DRIED FRUIT AND VEGETABLES FOR URBAN AND EXPORT MARKETS
SUB SECTOR AND VALUE CHAIN ANALYSIS
TANZANIA

JANUARY 2008
FINAL DRAFT

STUDY COMMISSIONED BY SME COMPETITIVENESS FACILITY AND CONDUCTED BY MATCH MAKER ASSOCIATES LIMITED (MMA)
<table>
<thead>
<tr>
<th>ABBREVIATION</th>
<th>FULL NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>AREED</td>
<td>African Rural Energy Enterprise Development</td>
</tr>
<tr>
<td>ARI</td>
<td>Agricultural Research Institutes</td>
</tr>
<tr>
<td>CAC</td>
<td>Codex Alimentarius Commission</td>
</tr>
<tr>
<td>CARITAS</td>
<td>Roman Catholic economic development organisation</td>
</tr>
<tr>
<td>CBI</td>
<td>Centre for the Promotion of Imports from Developing Countries</td>
</tr>
<tr>
<td>CPE</td>
<td>Chemical and Processing Engineering</td>
</tr>
<tr>
<td>CRS</td>
<td>Catholic Relief Services</td>
</tr>
<tr>
<td>DC</td>
<td>District Councils</td>
</tr>
<tr>
<td>DFID</td>
<td>Department for Foreign and International Development - UK</td>
</tr>
<tr>
<td>ELCT</td>
<td>Evangelical Lutheran Church of Tanzania</td>
</tr>
<tr>
<td>EPOPA</td>
<td>Export Promotion of Organic Products from Africa</td>
</tr>
<tr>
<td>FADECO</td>
<td>Family Alliance for Development and Cooperation</td>
</tr>
<tr>
<td>FGD</td>
<td>Focus Group Discussion</td>
</tr>
<tr>
<td>ICIPE</td>
<td>Centre of Insect Physiology and Ecology – Nairobi Kenya</td>
</tr>
<tr>
<td>ICS</td>
<td>Internal Control System</td>
</tr>
<tr>
<td>ITC</td>
<td>International Trade Centre</td>
</tr>
<tr>
<td>Kgs</td>
<td>Kilogramme</td>
</tr>
<tr>
<td>LG</td>
<td>Local Government</td>
</tr>
<tr>
<td>NGO</td>
<td>Non Governmental Organisation</td>
</tr>
<tr>
<td>MAFC</td>
<td>Ministry of Agriculture, Food and Cooperatives</td>
</tr>
<tr>
<td>TATEDO</td>
<td>Tanzania Traditional Energy Development and Environment Organisation</td>
</tr>
<tr>
<td>TFDA</td>
<td>Tanzania Food and Drug Authority</td>
</tr>
<tr>
<td>TIRDO</td>
<td>Tanzania Industrial Research Development Organization</td>
</tr>
<tr>
<td>PMG</td>
<td>Producer Marketing Groups</td>
</tr>
<tr>
<td>PSD</td>
<td>Private Sector Development</td>
</tr>
<tr>
<td>QQC</td>
<td>Quantity, Quality and Consistency</td>
</tr>
<tr>
<td>SILC</td>
<td>Saving Internal Lending Communities</td>
</tr>
<tr>
<td>TFNC</td>
<td>Tanzania Food and Nutrition Centre</td>
</tr>
<tr>
<td>TShs</td>
<td>Tanzania Shillings</td>
</tr>
<tr>
<td>UK</td>
<td>United Kingdom</td>
</tr>
<tr>
<td>UNCTAD</td>
<td>United Nations Conference on Trade and Development</td>
</tr>
<tr>
<td>UNEP</td>
<td>United Nations Environment Programme</td>
</tr>
<tr>
<td>UNIDO</td>
<td>United Nations Industrial Development Organisation</td>
</tr>
<tr>
<td>USA</td>
<td>United States of America</td>
</tr>
<tr>
<td>VCA</td>
<td>Value Chain Analysis</td>
</tr>
<tr>
<td>WAWATA</td>
<td>Wanawake Wakikristu Tanzania – (Roman Catholic Christian Women Association)</td>
</tr>
</tbody>
</table>
# TABLE OF CONTENT

