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THE STATE OF FRUIT AND VEGETABLE PROCESSING INDUSTRIES IN AFRICA: THE CASE OF ALGERIA, EGYPT, CÔTE D'IVOIRE AND NIGERIA*

Background Paper

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* The views expressed in this document are those of the author and do not necessarily reflect the views of the Secretariat of UNIDO. This document has not been edited.

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SUMMARY CONCLUSIONS

1. There's considerable scope and potentiality and need for increased fruits and vegetables processed products in the African region for economic and social considerations. The varied climatic zones and rich soil conditions are also favourable for the production of a variety of fruits and vegetables. There is ample land, water for mobilization and exploitation and human resources as producers and consumers.

2. With the combination of the production factor, land, water and human resources, at its disposal, the African continent has an economic advantage in mobilizing its own natural and human resources. The agriculture and food sector should be the prime mover in the industrialization process. Thus processing of fruits and vegetables fits with the logic of industrial development in the African region.

3. There are also several benefits that can accrue to the African countries in the industrialization of the fruit and vegetable sub-sector. First there is the productive employment aspect in the entire production cycle of the product, that is, production, processing and marketing stages. Unemployment, especially of the young is a serious problem that continues to confront the countries visited, Algeria, Egypt, Nigeria and Côte d'Ivoire. Other economic and social benefits to a country include value added, saving or earning foreign exchange, solving food shortages, etc.

4. There are shortages of foodstuffs in demand especially in Algeria, Egypt and Nigeria, and processed fruits and vegetables would supplement and close the gap.

5. In looking at the industrial policies, strategies, programmes, resources and institutional framework, there is a general air of lack of focus, articulation and resources, shortage in management and organization. Lack of commitment and consistency leads to tentative operations. Lack of proper personnel and management to see a policy and programme through is a serious industrial problem.

6. All African countries, in the light of the current economic and social crises facing them, and in view of the national, regional and international commitments they have already undertaken, must undertake urgent measures to ensure that explicit, relevant and realistic industrial policies, strategies, programmes with adequate funds are in place, in order to tackle and resolve effectively their beleaguered industrial economies in general and the fruit and vegetables processing industries in particular.

7. The technologies, equipment, machineries are invariably imported from various countries with the inevitable consequences of having to depend on outsiders for the supply of spare parts, expertise, maintenance, servicing and training and education needs of the locals.

8. In the four countries there are industrial institutions, research and development bodies, and research and education organs, which can be used as a basis for developing and strengthening the technological capability of acquiring, assimilating and diffusing technical and technological processes and products. The capacity to adapt, improve, innovate and eventually design,

engineering and fabrication can only be had through the availability of a strong technological base. This base requires vast allocation of resources, beyond the present capability of these countries. These countries and the African continent in general, would need generous international support and assistance.

9. Education and training in industrial management, organization, transfer of appropriate technologies are the priority areas where the international community can make useful and productive contribution towards the acceleration of African industrialization process, especially in the fruits and vegetables processing technology.

10. Containers, in all the visited countries are a serious handicap and add to the final cost of the product. The average cost of a container ranges between 40-50 per cent of the price of the final finished product. The price of the product is prohibitive beyond the average income and purchasing power of the average citizen. When it comes to export also it poses the same problem, then it cannot compete with similar products on sale by other countries. A local material has to be found to reduce average sale unit price in order to make it competitive. These countries and the African countries in general require urgent support and assistance in packaging and handling.

11. The countries concerned should facilitate the importation of spare parts and intermediary inputs with the imposition of reasonable internal tariff or without duties, in the case of infant industries.

12. In the development of industrial market outlet, it is necessary to consider the tastes, preferences and needs of local consumers, and carry also public education and aggresive sale promotion to expand domestic markets. Local markets are the base and guarantee for a sustained demand of the product in question. Any surplus could be considered for export purposes, with all the consequences of strong competition.

13. In this regard, the need to maintain sanitary practice, quality standard cannot be overemphasized. The final product should be safe, wholesome, attractive and reasonable in price, be it for domestic or external market. There must be consistency, reliability, in order to command the confidence of the market.

14. It is necessary to develop a unit for quality control to the standard quality of intermediate inputs, raw materials as well as the final product for public consumption. From the hygiene, quality and standard point of view, the product should be sound and good.

15. Once the internal market is satisfied, it will be more advantageous to consider markets in the neighbouring countries within a framework of existing regional or sub-regional economic co-operation and integration scheme to mutual and common interest and benefit. The Maghreb countries, the Economic Community of West African States (ECOWAS), Mano River Union (MRU), and other regional schemes are the cases in point.

16. This report, in a broad way, focuses on the industrial development issues, and constraints that confront the fruit and vegetable processing industries, in a few countries and in the African region as a whole. The potential and need for increased fruit and vegetable processed products, for current and future markets have been established. In that way, certain legal, institutional and infrastructural facilities and services in these countries will require further strengthening and re-invigorating for a dynamic rehabilitation and restructuring of the industry.

17. UNIDO, through the System of Consultations, and in close collaboration with the UN agencies concerned, international and regional financial institutions and bilateral programmes, has a unique challenge and opportunity to assist and support these countries and the African region as a whole, in achieving their objectives and aims of accelerating the industrialization process for general economic and social welfare.

REPORT BODY AND METHODOLOGY

18. The paper examines the current state of fruit and vegetable processing industries in the Africa region, with particular reference to selected countries. Industrial strategies, policies and programmes carried out are described and analysed. In this regard, actual and potential resource endowments, the role of public and private sectors, technology utilized, the nature and extent of investment and budgetary resource allocation, human resources development, domestic and external market outlets, are considered in some detail.

19. Constraints that appear to hamper progress and development of the processing industries within specific countries of common interest in the region as a whole are identified. Development measures, that is policies, strategies and action programmes are identified at national, sub-regional, regional and international level to overcome the institutional or resource constraints, and facilitate increased economic and social development.

20. In looking at the present situation of the fruit and vegetable processing industries in Africa, special focus is laid on aspects related to processing, storage, packaging and delivery systems and the potential for expansion of production. The variety of climatic conditions, physical features and its human resources places the African continent in a favourable economic advantage for increased expansion and development of the fruit and vegetable processing industries.

21. The report is an outcome of interviews conducted, discussions carried out with UN officials and experts at UNIDO, Vienna, UNCTAD and ITC in Geneva, FAO in Rome, with public and private sector officials and UN field officials and experts in Algeria, Arab Republic of Egypt, Nigeria and Côte d'Ivoire. At the same time available relevant data and information have been collected, analysed and relevant literature and UN publications consulted.

22. The data and information could not be completed due to absence of dependable statistical institutions, in the African countries in general. Statistical institutions in Africa tend to be understaffed, underequipped and under-resourced. The data provided comes from UN, mainly FAO sources, which is available, in relation to agricultural commodities, production, processing and marketing aspects. If the figures provided are read and used with prudence and perspective, they should be a reasonable basis for understanding and appreciating of the general state of the fruit and vegetable processing industries in the African region and the countries comprising it individually.

23. Under such situation, the African countries individually and collectively should take urgent and appropiate measure, to further strengthen and upgrade the institutions which collect, analyze, publish and disseminate basic statistical data and information on the various sectors, subsectors and activities of the economy on a continuous basis in order to facilitate studies and planning of their economies.

PART I

Technology of processing

24. The term processing refers, in this context, to the deliberate transformation of a previous agricultural food commodity, with a view to preserve and prolong its shelf-life while maintaining its essential nutritive qualities, including taste, colour, odour and texture, under hygienic and stable conditions. In developing countries, particularly in the African region, traditional food processing methods do play a crucial role in feeding the vast majority of the rural population and should not be ignored.

25. Fruits and vegetables have been processed too in traditional methods for consumption essentially by the household. When there could be surplus, it would be made available for sale outside in a village or urban markets.

26. Nowadays with commercialization of fruits and vegetables and increased urbanization process, many countries have introduced and developed different technologies for processing their fruits and vegetable products. Some of the processing technologies adopted these days are briefly described in the following paragraphs.

27. Thermal processing:

The efficient high temperature/short-time thermal treatment of aseptic processing minimizes damage of sensitive flavours, such as in tropical fruits, and process flexibility permits operations from bulk sterilization to retail single portion packaging. Skilled labour is required and the operation must be practically continuous in order to be economical. The efficiency, versatility, and quality potential are worth considering. An aseptic line can be integrated with fresh product handling or processing of discrete particles (slices, chunks, etc.).

