerations

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.

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 Francophone 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 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 1997)

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.

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 Indonesia and 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.

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. At least half of total production is used directly for human food. Animal feed and industrial uses account for 20 to 30% of production³. Brazil and Paraguay are the region's largest producers. On-farm feeding of fresh or dried cassava has been practised for a

³ Personal communiqué for Dr. Guy Henry, 2 February 1998.

long time, but their use in balanced rations is growing. Starch production in Brazil, Columbia 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.

Research and Development

“We now know that science-driven agricultural transformation can occur in countries that develop effective agricultural research capacities” (Working Group on International Agricultural Research, 1997).

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.

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. Both the Centro Internacional de Agricultura Tropical (CIAT) in Colombia, and the International Institute of Tropical Agriculture (IITA) in Nigeria hold large collections of cassava germplasm. 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.

Production and Processing Strategies: Possible R & D needs

The demand driven approach inevitable leads to needs for research and development related to the production and processing of cassava. Some possible R&D needs include the following:

- Varietal development
 - value added traits, e. g., for high insect and/or disease resistance along with high starch content and recoverability
 - more investment in research on evaluation for specific traits 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
- Improved production systems to:

- produce more per unit of land
- reduce costs of production
- increase product value, while keeping cost of production the same or lower

- Crop management
 - improved agronomic practices
 - effective pest management - quarantine measures, monitoring of new or emerging pests and diseases, biocontrols, IPM
 - mechanization - small-scale mechanization through university/research institute/private sector partnerships

- Processing research
 - new products
 - new methods and techniques
 - modified starches, more advanced techniques of modification, including use of biotechnology
 - small-scale processing

- Environmental concerns
 - reduce soil erosion, research on motivation and practices
 - reduce pollution, especially in the production/processing for starch,
 - prevent destruction of ecosystems, forests, shifting cultivation

- Institutional support
 - public/private sector partnerships essential, e.g., for herbicide resistance, response to plant nutrition practices, research infrastructure, training of scientists, farmers, organizations, and cassava networks.

Summary

The vision for cassava is

Cassava will spur rural industrial development and raise incomes for producers, processors and traders.

Cassava will contribute to the food security status of its producing and consuming households.

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 well-being of numerous disadvantaged individuals in the world. It is suggested that a ***necessary condition*** for the implementation of this strategy is the existence of a **growing demand** for cassava.

To achieve this vision the Global Cassava Strategy is proposed. The essence of the Global Cassava Strategy is

to use a demand-driven approach to promote and develop cassava-based industries with the assistance of a coalition of groups and individuals interested in developing the cassava industry.

The strategy consists of identifying, in a systematic manner, the opportunities and constraints of cassava at each stage of the commodity development cycle. This can be done by groups and individuals interested in developing the cassava industry; producers, processors and consumers of cassava, as well as associated national, international and non-governmental organisations. Concepts of business development and management as well as international economic cooperation are important tools in implementing the strategy. Scientific support is also essential to help overcome important problems within the production-processing-marketing continuum. Adaptive research is essential to ensure that existing and evolving knowledge is harnessed in an appropriate and useful fashion. The overall aim is to achieve demand-driven technical change and economic growth.

The Global Cassava Strategy suggests the utilization of “industry analysis”. Industry analysis consists of identifying, in a systematic manner, the opportunities and constraints at each stage of the supply chain. Industry analysis involves stakeholders in a participatory effort to identify strengths, weaknesses and opportunities. Industry analysis is a demand-driven approach to technical change through (1) explicitly considering stakeholders as equal partners in determining the needs and future plans for a dynamic cassava industry, (2) building a practical, shared vision for cassava development, (3) helping make action plans for the industry, including the who, what, why, and how, plus the question, with whose money? (4) building better linkages with private sector organizations, (5) better links with and among public-

sector institutions, (6) co-stewardship of research and service outputs with users, and (7) rapid introduction of high-impact technologies through public and private sector partnerships. 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 harnessed in an appropriate and useful fashion.

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. A **second step** is the provision of a consistent supply of a relatively uniform product. A **third step**, related to step two, is to provide the market with a competitively priced product that meets the consumers' requirements. A **fourth step** is to secure the cooperation of those associated with the market opportunity.

The initiation of this Strategy will require **catalysts** capable of identifying marketing opportunities, and bringing these to the attention of stakeholders, and **champions**, capable of providing support and resources for the growth and development of cassava markets. 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.

The development path for cassava will be **product, location** 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 global strategy should be seen as comprising both bottom-up and top-down approaches. The global strategy is an amalgamation of national, regional and continental strategies and plans, augmented by global efforts to identify and stimulate markets. The national efforts will be the action-sites for implementing the global strategy. The global effort assists with financing, changing policies that constrain markets and production, and identifying and supporting global research and development.

National strategies should evolve from a process of industry analysis. In this process, the relevance of roots and tubers, especially cassava, as a possible entry point in developing a national strategy should be explored. In particular, special reference should be given to the role of the cassava production-processing-marketing continuum in specific ecological zones or socio-geographic communities, from the viewpoint of food security or income generation and economic diversification.

Regional strategies should be developed where farming systems, environmental conditions, and processing and utilization of cassava are similar. Regional strategies should be supportive of and supported by regional entities such as ASARECA in East and Central Africa, SACCAR in Southern Africa, or CORAF in West Africa that are actively involved in agricultural development of root crops. These regional entities could act as champions or catalysts for cassava.

The continental strategy expands on national and regional strategies. The continental strategy highlights the needs and support that transcend national and regional concerns.

The Global Strategy seeks global support to help implement the strategy. Development banks and institutions such as the World Bank, Asian Development Bank, Interamerican Development Bank and African Development Bank may play a vital role. The Global Strategy provides assistance to cassava-growing nations that are developing and supporting national strategies. The Global Strategy should assist with the development of a global forum for the pursuit of cassava market opportunities, identification of source of capital, and promotion of a strong base of research support for global genetic resource and enhancement studies, including biotechnology, at CIAT, IITA, and CENARGEN, in particular.

Action Needed

The Global Strategy implies that certain actions need to be undertaken to forward and maintain its cause. These actions arise from the strategy and regional workshops⁴ where the strategy was reviewed. These actions require national, regional and global input.

Interested stakeholders need to work together to identify areas where the Global Cassava Strategy is applicable. There is a need to apply the Strategy and validate it, perhaps through the initiation of pilot projects. In some instances there is a need to provide global and regional support to the development of national strategies. There is a need to

⁴ Workshops were held in Brazil, Colombia, Uganda, Ghana and Thailand.

share experiences learned. The Global Strategy should 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.

The following were identified as some of the actions needed at the global level.

- Promote the Global Cassava Strategy.
- Seek support for Global Cassava Strategy at national, regional and global levels.
- Establish a form of coordination or network for global level activities.
- Identify a mechanism to provide follow-up on the Global Cassava Strategy.
- Develop a management information system related to the Global Cassava Strategy.

Finally, there is a need to realize that for the vision to be realized the use of cassava as an engine of growth must be included as part of a nation's development plan.

Reference List

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