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABBREVIATIONS</td>
<td>II</td>
</tr>
<tr>
<td>TABLE OF CONTENT</td>
<td>III</td>
</tr>
<tr>
<td>ACKNOWLEDGEMENT AND DISCLAIMER</td>
<td>IV</td>
</tr>
<tr>
<td>EXECUTIVE SUMMARY</td>
<td>VI</td>
</tr>
<tr>
<td>1. INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>1.1 BACKGROUND TO THE STUDY</td>
<td>1</td>
</tr>
<tr>
<td>1.2 OBJECTIVES AND RESULTS OF THE STUDY</td>
<td>2</td>
</tr>
<tr>
<td>1.3 APPROACH AND METHODOLOGY</td>
<td>2</td>
</tr>
<tr>
<td>1.4 LIMITATIONS</td>
<td>3</td>
</tr>
<tr>
<td>1.5 STRUCTURE OF THE REPORT</td>
<td>4</td>
</tr>
<tr>
<td>2. DRIED FRUIT AND VEGETABLES WORLDWIDE</td>
<td>5</td>
</tr>
<tr>
<td>2.1 BACKGROUND</td>
<td>5</td>
</tr>
<tr>
<td>2.2 DRIED FRUIT AND VEGETABLES INTERNATIONAL TRADE</td>
<td>5</td>
</tr>
<tr>
<td>3. DRIED FRUIT AND VEGETABLES PRODUCTION</td>
<td>12</td>
</tr>
<tr>
<td>4. DRIED FRUIT AND VEGETABLES IN TANZANIA</td>
<td>20</td>
</tr>
<tr>
<td>5. DRIED FRUIT AND VEGETABLES IN THE NORTHERN CORRIDOR</td>
<td>31</td>
</tr>
<tr>
<td>5.1 DEFINING THE SUB SECTOR</td>
<td>31</td>
</tr>
<tr>
<td>5.2 KEY ACTORS AND FUNCTIONS</td>
<td>31</td>
</tr>
<tr>
<td>5.3 SUB SECTOR MAP</td>
<td>33</td>
</tr>
<tr>
<td>5.4 PROFITABILITY ANALYSIS</td>
<td>34</td>
</tr>
<tr>
<td>5.5 SUB SECTOR DYNAMICS</td>
<td>35</td>
</tr>
<tr>
<td>5.5.1 DRIVING FORCES</td>
<td>35</td>
</tr>
<tr>
<td>5.5.2 CONSTRAINTS AND OPPORTUNITIES</td>
<td>36</td>
</tr>
<tr>
<td>6. VALUE CHAIN IDENTIFICATION</td>
<td>41</td>
</tr>
<tr>
<td>6.1 SUPPLY CHAINS ASSESSMENT</td>
<td>42</td>
</tr>
<tr>
<td>6.2 VALUE CHAIN MAPPING AND FEASIBILITY</td>
<td>44</td>
</tr>
<tr>
<td>6.2.1 EXPORTER MODEL</td>
<td>44</td>
</tr>
<tr>
<td>6.2.2 SME MODEL</td>
<td>45</td>
</tr>
<tr>
<td>6.2.3 CRITICAL SUCCESS FACTORS</td>
<td>47</td>
</tr>
<tr>
<td>7. SUB SECTOR/VALUE CHAIN DEVELOPMENT</td>
<td>48</td>
</tr>
<tr>
<td>7.1 GENERIC (SUB SECTOR) INTERVENTIONS</td>
<td>48</td>
</tr>
<tr>
<td>7.2 VALUE CHAIN DEVELOPMENT STRATEGIES</td>
<td>48</td>
</tr>
<tr>
<td>8. WAY FORWARD</td>
<td>50</td>
</tr>
<tr>
<td>REFERENCES</td>
<td></td>
</tr>
<tr>
<td>ANNEXES</td>
<td>52</td>
</tr>
<tr>
<td>ANNEX I: NON TROPICAL DRIED FRUIT</td>
<td>53</td>
</tr>
<tr>
<td>ANNEX II: ITINERARY</td>
<td>57</td>
</tr>
<tr>
<td>ANNEX III: USEFUL CONTACTS</td>
<td>58</td>
</tr>
<tr>
<td>ANNEX IV: CODEX ALIMENTARIUS COMMISSION (CAC)</td>
<td>61</td>
</tr>
</tbody>
</table>
List of Tables:
Table 1: EU Top Food Processors in 2003 .......................................................... 6
Table 2: Imports of dried fruit into the EU by leading suppliers ......................... 8
Table 3: The leading suppliers of processed fruit in 2003 .................................. 8
Table 4: Simplified Gross Margins for pineapple and apple banana .................. 34
Table 5: Profitability analysis for pineapple and apple banana – experience of Uganda .......................................................... 35
Table 6: Constraints and Opportunities in drying fruit and vegetables ............. 40
Table 7: Critical Success Factors to supply dried fruit and vegetables to urban and export markets .......................................................... 47