28. Freezing:

The quality-retaining potential of freeze preservation can be realized in the tropics only where frozen storage and transportation capabilities exist. Central freeze-processing is a feasible enterprise, even to the extent of air shipment, when the food value warrants the additional expenses. Such an infrastructure can tie in well with the handling of fresh produce, where temperature control and careful scheduling of harvesting and shipping are even more critical than with frozen foods.

29. Dehydration and concentration:

The weight and bulk reduction and enhanced stability of dried foods can facilitate tropical food handling, provided that quality is retained. The major food staples and other items of international trade are often based on solar drying; cereal grains, grain legumes, spices, coffee, cocoa, and tea are some examples. More widespread use of such methods in the tropics depends upon efficient dehydration equipment, hermetic packaging, and sound storage facilities.

30. Concentration of fluid foods when tied in with frozen storage, likewise, is a practical preservation method. Highly flavoured fruits such as passion fruit, guava, and lime could be converted into natural concentrates. By mere addition of sugar to the frozen product, the juice is converted into nectar bases, without the need for concentration.

31. Irradiation:

Although irradiation is a proven pasteurization and sterilization process, its initial and most urgent use in developing countries will probably be for insect deinfestation, as a replacement for chemical fumigants to meet the fresh produce quarantine requirements of importing countries.

32. Fermentation:

Tropical fruits are underutilized. It has been suggested that tropical fruit wines could be produced, if proper research and experimentation is carried out. Fermentation technology now means much more than traditional foods. One of the findings in recent years has been the development of high-fructose corn syrup which is said to have irreversibly diminished the use of cane sugar in developed countries. However, bio-technology applied to the tropics will eventually enhance the quantity, quality and diversity of tropical foods as raw materials and ingredients for processing. Tropical foods are in a position to both lose and gain international markets. One difference is that the pace of innovation and obsolescence is much faster today than some years ago.

33. Food bio-technology 1/:

It is perhaps useful to make a brief reference to the impact of biotechnology on food-processing, even when we are discussing just a single sub-sector of the industry. It is said that while during the last two decades food research and development were marked by work on proteins, energy concerns, consumerism, food quality and safety issues, the present and the next decade are likely to be concentrated on bio-technology and natural products. The demand for natural products has prompted the increased use of biological production and processing systems, such as fermentation for preservation purposes, and micrc-organisms and bio-catalysts from plant origin and flavour production. The production and utilization of fuel alcohol and the world-wide attempts to increase plant resistance to pesticides, drought, or high salt concentration, exemplify the impact bio-technology has on food production.

1/ Food Technology, April 1987, Food Biotechnology, Its Organization and Potential, pp 95-99.

34. During the antibiotic (pharmaceutical) era, different disciplines such as microbiology, biochemistry, and process engineering contributed to the newly developing fermentation industry. Conventional technologies derived from the food processing and chemical industries were applied to the fermentation industry.

35. The post-antibiotic era was marked by the "metabolic engineering", the systematic exploitation of the capabilities of microorganisms to produce a variety of metabolites and enzymes. One relevant breakthrough was the large-scale enzymatic conversion of starch to high fructose corn syrup, to which reference has been made earlier.

36. The era of present biotechnologies is dominated by controlled sciences such as genetic engineering, and computer-controlled bioprocesses.

37. It would appear to be useful to refer to the dried fruits industry 2/, which is of particular interest to the tropical-developing countries in the region. Prominent among the large number of fruits produced are banana, pineapple, and mango. There are a large number of other fruits, all of which have exotic flavours, texture and appearance. Among the many problems in marketing of these products there is the short shelf life of 1-4 weeks. For tropical countries that are a considerable distance from the markets, shipping by sea is the most economical method, but it is slow. Unless the whole system from production through packaging and shipping is well organized only sub-standard quality produce with low sales appeal will be available. A classic example of successful operation is the banana industry, which markets a large volume of bananas throughout the world. Air freight is expensive. The fruit or vegetables must command a high price in the retail market to cover the cost of air freight. The whole operation needs to be well organized to maintain temperature and humidity control to deliver the produce in top condition. This requires a large-scale operation and is not suited to a small business. The export of canned or frozen tropical fruits is a well established industry but it also demands considerable resources which place it out of reach of all but a few large organizations.

38. An alternative to small-scale processors is to dry the fruits and to convert them into stable products of longer shelf life of about a year. The advantages of drying are:

2/ Food Technology, May 1987, Post-Harvest Handling of Fresh and Dried Tropical Products, pp. 120-122.

-A more concentrated product than the fresh fruit. This reduces the cost of storage, packaging, and freight. For example one ton of fresh apricots, when dried, will weigh only 450 lbs.

-It is less costly than canning or freezing.

-It converts products into a stable with longer shelf-life.

-Capital costs are low.

-Farmers can harvest their produce and dry them as and when they become available.

-It is possible to grow and dry fruits in small units. It is not necessary to have large plantations or orchards, which are usually demanded for fresh-market fruits such as bananas.

Such operations are labour-intensive.

39. The annual world production of such dried fruits viz, apricots, dates, figs, prunes, raisins, and currants is 1.2 million tons representing 4.6 million tons of fresh fruit. The drying ratio (number of pounds of fresh fruit required to produce one pound of dried fruit) is: apples 7-10, apricots 5.5-8.5, figs 3, peaches 6-8.7, pears 6 7, prunes 2.75-3.25, and raisins 4-5. The United States of America is reported to be importing dried fruits of a total value of U.S. $ 26.5 million per annum.

40. While the fruits referred to above are from semi-tropical region, it is reasonable to believe that some tropical fruits will lend themselves to drying into a quality product with the potential for a large-volume export business, if suitable drying technologies are adopted. A good system would be to dry the fruit on the farm, and then bring it to a central packing house with large-scale operation catering to a large number of producers. The Dried Fruit Association of California (DFA) came into existence in 1908 and is said to have served the fruit industry very well. The services rendered are:

- Standardization
- Disease and pest control
- Research
- Sanitation
- Liaison, and
- Grade standard inspection service.

41. DFA has helped to build a sales volume in excess of one billion dollars per annum in dried fruits and nuts.

42. Technologies adopted, need to be efficient and cost-effective, that respond to the economic and social conditions of specific country concerned. In this regard, special efforts should be taken to develop methods and types of preserving that permit the sale of transformed fruits and vegetables at prices the producer country could afford, both for domestic consumption and for development of a stable export market.

Quality control, standardization, health and safety regulations

43. If the fruit and vegetable processing industries in the African region are to contribute effectively towards the growth of the national or regional economies, they must be in a position to manufacture canned or preserved products of high quality, acceptable to the national and international communities. Recognized international standards should be applied in the selection and use of raw materials. Neither the preservation process nor the can itself should impair the quality of the food product in any way. The nutritional value, the form, colour, aroma, flavour and consistency of the fruit and vegetable, as much as possible, should be maintained. Moreover, no heavy metals such as traces of lead should be permitted to migrate from the can material into the product, where they may constitute a health hazard.

44. The application of the right standards and procedures in canning, and the prevention of heavy metal contamination, are the central concern of the international community. The final product should be stable, cheap, nutritive and attractive.

45. It is essential that the African countries consider establishing or strengthening appropriate legal and institutional measures, in order to monitor size, quality, quantity and sanitary conditions of the processed product.

Packaging materials in fruit and vegetable processing industry

46. The interests of fruit and vegetable producers and consumers are similar, that is, the provision of wholesome and safe products at reasonable prices. The consumer is not interested only in the safety aspects of the food, but also in its economic and sensory attributes.

47. Fruits and vegetables are seasonal and perishable commodities. In this case, the packaging of the fruits and vegetables is considered to be the most crucial factor determining their storage life, while maintaining demanded quality of the product. It is particularly appropriate that one makes a serious study at, and a contribution on development in packaging materials.

48. There are certain internationally adopted pre-conditions for the use of packaging materials, demanded by traders and consumers alike. These are features related to inertness and usability of the material and economic efficiency.

49. As far as inertness goes, the quality of the packaged fruit and vegetable should not be impaired by the migration of substances, nor must the taste of the product be affected. When it comes to usability, the packaging material must be compatible with the fruit or vegetable to be canned and must protect the product during thermal processing, storing under different climatic conditions, mechanical handling and its journey to the consumer.

50. A third pre-condition refers to packaging and the environment. Today, the selection and use of various packaging materials are determined on the basis of economic criteria, which also take into account the amount of energy used in the production of such materials, and the availability of the packaging material.

51. For the industry, the packaging material and the package must be suitable for processing. The pre-requisite is efficient economic production on packaging machinery.

52. For a trader, the packaging material must be space saving in stacking and efficient. Transportation of packages are decisive pre-requisites for low-cost distribution. For the consumer the processed product must be convenient. If the consumer is to be satisfied with a product, then the sensory qualities such as flavour, colour and consistency must be maintained through strict quality controls. The inside of the package must also look hygienic with no evidence of excessive corrosion. The packaging materials used predominantly in the production of hermetically sealed containers are tin-plate, tin-free steel, aluminium and glass.

53. Tin-plate is the common term used for a steel sheet with a protective coating of tin. This combination of materials gives the properties of, a shiny metallic appearance, formability, possessing a gas barrier, rigidity, and providing adequate protection against corrosion and solderability. The hygienic appearance of this packaging material with nearly 175 years of experience of safety in the packaging of fruits and vegetables, has made it by far the most popular material for rigid food stuff containers.

54. The quality of this material is not critical for many products, but in the case of fruit and vegetable juices and certain vegetables the quality of steel used is of supreme importance, both in respect of chemical composition and steel microstructure.3/

55. Corrosion and migration of metals in cans are serious concerns of the fruit and vegetable industry in developing countries. Canning is used for the preservation of fruits and vegetables through packing them in a hermetically sealed container and heating it, before or after the packing. The term derives from the characteristic form of container used, that is a metal can. Other materials used in making containers include glass, plastics and laminates, in various forms and combinations. Canning serves the purposes of preserving the fruit or vegetable maintaining (and in some cases increasing) its nutritional value, and facilitating its storage and transport.

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* FAO Guidelines for Can Manufacturers and Food Canners, Food and Nutrition Paper 36, 1986.

Benefits of processing

56. Fruits and vegetables are seasonal and perishable commodities. Consequently their prices fluctuate between the lowest during the glut periods and the highest during off-season. Cold storage facility serves for short term preservation and that is insufficient for certain fruits and vegetables (potato and banana for example), which could not be adequately preserved through use of this facility. Perishable foodstuffs may be converted into stabilized products when stored for extended periods of time, by employing technologies such as canning, freezing, freez-drying, dehydration, fermentation, irradiation, etc.

57. The soil and climatic conditions of almost all the African countries, be it in the tropical, sub-tropical, dry and temperate like zones are suitable for the cultivation and production of a variety of fruits and vegetables. Despite the obvious natural resources endowment and economic advantage, the majority of these countries have yet to exploit fully these resources to optimum level. There is indeed great scope and possibility, with efficient use of available resources, to expand and diversify their fruits and vegetables production, processing and marketing opportunites. UNCTAD and FAO consider that fruits and vegetable products as useful commodities for diversification programmes of the agricultural and industrial sectors of the economies in Africa.

58. Such a diversification programme into fruits and vegetables could serve not only to satisfy the consumption needs of the population, but also would contribute towards the demand of industrialization process of their economies in developing fruits and vegetable processing industries.

59. Processing industry stimulates investment in other sectors as well, that is linkage effects within as well as outside the sector. Through spread and linkage effects, the processing industry creates other related economic activities and through input and output processes expands the production base of the economy, for increased growth and development.

60. The industrial processing of fruits and vegetables brings several economic and social benefits and advantages to a country. In the first place, domestic consumption needs of several products is made available on a year-round basis. Such a strategy promotes development of agriculture resources, increasing income of the farming populations, development of agricultural resources, and thereby also creating high employment opportunities in the industrial sector. Finally, the country develops the capacity for import substitution to meet national needs, thus saving scarce foreign exchange earnings. Also an opportunity may arise for export of surplus fruit and vegetable products, thereby fetching valuable foreign exchange currencies.

61. The value-added element is crucial. For according to UNCTAD, a fresh fruit exported overseas fetches no more than 11.5 per cent in gross return to producing countries. More than 88 per cent is the share of foreign enterprises. The country should retain a far higher share of the production, processing and marketing of its natural products.

62. A far greater benefit of processing a local produce, is for the country to be self-reliant to consume what it produces. On a broader industrial perspective, industrialization process brings about industrial organization and management, industrial skill, knowledge, experience and discipline. Familiarization and use of new technology would assist to enhance indigenous innovative and creative capacity for economic and technological independence.

Special problems of the African region

63. The African region is a vast geographical area of 30 million km2, about six times the size of continental Europe. The variety of physical features and climatic conditions bear far reaching consequences on the cost and use of energy and physical infrastructures, especially transport and communication. These constraints are the underlying key determinants of the rate and dimension of the industrialization process, with particular reference to the development of the food-processing industry, especially the fruits and vegetables processing industry sub-sector.

64. Another related area of concern which seriously affects food production and processing as well, in the African continent is the question of post-harvest losses, with direct bearing on productivity. According to FAO food wastage, attributed to post harvest losses, reaches between 40-50 per cent depending on the sub-region, country or community concerned. In this connection, the African climatic conditions, accelerate deterioration in biological material. Heat and humidity generate various fast reactions and transformation, which provoke growth of undesirable micro-organisms of different nature, for example, growth of mould, which attacks and causes fast deterioration in foodstuff.

65. Tropical climatic conditions do encourage the multiplication and profusion of insects and pests which attack agricultural produce and result in serious food losses. In this instance the question of food preservation, that is appropriate refrigeration equipment and processes, assume a proportion of importance and urgency that demand higher resources and special management measures over and above those needed in milder climatic continents. The application of refrigeration equipment and processes could require extraordinary resources and costs in energy generation, of cooling from higher climatic conditions down to lower temperature needed for appropriate preservation. Considering the resource capacity of the African countries as a whole, alternative strategies and policies should be adopted in energy conservation and elimination of waste. As far as fruits and vegetables processing industries go, good management, improved refrigeration equipment, evaluation of current production in food-processing enterprise and education of the public are some of the areas that should be studied carefully and policies and strategies evolved that respond to current needs.

66. Coupled with the food wastage and energy problems, there is also the vital pre-requisite of building up physical infrastructure, especially in the sector of transportation and communications, within and between African countries, without which one cannot seriously entertain the possibility of establishing a successful operation of fruit and vegetable processing industries, of any size and nature, anywhere in the continent.

67. The problem of post-harvest food losses, related energy requirements and physical infrastructure, especially transportation and communications, are initial formidable economic barriers, that require careful assessment and solutions in setting up appropriate, viable and feasible fruit and vegetable processing industries that respond to the economic and social conditions of the African countries individually and as a group of countries at the level of the region.

Pre-requisites for the creation of the fruit and vegetable processing industry

68. From past experiences of the successes and failures and costs of industrialization in some developing countries, there are certain lessons that have been learnt. Some of those lessons relate to the various economic and technical issues that need to be considered in attempting to set up fruit and vegetable processing industries in the African countries. These pre-requisites are of universal nature, they have to be tailored and adapted to the specific socio-economic environment and capacity of the economy concerned.

69. The outline of pre-requisites discussed in the following paragraphs, existence of explicit and articulate policies, strategies, programmes, with appropriate investment and budgetary resources allocation in favour of the fruits and vegetable processing industries. These policies would link the production, processing and marketing aspects, within a framework of a dynamic and progressive food and agro-industrial development plan. Linkage effects within as well as outside the sub-sector and the economy as a whole have to be taken into account.

70. Once the government authorities decide on setting up a fruit and vegetable processing plant, there are several vital technical requirements that have to be attended to simultaneously. These major and crucial requirements involve supply of materials of various nature, design and equipment, utilities and auxiliary services, manpower, technology and organization, effective demand of the product, and factory location.

(a) Supply of materials

71. In looking at the industrial processing aspect of fruit and vegetable products, it is essential that the supply (production) and demand (marketing) sides of the entire production cycle is studied and assessed in tandem. In essence, the production, processing, and marketing aspects are organically linked in a continous process. Therefore, it would be essential to ensure the availability of an adequate supply of raw materials in quantity, quality, price and regularity needed by a plant. Lack of raw material supply has been a major handicap and cause for a failure of many plants in Africa. In many instances unjustifiably and excessive optimism of availability of raw materials, far in excess of actual reality, have left plants underutilized or idle to the cost of the economy.