List of Figures:
Figure 1: Imports of dried fruit into the main EU countries 2001 – 2003 .............. 7
Figure 2: Imports of dried vegetables into the main EU countries 2001 – 2003 .... 7
Figure 3: Box drier ......................................................................................... 13
Figure 4: Indirect solar drier ........................................................................ 15
Figure 5: Heavy duty indirect solar drier ........................................................ 15
Figure 6: TIRDO small scale cabinet drier ...................................................... 16
Figure 7: Typical fruit drying process .............................................................. 17
Figure 8: TIRDO mixed solar drier ................................................................. 18
Figure 9: GMF Gouda drum drier ................................................................. 19
Figure 10: Electric powered batch drier .......................................................... 19
Figure 11: UNIDO drying facility at Muheza Tanga ........................................ 28
Figure 12: Dried fruit and vegetables sub sector map – Tanzania .................. 33
Figure 13: Matunda Mema Outgrower’s Model ............................................. 43
Figure 14: Local exporter – Value Chain Model .............................................. 44
Figure 15: Foreign exporter – Value Chain Model ........................................... 45
Figure 16: SME – Value Chain Model ............................................................ 46
ACKNOWLEDGEMENT AND DISCLAIMER

This report has been prepared by Edmond Ringo, Senior Consultant with Match Maker Associates Limited (MMA) with support from the other colleagues in MMA. SCF Interns - Johan Mørck Meînichen and Gema Nganyagwa have also been resourceful in the data collection in the initial stages of this study. The authors would wish to sincerely thank each and every one who contributed in one way or another during the research phase and towards the analysis and preparation of the report including the provision of crucial data and information.

While it is not possible to mention every one who contributed to this study, the authors would like extend many thanks to all those unreservedly offered information relevant for the preparation of this report. In particular, the authors wish to convey very special thanks to the various people who took time off from their busy schedule to provide relevant information for this study. Without their contributions, this task would have been much more onerous if not impossible at least in such a short time.

Special thanks go to SME Competitiveness Facility (SCF) Board and management team, who entrusted MMA Ltd with this assignment. Also special thanks for Barbara SCF Consultant, Sosthenes Sambua, SFC Manager, and their colleagues for their knowledgeable inputs and logistical support. Our gratitude also goes to TNFC, UDSM - CoET, TATEDO, SUA and TIRDO experts for their insights and guidance during the field study. We are particularly thankful to Mr Francis Modaha of TFNC, M. Osman of University of Dar es Salaam - College of Engineering and Technology (UDSM - CoET), Mr Deus Mwita of TATEDO, and Mr J. Tarimo of TIRDO. We acknowledge insights from Dr Peter Mamiro of Department of Food Science and Technology of the Sokoine University of Agriculture (SUA) and Prof. Maerere – Head of Department – Crop Science and Production – SUA.

We are indebted to Mr Andrew Kazimoto, the Managing Director of Matunda Mema (T) Limited, a progressive exporter of organic dried fruit from northwest Tanzania. Andrew's insights and experience in the industry gave us a better understanding of the challenges of developing urban and export markets for dried fruit and vegetables in Tanzania. We are thankful for the openness and insights of Mr Lawrence Muze, General Manager – Kwanza Collection Company Limited. We are grateful to talk to women entrepreneurs too. We are delighted by the entrepreneurial spirit of Ms Clara Ibihya of Claphijo Enterprises in Kibamba – Kisarawe district in Coast region.