72. The suitability of existing varieties of fruits and vegetables for processing needs to be checked and tested before the plant is established and the local farmer has to be trained in cultivating the new varieties. There is also a tendency for processing plant capacity to be larger than the actual scale of operations justify, leading to excessive overhead costs. Industrial processing plants demand a given standard of quality, punctuality and regularity of deliveries, for a smooth and continuous operation.

73. It is admirable that the size of operation and capacity of a processing plant corresponds to what is economically and technically feasible, for the immediate and medium terms, while making provision for future expansion, where increased effective demand justifies it.

74. Industrial processing plants consume a vast amount of water in their operations. It is essential to secure an adequate amount and supply of water, in quality and quantity required, in order to operate the plant efficiently. Regular chemical and microbiological tests should also be carried out to ensure an acceptable standard of hygiene and cleanliness.

75. Imports such as chemicals and packaging materials that may not be available locally might be difficult to have them on a continuous basis, usually due to shortage of foreign exchange. Packaging material is one item input that inflates the cost of a product. In many African countries, the cost of the container ranges between 40 and 60 per cent of the total cost of the product, depending on the material, size and type used. In developing and using packaging materials, particular attention should be paid to the low income and limited purchasing power of the local consumers, who cannot afford to pay for sophisticated packaging material.

76. In planning a food processing plant in any African country, it is desirable and necessary to carry out an economic and technical appraisal of major inputs and their effective contribution to the costs of the final product.

(b) Design and factory equipment

77. At this stage, it is important to underline that special knowledge, skill and industrial experience are valuable assets, in designing a factory premises and in the selection and purchase of technology. The nature of the premises constructed, and quality of equipment selected and purchased should be in conformity to the economic capacity and environmental and working conditions of the country. They should be functional and economic in their operations. The premises and equipment of a factory are major overhead capital items, which are relatively large and costly installations. Moreover, such lumpy capital items do have future costs to the economy particularly in terms of labour for their operation, maintenance, spare parts, depreciation and eventual replacements.

78. The adequacy, appropriateness, suitability and serviceability of the premises, and equipment in such climatic and working conditions, are essential considerations in the design and equipping of an appropriate fruit and vegetable processing plant.

(c) Utilities, auxiliary services and transport

79. Modern industry uses water in enormous quantities for processing, filtering, flushing and cooling. Its significance can hardly be overemphasized. Electric power supply for steam heating, light and other purposes in industrial development is a basic necessity.

80. The disposal of waste materials and effluents are items that should be studied with great care because the cost of disposal becomes in many cases a high proportion of the operating costs of a factory.

81. Transport facilites are commercially important in developing countries where the main road and railway systems may be inadequate and rural roads are also deficient.

(d) Manpower, organization and technology

82. Trained, skilled and experienced manpower at technical and management levels is essential for the establishment and development of a sound processing plant. The labour force must be trained to be able to enhance the capacity of the plant to expand in relation to effective market demand.

83. Proper internal organization of the processing plant, especially its labour force, should be given opportunities to learn new techniques, and have access to training facilities, including on-the-job training, with a view to upgrade their knowledge, skills and broaden their experience.

84. Modern accounting systems should be introduced to effectively control the flow of funds, and through different auditing systems also identify and rectify major shortcomings in operational efficiency. The lack of an incentive system to encourage staff to improve its work performance and productivity has been a major hinderance for increased efficiency and effectiveness of processing plants.

85. Management and technical personnel of processing plants should have a sound understanding of the utilized technology, in order to have it improved, adapted and changed according to the socio-economic environment of a country.

86. Education and technical training is an area that should be given higher priority in the industrialization process. Education and training give the work forces opportunity and possibility of understanding of what is happening in the environment in which they live.

(e) Effective demand for product, problems of market

87. Underutilization, idleness and economic losses of many plants in developing countries are mainly attributed to over-estimation of actual capacity. In certain cases, no proper market research has been carried out, before a decision on the investment is made. In some other cases, the survey was superficial and led to inaccurate assessment of current and future demand of the market. The domestic and the export markets, should be studied carefully, based on a short, medium and long-term framework.

88. Herebefore, in search of foreign exchange the African countries tended to establish food industries primarily concerned with the export market. This tradition needs some deliberate reorientation. It is important that products of the fruits, vegetable and processing plants are geared to satisfy the needs and demands of the local consumers in the first instance.

89. The assessment of demand for processed fruits and vegetable products by local consumers require precise and detailed information. Such information should be able to reveal the size and location of the consumers, their tastes, preferences and income. It is important to realize that due to low income a majority of the local consumer may not be able to afford to buy elaborately processed and packaged fruits and vegetables. Hence the price should be reasonable, and consumption pattern, including taste and preferences could be changed with sale promotion and public education. It is important and makes economic sense that any processing plant has a better chance of survival and future expansion, if its market is based on a strong sustained local demand.

90. The assessment of commercial external demand for fruits and vegetable products such as canned goods is more difficult and requires further reliable and detailed information on commercial aspects such as packaging, pricing, credit, transport, storage, sales promotion, trade rules and procedures, quality, access to markets, in particular information on tariff and non-tariff barriers.

(f) Factory location

91. The decision on the location is normally based on economic factors aimed at minimizing marketing and processing costs, and maximizing profits and benefits which accrue from marketing advantages, such as, for example availability of raw materials, convenience for ports or wholesale distribution centers.

92. On the other hand, there is a recognition in many developing countries, that the decision on location is sometimes influenced by political consideration. There are situations where active measures should be taken to stimulate development in certain deprived regional or rural areas in order to create employment opportunities and thereby reduce exodus to cities. In this case, political decisions may be made which can be in conflict with technical and economic considerations.

93. Another significant aspect is the use of a combination of several raw materials for processing in the same plant. The demand for individual processed products may be limited, and in order to operate the plant at full or nearly full capacity and reduce overhead costs, a variety of products are processed simultaneously or in succession. The problem here is to decide on the right combination of products such as fruit and vegetables and other products.

(g) Investment in research and development

94. The concept of fruit and vegetable processing is a question of vital national and regional interest in the African region, and its significance and level of priority attached is a function of the size of the investment resources allocated to the industry. It is a challenge and opportunity for the countries to show their determination.

95. The African governments cannot ignore the fruit and vegetable sector when it comes to laying down national policies, strategies, and explicit development programmes. In Africa as a whole more than 20 per cent of economic activity is related in some way to the agro-food industry. The food and beverage processing industries make a significant contribution to this effort.

96. It is recognized that research and development play a key role in creating material wealth through growth and competitiveness of the processing industry. The importance of technology, know-how transfer cannot be emphasized enough. It should be a primary concern of all food processors, researchers and engineers. Measures need to be taken to move more vigorously to raise the productive capacity and competitive level of the fruit and vegetable processing industry in Africa.

97. A strong and dynamic fruit and vegetable processing industry, inter alia, depends on the existence of sound agro-industrial policies, strategies and programmes with investment resources and budgetary allocation. Government policies on education and training, the transfer of technology and on research and development are key underpinnings for the operation of a sound and successful fruit and vegetable processing industry.

(h) Other requirements

98. Fruit and vegetable processing industries can equally benefit from equally dynamic government led marketing policies and services.

99. As far as marketing policies go, the government has influence and role in export and import policies on the development of processing industries, equally in relation to tax exemption and subsidy, as the need arises. Governments can provide useful services in marketing by way of promoting the fruit and vegetable processing industries.

100. New processing industries as well as old ones could benefit also from services such as applied market research, including a regular market information service, assistance in organizing trial shipments to study the acceptability of processed products in new markets, economic feasibility studies, sales promotion activities by participating in exhibitions and fairs, establishment of national brands where appropriate, advertisements, a quality control service, a grading and inspection service for processed products and for the raw material to be processed.

101. The fruit and vegetable processing industry in Africa has a responsibility to provide a nutritive, safe, quality product at a reasonable price. At present circumstances, such ambition of standard of quality product cannot be achieved without the support and assistance of the governments.

African Overview

Fruits and vegetables production

102. The African continent produces a variety of fruits and vegetables, due to its diverse climatic and soil conditions and abundance of human resources. The various African climatic zones, that is, tropical, sub-tropical, arid, semi-arid and temperate highland are suitable for almost all fruits produced in the world. The composition of fruits and vegetables produced and consumed in Africa are shown in Table 1.