During this study we managed to visit Uganda where they have excelled in this sub sector. We are grateful to had privilege of visiting Amfri Farms Limited of Kampala Uganda during this study. Amfri Farms is a successful exporter of organic dried fruit, spices and vegetables from Uganda. Special thanks to Amfri Farms’ Managing Director Mr Amin Shivji for sharing his experience in drying technologies and marketing of dried fruit and vegetables. During our mission in Uganda we also managed to speak to FIT Uganda, Private Sector Foundation Uganda (PSFU) and Kilimo Trust and their invaluable inputs have influenced the way we have shaped our conclusions and recommendations.

Finally, it must be stressed that opinions expressed in this report are however, purely those of the authors based on observations and findings during the study. It therefore goes without saying that the authors, and not SCF who takes full responsibility for any errors of commission or omission that may be found in the report.
EXECUTIVE SUMMARY

Background
SME Competitiveness Facility (SCF) is a matching grants opportunity for businesses in Tanzania that wish to develop or increase their ability to trade and export. The SCF aims to support product quality improvement and the meeting of international standards to enable SMEs with potential market development within and outside Tanzania. SCF supports the Government of Tanzania’s endeavour to develop the business sector as an engine of pro-poor economic growth, in line with Tanzania’s National Strategy for Growth and Reduction of Poverty (MKUKUTA). The SCF focus is on business activities that contribute to export, economic growth, employment creation and the reduction of poverty. This study is part of a wide supply chain analyses commissioned by SCF to gather the potential of the Lushoto, Tanga, Moshi and Arusha Fruit and Vegetables Corridor and strategic interventions to increase access to markets for fruits and vegetable sub sectors made by SME Competitiveness Facility (SCF). This study was thus commissioned by SCF and conducted by Match Maker Associates Limited (MMA).

Fruit and vegetables, consisting of more than 80 percent of water, are dried in order to stop the multiplication of micro-organisms. These organisms obtain the water and nutrients they need for growth from the fruit or vegetable in which they grow. By drying or dehydrating fruit or vegetables, the water is removed from the food and from the bacterial cell, thus ending the multiplication. The dried fruit and vegetables described in this study are whole, cut, sliced, broken or powdered, but not further prepared. Dried fruit can be divided into vine fruit and tree fruit. The best-known vine fruit species are raisins, sultanas and currants, whereas apples, apricots, bananas, pineapples, mangoes, dates, figs, papayas, peaches, pears and prunes are the most important tree fruits. Dried fruit is mainly used as a snack or a constituent for breakfast cereals, muesli, bakery products, dairy products and desserts. Although some vegetables are sun-dried or field-dried, most vegetables are dehydrated industrially. The main dehydrated vegetables are onions, tomatoes, garlic, carrots and olives.

Dried fruit and vegetables production and marketing worldwide and in Tanzania
Dried fruit is used in consumer or food service packing, mainly consumed as a snack and as an ingredient for breakfast cereals, healthy ready-to-eat snacks and desserts. Bakeries and breakfast cereal mixes are one of the largest end users of dried fruit. The market for bakery products in the EU had a value of € 70.3 billion and a volume of 26.8 million tonnes in 2003. Considering the imports of dried fruit, sultanas are the most popular (mainly for industrial use) dried fruit in the EU, accounting for more than a quarter of the total imports by EU member countries of dried fruit. Sultanas, other raisins, dates, prunes, apricots and figs are the major imported dried fruit species.

Dried vegetables are mainly consumed by the dried soup industry. It uses most types of dried vegetables, especially potatoes, onions, tomatoes, leek, carrots and peas. A few large multinational companies dominate the soup industry in the EU. These are Unilever (Knorr, Unox), and Nestlé (Maggi). In most markets, the ratio is moving towards higher relative usage by the industrial sector, reflecting the growing popularity of ready-to-eat healthy snacks, muesli, and processed foods using more healthy ingredients like dried fruit.

It has been recently established that EU importers are less interested in sun-dried product and industrially dried products are very competitive overall. The perception is that the product from small scale processors in developing countries will have too many foreign products (insect
fragments, defects, spoilage, microbiological problems, and bacteria) and will not pass hygiene and food safety regulations. Some EU importers are willing to look at the sun dried product and see whether it meets specifications however, all stressed that the market is well supplied and that new entrants must have some comparative advantage in terms of price or presentation.