103. The total production of fruits and vegetables reached about 69,563,000 tons in 1986. The per capita production and consumption is much lower than the actual potential. Through articulate and explicit policies, strategies and programmes, coupled with public education and sale promotion, the production and consumption could be increased substantially. It would be a definite contribution towards growth and development, with increased employment opportunities, higher income and expanded domestic market activities. There is a great scope for improved production and productivity of fruits and vegetables in the African continent from the point of view of economic, social and technical considerations.

104. Table 2 describes several fruits and vegetables produced, harvested areas in hectares and yield in kilogram per hectare, as compared with the overall world output and productivity. The average relative percentage production of fruits and vegetables ranges from 2 per cent of cabbages, about 11 per cent of tomatoes and artichokes, more than 15 per cent of pumpkins, squash, chillies, peppers, pineapples, bananas, about 36 per of dates and citrus fruits. As far as vegetables go Africa on average produces about 7 per cent and that of fruits about 13 per cent, of total world production. Given the favourable climatic and soil conditions, with some improvements in cultural technique and husbandry, production and productivity could be enhanced considerably.

105. When it comes to yield per hectare, on average Africa has registered higher productivity in most of the fruits and vegetables mentioned in Table 2.

106. All African countries produce a variety of fruits and vegetables. The North African countries, namely Morocco, Algeria and Tunisia are major producers of grapes, citrus fruits, oranges, manderine, lemon, dates, apples, pears, apricots and most of the vegetables.

107. In East Africa, Kenya is a principal producer of several type of fruits and vegetables such as avocados, beans, mangoes, pineapple and strawberries.

108. In West Africa, Nigeria, Ghana, Côte d'Ivoire, Cameroun, Mali, Senegal and Burkina Faso are major producers of pinapples, mangoes, melon, bean.

109. As indicated in Table 3, Algeria, Egypt, Côte d'Ivoire, Kenya, Morocco, Sudan and Tunisia are the major fruit and vegetable producers in Africa.

Selected off-season fruits and vegetables export

110. Table 4 indicates selected fresh off-season fruits and vegetables exported by certain African countries, namely, Burkina Faso, Cameroon, Côte d'Ivoire , Egypt, Kenya, Mali and Senegal, to five major markets in Europe in 1986. The countries involved included the United Kingdom, France, the Federal Republic of Germany, the Netherlands and Switzerland.

111. Burkina Faso in 1986 exported green beans and mangoes in the order of 3,437 tons and 1,536 tons, capturing 3,4 per per cent and 6,5 of market share, respectively.

112. Cameroon is the second largest supplier of pineapples to the European market. Its share over 2,674, that is 1.6% of the market and more than 90% went to France.

113. Côte d'Ivoire is the largest supplier of pineapples to Europe. In 1986, it exported more than 144,000 tons of fresh pineapples to the European market. Furthermore 827 tons of mangoes and 204 tons of papayas were supplied to Europe the same year.

114. Egypt exported a sizeable quantity of green beans, that is about 12,608 tons, sharing more than 12% of the market.

115. Kenya, with its strategic geographical position and its favourable climatic and soil conditions, has developed a dynamic horticultural industry and effec' contribution to the economy. High quality fruits and vegetable. both tropical and temperate, are grown throughout the year. In 1986, Kenya exported French beans 8,845 tons, with a share of 8.7% of the European market, including avocados 1,928 tons (1.9%), pineapples 367 tons, mangoes 690 tons, strawberries 222 tons and aubergines 172 tons, all in 1986.

116. Mali is a major supplier of fresh mangoes to Europe and exported 2,071 tons, that is 8.8% share of the market. All are air freighted to Paris. Fine and extra-fine beans are also exported, the figure for 1986 being 350 tons.

117. Senegal supplied the European market with 3,959 tons of green beans and 1,107 tons of melons. Exported also 54 tons of mangoes and 17 tons of capsicums in 1986.

118. A few years ago these fruits were considered as luxury items and their consumption was limited to high priced stores and restaurants. The recent expansion of markets and effective increasing demand has to be explained by the development of refrigerated sea transport; with reduced transport costs; Europeans travelling overseas and acquiring new eating habits; and effective sale promotion carried out by the major suppliers of these items. In any case, air freight charges and lack of adequate cargo capacity pose special problems. Sea transportation is considered as an alternative solution, at least for some type of fruits and vegetables.

119. The principal barrier to increased sales of tropical fruits and vegetables is namely the consumers' lack of knowledge of these products. If prices can be reduced by improved organization of production and marketing and by the development of sea freight, well-planned promotion campaign may lead to increased pattern of consumption, with the growing vogue for "health foods", especially in Europe and the USA.

120. However, in view of the seasonality and perishability of fruits and vegetables, it should make economic and social sense for the exporting countries to have their products processed locally and export the final product to Europe and other markets.

Processed fruits and vegetables

Traditional methods

121. The processed fruit and vegetable products have grown up from the traditional cottage-type industry, where local knowledge, skill and experience of storage and preservation and processing have been carried out in or near the home or compound. Their primary objectives were and are to provide cooked or prepared foodstuffs for the immediate household and in some cases, where there is surplus, for sale outside in the village or urban markets. Problems encountered at this level revolved around storage, prevention of food losses and distribution. The main traditional methods involve mainly cooking and drying as far as fruits and vegetables are concerned.

Modern methods

122. The fruit and vegetable industries in Africa have evolved over the years by adopting improved methods and technologies. There are two types, the first being small in scale and operation and utilizing relatively low level technology. The second category is the agro-industrial complex type, capital intensive, modern machines, organization and management, more often than not publicly owned or mixed public and private enterprises.

123. While the traditional methods of processing are continuing on an extensive wide country level, and its importance in feeding the population can hardly be overemphasized, however, for practical reasons, focus of this study is essentially on the modern operated processing plants in Africa.

Production structure

124. When one considers the overall fruits and vegetables production in Africa, as in Table 2, most is consumed fresh locally and some exported, others wasted and a very small portion actually processed. In essence, fruits and vegetables processing industry in Africa is still in its infancy, reflecting the general situation of the food and agriculture sector and the industrialization process in general. According to UNIDO, Africa's current share in world industrial operation is considered to be less than 2 per cent. Its insignificant contribution, however, should be a scope and opportunity for increased industrialization process of the African economy and also increased industrialization of the agricultural and food sectors, particularly the fruits and vegetables processing industries.

125. According to UNIDO, the food processing industries in most developing economies generally account for at least 22% of all manufacturing industries and about 25% of all manufacturing industries in Africa. In studying Table 5, economic structure of eleven African countries, which are among the major producers of fruits and vegetables, the share of the manufacturing sector of GDP in 1986 on average was less than 12 per cent whereas that of agriculture, industry and service sectors registered much higher, indicating the relatively low level of industrialization of the economies.

126. On Table 6, with the exception of Algeria and Zimbabwe, the value-added of the manufacturing sectors were inferior to that of the agriculture sectors, on average. Within the manufacturing sectors, the food and agriculture sub-sectors, on average, registered higher contribution to value-added as compared to textile, machineries, chemicals and others. The food and agro-industrial sub-sectors do play crucial economic and social roles in the growth and development of the economy.

127. When one looks at the structure of merchandise of exports and imports, as in Table 7 of the eleven major producers of fruits and vegetables products, on the export side, primary commodities, that is, minerals, fuel and agriculture are the major items, while machines, manufacturing contribute relatively less. On the import side manufacturing plays a leading role in all eleven countries, followed by manufacturing and transport equipment, other primary commodities, food and fuels, as intermediary and supply materials for local industries. There is indeed tremendous scope and possibilities for the industrialization process in Africa. It poses a challenge and opportunity for catching up with the industrialized countries, but much more important for satisfying the economic and social needs and demands of the populations.

Characteristics of the fruit and vegetable processing industries in Africa

128. The fruit and vegetable processing industries, as observed in the visited countries that is Algeria, Egypt, Nigeria, and Côte d'Ivoire, have the following features in common, and might also reflect a general picture of the African situation.

129. Almost all major processing plants, currently operational, are wholly public-owned or in partnership with private sector, with the government having a major holding on the factory.

130. Equipment used generally are simple, out-of-date and of low-capacity, exacerbated by lack of spare parts and maintenance problems. There are also some equipment and machineries on modern lines, capital intensive with consequences of heavy cost burden and non-competitive. Consequences of such situations may lead to capacity underutilization, idleness of machinery with subsidy behind high tax barrier protection.

131. The processing plants generally depend on the supply of basic raw materials which may not be available on a continuous basis, throughout the year. But there are several vital input materials that have to be imported such as chemicals, fuels, oils and other intermediary goods, always adding to the cost.

132. Generally labour intensive but capital intensive as well, but over-manned for social consideration.

133. At the outset, the processing plant is established to meet domestic demand but gradually the surplus is exported. The export material is generally in the form of bulk raw material and semi-finished products.

134. The processing plants are dispersed in the outlying district areas in order to be close to the source of raw materials.

135. As indicated in Table 6, the importance of the food and agro-industry in relation to all the other manufacturing sub-sectors, is quite high in the African countries. It is likely that the leadership of the growth of the agro-food industry will be maintained for years to come, in view of population growth, increased urbanization and higher income and purchasing power of the population. The above factors will inevitably contribute towards a greater and effective demand of processed fruit and vegetable products. Furthermore, a developed agriculture sector will provide sufficient food supply as well as stimulate the development of an agro-based industry in these countries.

Technology and organization

136. In general, the picture of the fruits and vegetable processing industries would require rehabilitation, reorganization, technologies, modern management, in order to make them efficient and competitive. Institutional measures including proper quality control can facilitate progress towards a modern fruit and vegetable processing industry.

137. The equipment and machinery utilized generally is either obsolete and out-of-date or new and sophisticated. In either case, the cost is high to these countries, especially in terms of spare parts, maintenance service, etc. The equipment, machinery and spare parts are imported from developed countries, and more often than not, the imported technologies are not suitable and appropriate for the existing socio-economic conditions.

138. In the absence of skilled and experienced management and work force, one is faced with poor manufacturing practices, materials handling and plant lay-out leading to inefficiency and economic loss. Most of the equipment and machinery used are second hand, brought about under special contractual arrangements. In such a situation, the suppliers of second hand machinery are usually unable to provide adequate back-up service or spare parts. Finally, the capacity of the equipment and machinery does not respond to the immediate needs of the market and is often either too big or too small.

Industrial policy and planning

139. In view of the technological and organizational handicaps that continue to influence the African industrialization process, especially as it concerns the fruit and vegetable industries organization, what is required is to develop a sound and coherent framework, that would link technology and the development process in the socio-economic development planning process.

140. Industrial development can be linked with development of technology. The process of technology production is stimulated by research and development which involve (a) inputs of resources, including finance, materials, energy, facilities, manpower and management, and (b) intelligence-based inputs, such as science, knowledge, skills, information and existing technologies. The outputs of research and development organization become technology, when they are engineered, industrialized and available for commercial use.

Science and technology policy

141. In order to redirect and reorient the industrialization process of the fruit and vegetable sub-sector, and achieve higher development goals, it is necessary that the governments adopt an explicit and articulate science and technology policy. The outlines of the science and technology policy need to put emphasis on assessment, adoptation, improvement and utilization of existing indigenous and foreign technologies. There should be comprehensive technology for research and development capabilities. In time, the science and technology policy has to shift from labour intensive to high technology for export-oriented production through research and development and technology transfer.

142. Transfer of technology is an input which has been utilized by recently industrialized countries to enhance their countries' capital and productive levels.

143. With appropriate research and development capability, foreign technology can be assimilated and diffused in order to enhance the productivity and production of the agro-food sector.

144. National institutions for the promotion and establishment of science and technology could assume several organizations on a combination of some of them including Ministry of Science and Technology, National Council for Science and Technology, Food Industry Research Organization, etc.

145. An efficient fruit and vegetable processing industry benefits a country in real economic and social terms, that is, value-added, productive employment and earning higher income, broadening domestic markets. Above all, the economy will benefit through spread and linkage effects with the creation of similar and related other economic and commercial activites. The created interreaction of economic activities stimulate also further technological development and the growth of other industries.

Key role of the state

146. African governments can play a crucial role in the stimulation and promotion of the advancement of technological capability of their countries, by implementing a progressive and balanced policy for industrial development.

147. Some of the approaches and incentives to stimulate industrial development would, inter alia, include:

(a) a dynamic articulate national policy and strategy;
(b) a legal framework, with appropriate rules and regulations;
(c) various tax incentives and subsidies;
(d) progressive banking institutions;
(e) modern tax structures, services and physical infrastructure.

148. Other supporting services and facilities that would assist industrial development are:

(a) efficient energy management;
(b) production of machine tool industry;
(c) transportation and telecommunications systems;
(d) information systems;
(e) education and training;
(f) international marketing.

149. Development of management systems for each sub-sector mentioned above is vital. Skilled and experienced manpower, funds, resources and management together with marketing are the essential components for industrial development and transfer of technology in the African continent.

150. In the light of the considerations above, African governments should create the necessary legal, institutional and physical infrastructure, and adopt specific required technology, that corresponds to the needs and capacity of the economy, for accelerated industrialization process of the fruits and vegetables produce.

151. The general situation of the fruits and vegetables processing industries, and constraints and problems facing them, in the four countries visited, namely, Algeria, Egypt, Nigeria and Côte d'Ivoire, are discussed briefly in the following paragraphs. Future prospects are also considered.

PART II

Algeria

152. Algeria is an important African producer of a large variety of fruits and vegetables. Most of these fruits and vegetables are consumed locally in fresh form. Some, like tomatoes, vegetables, oranges, grapes, figs and dates are processed and a small portion exported in fresh and processed forms.

153. The climatic and geographical conditions are favourable for the production, processing and marketing of fruits and vegetables on a larger scale. However, industrial policy, strategies and programmes adopted and resources made available by the Algerian authorities will determine the level and scale of industrial development of fruits and vegetables.

154. At present there are four autonomous bodies, under the overall direction of the Ministry of Agriculture, which handle the entire production cycle levels between them, that is:

ENAFLA: Enterprise Nationale d'Approvisionnement et de Regulation en Fruits et Legumes

ENAJUC: Enterprise Nationale des Jus et Conserves Alimentaires

ONCV: Office Nationale de Commercialisation des Produits Viti-Vinicoles

OND: Office Nationale de la Datte

Constraints

155. Some processing problem issues raised included raw materials supply, on a continous basis, with the size, standard and quality required. This had to do more with the supply (production) aspect, which involves production policy, strategies and programmes, especially research and extension aspects.

156. A central problem is the question of technolgy and the transfer of technology. The various equipment and machineries utilized for processing are imported from various countries, in different sizes, capacity and efficiency.

157. There was the question of the appropriateness or suitability of the equipment and machineries imported from abroad, whether bought or given in grant aid. Whatever the source, all such capital items have future costs to the economy. These costs include maintenance, depreciation, spare parts, replacement and hiring of skilled personnel.

158. The need for the transfer of technology which is adapted, improved, adjusted to the needs of the country, has been much stressed. Also the issue of capability, that is, the capacity to know, acquire, assimilate and diffuse new technologies that correspond to the socio-economic reality.

159. Training and education, with special focus on fruits and vegetables processing is another area emphasized in the course of the discussion. Skilled and experienced technicians with full grasp and appreciation of the sub-sector is central to dynamic, and vigorous, continous life of the industry. Algeria, endowed with favourable climatic soil, conditions and adequate surface area has potentiality to expand its fruit and vegetable production and processing for domestic market and any surplus for export purposes. At the current rate of the population growth, the internal demand for processed fruits and vegetables will continue to expand.

160. The structure of the fruits and vegetables processing industry requires to be looked at in depth and great detail, to ensure that the institutions, responsible for the care of the processing industry, are properly organized, adquately staffed, well funded, for higher production and productivity. Data and information relating to those institutions need to be readily available, for proper analysis, and discussions, on a regular routine basis.

Egypt

161. Egypt is the largest producer of fruits and vegetables in absolute terms and per capita in vegetables. Although most of its produce and products are consumed locally, some are exported to Europe, the Middle East and Africa. It must be ahead of many countries in terms of the availability of processed fruit and vegetable products, including management, organization and technology. Egypt has a large core of educated and trained work force, including research and development back up potentiality.

162. Egypt produces a variety of fruits and vegetables, most of it is locally consumed, in fresh form and some processed, mostly for the local market and the surplus exported mainly to the Arab countries.

163. Processed food is encouraged for export to the Arab countries in order to earn foreign exchange. Egypt seems to enjoy comparative advantage in the processing of food flavours, such as vegetable oils, jams and marmalades.

Constraints

164. The Ministry of Agriculture supports increased production and productivity of fruits and vegetables even in newly reclaimed lands, for domestic consumption as well as providing the required raw materials for the private and public owned processing plants.