There is a growing demand for organically certified product that is also low in sugar (natural levels). Organic products can reportedly sell for several times the price of regular product. Although growth of organic foods reached double digit figures in percentage in 2000 and 2001, since 2002 the markets have tended to grow much more slowly (3-4 percent). A remained fact is that because of its nature, organic production is highly suitable for small and medium-sized farmers working in areas which may not be suitable for large-scale food production. Dried fruits like apricots, bananas and pineapple are important organic products within the preserved fruit and vegetables segment for industrial use. While the organic market absorbs at least half of the volume of natural dried tropical fruits (about 500 tons), it also uses a significant but unknown volume of deep-fried banana chips. As yet, there are no organic pendants of the dominant conventional category of candied dried fruits. It is uncertain if there would be demand for these products, since the inherently low quality may form a constraint. If there is a market at all for candied organic fruit, the food industry would be the most likely candidate, using it in breakfast cereals or snack bars.

Organic dried fruits are used primarily as snack, while the portion that is used by the food industry as an ingredient is small. One factor explaining this is the relatively high price of these natural dried fruits. But limitations in diversity, quality and reliability of supply will also play a role. Organic deep-fried banana chips do find a market in the food-industry, for one reason since these are more competitively priced. They are also sold in single product packages, as a snack. Like the organic market, the fair trade markets uses natural dried tropical fruit and deep-fried banana chips. These products are offered to the consumer mainly in single product packages. At global level there is limited demand for tropical dried fruits as an ingredient for fair trade products. The size of this market is an approximate 50 tons, which is bought directly from source by Alternative Trading Organizations.

Furthermore, a recent ITC study revealed that after some years in the early 2000s of relative pessimism (at least in most European markets), most major dried fruit and vegetables markets seem again to be enjoying healthy growth with very positive outlooks for the years to come, although recent years’ growth rates of about 20% in Canada and the USA and even higher in the UK, for example, are unlikely to continue. Many industry leaders seem to believe that a growth rate of about 10% annually on average is sustainable in most major markets and perhaps even possible for the world market as a whole. This is a fairly enviable situation, considering that the conventional food business is mostly stagnant or, at best, experiencing very little growth. Most of these products as mentioned earlier are vine dried fruits and not tree dried fruits which mainly come from developing countries.

Various studies have revealed that apple bananas, pineapples and mangoes were the major fruits dried in Africa. For instance, in Uganda the fruits to be dried were mainly sourced from central Uganda, followed by western and northern regions. Banana production in Uganda is high and is most competitive within the region. In Uganda banana takes about 95% of the fruit production. Pineapple production also showed to be competitive with a share of 27% in comparison with Kenya and South Africa. The market size of the dried fruit from Uganda alone is estimated at 90 Metric
tonnes per annum. This output is mainly from 5 companies involved in fruit drying and export, with Fruits of the Nile enjoying a 76% share, AMFRI Farms Ltd 10%, Masaka Organic Producers 9%, Tefu Ltd 4% and Flona Commodities 1%.

In Tanzania there have been attempts by different R&D organisations to modify the currently available fruit and vegetables solar drying technologies aiming at either the requirements stated in the potential market or adaptability by potential users. Research in this area has established various choices of technologies which in return influence what the role of the actors will become; which organisation structure is most suitable and in which location in Tanzania (context) the solar driers will be most suitably placed. Most of current initiatives in Tanzania are still revolving around these R&D activities and are driven by donor/project support. Consequently, the private sector actors are still reactive to these initiatives. Several actors in Tanzania are more or less involved in the dried fruit and vegetables sector through production, processing and provision of various services including training, information supply and credit. Generally, during this study it has been established that most of the initiatives around dried fruit and vegetables in Tanzania are geared towards domestic food security. Most technology transfer initiatives have put emphasis on household processing technologies. There is no locally produced drying machine which can have viable throughput for commercial drying of fruit and vegetables. Two initiatives to commercialise the sector has been attempted by international development agency UNIDO and a private company in north western Tanzania called Matunda Mema.

The driving force and Sub sector actors and channels
Healthy eating established itself as a driving force behind many sectors of the world’s food market, a trend which has benefited demand for premium nuts, mixes and dried fruit, and given rise to the emergence of seeds as a mainstream snacking food. Retail sales of nuts, seeds and dried fruit in UK for instance has increased by 34% between 2001 and 2005 to stand at £449 million and exceeded £500 million by the end of 2006. To date dried fruit and vegetables manufacturers have focused on achieving growth through NPD1 and improvements in merchandising and distribution.