165. In the light of the discussions held with several Egyptian authorities on the priority of constraints that hinder the fruits and vegetables processing industries, the question of industrial management and organization have topped the list. Packaging and handling are perenial problems of the fruit and vegetable processing industries and require urgent attention and solution. Immediately following would be the areas related to standard and quality control and sanitary conditions. The Food Development Centre should be able to assist the processing industries in achieving and maintaining an acceptable international standard in quality control and sanitary procedures.

166. Development of human resources at workforce, technical and managerial level, is a continuous area that has to be kept under review and abreast of new knowledge and technology in industrial progress.

167. The various fruit and vegetable industries in Egypt have shown sometimes underutilized capacity for a combination of factors, including lack of spare parts, shortage of raw materials supply, energy related problems, in relation to electricity, oil, gas, water shortage, absence of skilled and experienced staff, etc.

Nigeria

168. In view of the varied climatic and soil conditions and a fairly broad domestic market, the country has the capacity and potential for increased production, processing and marketing of fruits and vegetable products, far beyond its current production as indicated in Table 3. Per capita vegetable production is less than 25% and in fruits less than 30% than that of Egypt in 1986. There is therefore tremendous scope for increased production and productivity in fruits and vegetables in industrial processing as well as in actual growing.

169. One of the objectives on industrial raw material production is to achieve self-sufficiency in raw materials required for industry. In this regard, vegetables and fruits for use in canning and bottling industries are priority areas, targeted for high resource investment, for accelerated and higher output and productivity.

Constraints

170. The basic limitation is absence of policies, strategies, programmes, funds, and resources with special focus on fruit and vegetables, be it in production, processing and marketing aspects. Once the proposed industrial and agricultural policy measures are implemented, the private sector may take the initiative to invest resources in industrial processing of fruits and vegetables.

171. The sheer size and distance involved in covering Nigeria create serious problems in infrastructural services and facilities, especially energy (oil, gas, water), transport (road, railways, air, sea) and communcations (telephone, telex, radio, etc.) and banking.

172. Related to size and distance is the raw material supply (production) factor, that needs be sorted out. This involves quantity, quality and regularity of delivery.

173. Equipment and machineries for processing are imported from various countries, sizes and quality, with consequences in maintenance, servicing, spare parts, expertise and consultancy costs, which add to the final cost of the product. The need to create industrial research and development capacity, in order to adopt, improve, innovate technologies suitable to the socio-economic conditions of the country, cannot be emphasized enough.

174. The container for the processed fruit and vegetable product, be it can, glass, plastic, etc., is more costly than the actual content and thus the final cost output becomes beyond the means of the local or even external market. It fails to compete with similar products or substitutes produced in other countries. The intermediary material for the container as well as some input into the processing equipment and machineries, all add to the cost of the final product.

175. There is a 65% tariff on imported tinplate, which invariably increases the final cost of the product. It is generally reckoned containers tend to cost ranging from 40 to 60 per cent of the final cost of the product. That makes it prohibitive and drives such products out of the market.

176. Top list of all constraints must be industrial management and organization, including packaging and handling, followed by research and development capacity, transfer of appropriate technology, and technical education and training.

Côte d'Ivoire

177. The fruits and vegetables sub-sector is one of the advanced in the African continent. Most investment and resources have gone into the sub-sector from public and private sectors alike. In production, processing and marketing of fruits and vegetables, it is far ahead of most African countries, especially in fruits, where per capita production in 1986 registered the highest out of a selected eleven major African producers as indicated in Table 3. As far as fresh pineapple goes, Côte d'Ivoire is the largest exporter to the European market as shown in Table 4. It exports also mangoes, papayas and avocados. It has tremendous capacity and potentiality for industrial processing of fruits and vegetable products. The Government of Côte d'Ivoire has explicit policies, strategies, programmes for fruits and vegetables, with appropriate social and physical infrastructure facilities and services.

Constraints

178. The industrial policy in Côte d'Ivoire, in relation to agro-industries especially fruits and vegetables is deliberate and explicit, with appropriate policy measures, incentives and institutional framework.

179. The Government encourages the private sector to invest resources in the production, processing and marketing of fruits and vegetables. The Government alone or in partnership with private sector establishes and operates processing schemes.

180. Major stumbling blocks seem to be management and technological problems, including equipment, machineries, spare parts and the cost of containers. Packaging and handling are key problem areas.

181. Energy, especially electricity, oil, gas and water, has been raised by many in Côte d'Ivoire as a serious constraint and add to final cost.

182. Markets, both domestic as well as external, are problematic. As far as the domestic market goes, in the first place, processed fruits and vegetables, tend to be beyond the purchasing power of the average consumer. Prices have to go down and public education and sale promotion have to be used effectively for change in consumption pattern. Distant, especially, developed countries markets cannot be relied upon. Stringent non-tariff barriers such as health requirements, quotas, size could be used to deny access to a market.

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TABLE 1

FRUITS AND VEGETABLES

Definition and composition

On the definition of fruits and vegetables, Webster's International Unabridged Dictionary asserts, "there is no well-drawn distinction between vegetables and fruits in the popular sense, but it has been held by the courts that all those which, like potatoes, cabbage, carrots, peas, celery, lettuce, tomatoes, etc., are eaten (whether cooked or raw) with the principal part of the meal are to be regarded as vegetables, while those used only for dessert are fruits".

A composition of fruits and vegetables, cultivated in the African region, classified in alphabetical order is appended herewith for reference purposes.

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FRUITS

Apricot
Apple
Avocado
Banana
Blackberry
Black current
Carorbole
Cherry
Coconut
Date
Fig
Grapes
Grapefruit
Gooseberry
Guava
Kiwi fruit
Lemon
Lime
Lychee
Loquat
Mango
Melon
Nectarine
Orange
Passion fruit
Paw-paw
Peach
Pear
Pineapple
Plum
Rhubarb
Tangerine (clementine, mandarine, satsma)
Strawberry
Ugli fruit
Watermelon

VEGETABLES

Artichoke (globe)
Asparagus
Aubergine (eggplant)
Bean (green, broad)
Beetroot
Brussels sprout
Brocolli
Cabbage
Carob
Carrot
Cauliflower
Celeriac
Celery
Chicory
Chilly
Courgette
Cucumber
Endive (french)
Fennal (english)
Garlic
Green pepper
Ginger
Kohlrabi
Leek
Lettuce
Marrow
Mushroom
Okra
Onion/shallot
Parsley
Parsnip
Pea
Potato
Pumpkin
Quince
Radish
Spanish Calabrese
Spinach
Spring onions
Sweede
Sweet potato
Tomato
Turnip
Yam

TABLE 2

AFRICA AND THE WORLD: VEGETABLE AND FRUIT PRODUCTION, AREA HARVESTED, YIELD-1986

COMMODITY	PRODUCTION 000 MT		AFRICA	AREA HARVESTED 000 HA		YIELD KG/HA	
	AFRICA	WORLD	% WORLD	AFRICA	WORLD	AFRICA	WORLD
Vegetables + melons	28,476	414,455	6.8				
Fruits	41,087	326,582	12.5				
TOTAL	69,563	741,037	9.4				
1. Cabbages	774	39,110	2	31	1,691	25,348	23,131
2. Artichokes	134	1,268	11	18	124	7,363	10,429
3. Tomatoes	7,177	60,408	12	475	2,572	15,108	23,489
4. Cauliflower	149	5,048	3	7	388	21,392	13,022
5. Pumpkins, squash, gourds	961	6,236	15	69	537	13,991	11,604
6. Cucumbers, gherkins	354	12,418	3	22	834	16,452	14,893
7. Eggplants	451	5,396	8	29	429	15,292	12,828
8. Chillies + peppers, green	1,297	8,697	15	157	1,073	8,248	8,101
9. Onions, dry	1,661	24,764	7	141	1,705	11,819	14,525
10. Garlic	105	2,547	4	5	412	19,566	6,188
11. Beans, green	247	3,028	8	36	450	6,798	6,737
12. Peas, green	157	4,823	3	25	761	6,299	6,341
13. Carrots	463	12,540	4	35	571	13,335	21,958
14. Watermelons	2,421	27,397	9	117	1,849	20,725	14,815
15. Cantaloupes + oth.me.	776	8,967	9	46	606	16,724	14,796
16. Grapes	2,455	66,212	4	453	9,049	5,417	7,317
17. Wine	1,081	32,285	3				
18. Raisins	45	1,100	4				
19. Dates	1,042	2,934	36				
20. Pears	276	9,576	3				
21. Peaches + nectarines	275	7,705	4				
22. Plums	84	6,236	1				
23. Oranges	3,510	42,881	8				
24. Tang. mand. satsma	615	7,887	8				
25 Lemons + limes	381	5,653	7				
26. Grapefruit + pomelo	289	4,246	7				
27. Citrus fruits NES	382	1,151	33				
28. Apricots	215	2,005	11				
29. Avocados	137	1,723	8				
30. Mangoes	1,001	14,466	7				
31. Pineapples	1,335	9,629	14				
32. Bananas	5,396	33,493	16				
33. Plantains	1,857	26,804	7				
34. Papayas	237	2,927	8				
35. Strawberries	4,359	2,121,476	2				

Source: Compiled by Dr. Y. Habtu, UNIDO, Consultant from FAO Production Vol, 41, 1987. London 1989

TABLE 3

AFRICA: FRUIT AND VEGETABLE PRODUCTION, POPULATION AND AREA OF SELECTED COUNTRIES

METRIC TON

COUNTRY	VEGETABLES		FRUITS		PRODUCTION P/CAPITA KG		POPULATION	AREA 1/
	1980	1986	1980	1986	Vegetable 1986	Fruit 1986	Mill.mid.1986	000 Km2
1. Algeria	818,003	1,288,099	1,393,636	1,579,986	54	66	22.4	2,382
2. Egypt	5,814,614	8,215,630	3,818,374	4,973,022	165	98	49.7	1,001
3. Ethiopia	485,200	559,700	199,600	213,900	11	5	43.5	1,222
4. Côte d'Ivoire	343,900	397,100	1,560,777	1,935,431	36	177	10.7	323
5. Kenya	465,807	470,942	743,065	871,837	22	41	21.2	583
6. Morocco	1,052,675	1,253,493	1,990,103	2,224,738	53	98	22.5	447
7. Mozambique	186,350	190,500	322,536	347,038	13	24	14.2	802
8. Nigeria	2,941,000	3,925,000	2,260,000	3,000,550	37	29	103.1	924
9. Zimbabwe	135,600	143,300	107,751	131,464	16	15	8.7	391
10. Sudan	651,636	773,120	914,192	968,670	34	42	22.6	2,506
11. Tunisia	773,195	1,018,049	1,013,636	1,015,620	137	137	7.3	164

1/ Africa Continent Area 30 million Km2

Source: Compiled by Dr. Y. Habtu, UNIDO, consultant on basis FAO Production Computer printout of 17 November, 1988, and World Development Report, 1988, by the World Bank. London, 1989

TABLE 4

AFRICA: SELECT OFF-SEASON FRESH FRUITS AND VEGETABLES EXPORT TO EUROPE, 1986 - TONS

COMMODITY	BURKINA FASO		CAMEROON		CÔTE D'IVOIRE		EGYPT		KENYA		MALI		SENEGAL	
	Q	%	Q	%	Q	%	Q	%	Q	%	Q	%	Q	%
Aubergine	-	-	-	-	-	-	-	-	172	0.4	-	-	-	-
Avocados	-	-	-	-	13	-	-	-	1,928	1.9	-	-	-	-
Beans, green	3,437	3.4	991	1.0	-	-	12.608	12.4	8,845	8.7	351	0.3	3,959	3.9
Capsicums	-	-	-	-	-	-	-	-	-	-	10	-	17	-
Mangoes	1,536	6.5	-	-	827	3.5	-	-	690	2.9	2,071	8.8	54	0.2
Melon	-	-	-	-	-	-	-	-	-	-	-	-	1,107	0.6
Papaya	-	-	-	-	204	7.3	-	-	-	-	-	-	-	-
Pineapples	-	-	2,674	1.6	144,354	87.8	-	-	376	0.2	-	-	-	-
Strawberries	-	-	-	-	-	-	-	-	222	0.1	-	-	-	-

Symbols: Q = Quantities
% = Percentage of total

Source: Compiled by Dr. Y. Habtu, UNIDO consultant, from ITC Market Study: Tropical and Off-season Fresh Fruits and Vegetables, Geneva, 1987. London, 1989.

TABLE 5

AFRICA: ECONOMIC STRUCTURE OF SELECTED COUNTRIES, 1986

COUNTRY				DISTRIBUTION OF GDP PER CENT			
	POP.MILL.	GDP 1986	GNP. 1986, $	AGRIC.	INDUSTRY	MANUFAC.	SERVICES ETC.
	MID-1986	Mill. $	Per capita	1986	1986	1986	1986
1. Algeria	22.4	60,760	2,590	12	44	13	44
2. Egypt	49.7	40,850	760	20	29	-	51
3. Ethiopia	43.5	4,960	120	48	15	10	36
4. Côte D'Ivoire	10.7	7,320	730	36	24	16	40
5. Kenya	21.2	5,960	300	30	20	12	50
6. Morocco	22.5	14,760	590	21	30	17	49
7. Mozambique	14.2	4,300	210	35	12	-	53
8. Nigeria	103.1	49,110	640	41	29	8	30
9. Zimbabwe	8.7	4,940	620	11	46	30	43
10. Sudan	22.6	7,470	320	35	15	7	50
11. Tunisia	7.3	7,790	1,140	16	33	15	52

Source: Compiled by Dr. Y. Habtu, UNIDO consultant, from World Development Report, 1988 by the World Bank. London, 1989.

TABLE 6

AFRICA: SELECTED COUNTRIES-VALUE ADDED IN AGRICULTURE (1986) AND VALUE ADDED IN MANUFACTURING (1985) MILLIONS OF CURRENT DOLLARS AND DISTRIBUTION OF MANUFACTURING VALUE ADDED, IN PER CENT, CURRENT PRICES (1985)

COUNTRY	VALUE ADDED		DISTRIBUTION OF MANUFACTURING				
	AGRIC.	MANUFAC.	FOOD AND AGRIC.	TEXTILE AND CLOTHING	MACH. AND TRANS.EQUIP.	CHEMICALS	OTHER
1. Algeria	7,401	6,157	26	20	11	1	41
2. Egypt	8,199	-	20	27	13	10	31
3. Ethiopia	2,403	492	51	23	-	3	22
4. Côte D'Ivoire	2,645	889	-	-	-	-	-
5. Kenya	1,770	631	35	12	14	9	29
6. Morocco	3,140	2,009	26	16	10	11	37
7. Mozambique	1,505	-	-	-	-	-	
8. Nigeria	19,964	7,373	29	11	17	9	35
9. Zimbabwe	562	1,314	28	16	10	9	36
10. Sudan	2,630	498	22	25	1	21	31
11. Tunisia	1,220	981	17	19	7	13	44

Source: Compiled by Dr. Y. Habtu, UNIDO consultant from World Development Report, 1988, by the World Bank. London, 1989.

TABLE 7

AFRICA: STRUCTURE OF MERCHANDISE OF EXPORTS AND IMPORTS: SELECTED COUNTRIES-PERCENTAGE SHARE, 1986

COUNTRY	E X P O R T S					I M P O R T S				
	FUELS, MINERALS, METALS	OTHER PRIMARY COMMODITI.	MACH. AND TRANS, EQUI	OTHER MANUFACT.	TEXTILES AND CLOTHING	FOOD	FUELS	O.P.C. 1/	M.T.E. 2/	O. MAN. 3/
1. Algeria	97	1	-	2	-	22	1	5	32	41
2. Egypt	74	14	-	13	9	22	4	6	29	40
3. Ethiopia	2	97	-	1	-	22	15	3	32	28
4. Côte D'Ivoire	6	85	2	7	1	15	7	3	34	41
5. Kenya	14	70	2	14	-	9	15	3	39	34
6. Morocco	26	27	1	46	18	17	14	14	26	29
7. Mozambique										
8. Nigeria	94	4	-	1	-	11	3	3	35	49
9. Zimbabwe	23	41	3	34	-	12	6	2	36	43
10. Sudan	6	88	3	4	1	21	9	3	30	37
11. Tunisia	27	13	5	55	28	14	7	12	26	42

1/ O.P.C. = Other primary commodities
2/ M.T.E. = Machinery and transport equipment
3/ O.MAN. = Other manufactures

Source: Compiled by Dr. Y. Habtu, UNIDO consultant from World Development Report, 1988, of the World Bank. London, 1989.