Global markets are becoming more sophisticated but equally volatile. For instance the U.S. nuts and dried fruit market showed strong growth from 2001 to 2006, riding favourable health and diet trends. Manufacturers also contributed to growth with successful product innovation that sustained consumer interest as health trends shifted and evolved. The effect of media promoting recent scientific research supporting nuts and dried fruit as functional foods; portion-control packaging, promotional efforts and, most importantly, health-related positioning claims to stimulate consumer interest, consumers’ desire for healthier lifestyles, and how that correlates to rising sales and opportunities for occasion-based marketing.

In Tanzania currently the driving force is technology transfer (project driven) and emphasis is still revolving around food security and income generation activity for poor women and self help groups. Most organisations active in this sub sector are engaged using project/research fund to promote skills (SIDO, TIRDO, FADECO), drying technologies (SUA, TIRDO, TDTC-CoET, TATEDO, FADECO), design and piloting drying equipment (TIRDO, UNIDO, TATEDO, CoET – CPE, FADECO) and promote food preservation for the purpose of food security and food nutrient (TFNC, TIRDO, TATEDO, FADECO). Even the emerging entrepreneurs – Matunda Mema,

---
1 The NPD Group, is a leading consumer and retail information company
Claphijo Enterprises and KNFC have received initial support from project fund i.e. Matunda Mema (EPOPA); Claphijo Enterprises (Rockefeller Foundation – UDSM CPE) and KNFC (AMKA – APT/DFID and now KWIECO). Contrary to regional counterpart – Uganda, the private sector in Tanzania has been very much inactive in this sub sector. During this study it was evident that dried vegetables are not exported from Tanzania so far and insignificant volumes of banana and pineapples are the only dried fruit exported. Local urban market attract pineapples, banana, mangoes (dried fruit) and mushrooms (dried vegetable). Tomatoes, onions and green vegetables are not popularly dried in Tanzania at commercial level.

**Profitability analysis**
During this study it was established that simplified gross margin from processing of dried fruit can be range between 40 - 60% but due to high utilities and labour costs the SGM could be negative. The drying of fruit and vegetables is labour intensive and requires efficient operation and management systems. The main variable costs of production in drying fruit and vegetables include: purchase of raw material; labour (for washing, cutting, and placing in and removing from solar drier); packaging; utility and transport. Processors should also budget for solar drier maintenance costs and replacement of cutting tools. Exporters may have further costs in meeting buyer specifications, including application of sugar and/or sulphur dioxide, repackaging, and other items.

**Sub sector constraints and opportunities**
The main market and product development constraints in this sub sector include absence of local standard which makes Tanzania dried fruit and vegetables of varied qualities. Currently the only overriding standard for dried fruit and vegetables is Codex Alimentarius Commission - CAC standard which is very stringent for smallholder processor to comply. Almost all initiatives in Tanzania are farm-level/homestead ‘small scale’ processing which cannot be commercialised. Most initiatives were not scaled up after pilot stage. Furthermore, there is absence or limited access to marketing information which makes it difficult for entrepreneurs to be interested in dried fruit and vegetables for local and export markets. This absence of market information may be influenced by low entrepreneurial drive among Tanzania SMEs, though further study could be conducted to validate this observation.

Main Opportunities include the fact that fresh mangoes market is becoming stringent due to quarantine fruit fly ‘*bactrocera invadens*’ affecting fresh mangoes, oranges, paw paws and guava. According to research by SUA and RMCA - drying mangoes is an opportunity to kill all pests and could be exported. Tanzania produces most tropical fruit and vegetables which could be dried for urban and export markets. Various drying technologies have been successful piloted and ready for scaling up (commercialisation). Successful supply chains of dried fruit and vegetables have been established in Uganda and recent in north-western Tanzania – this shows possibility of exploring export opportunities. UNIDO drying facility is Muheza is underutilised – there could be a possibility to engage an entrepreneur to manage and operate the facility commercially.

**Which way forward?**
Based on analysis of this sub sector and drawing experiences from an emerging outgrower scheme in Kagera region (Matunda Mema) and experience from Uganda it is proposed here to explore possibility of developing local exporter, foreign exporter and SME value chain models. The challenge will be to identify private sector companies ready to undertake the role of bulking, drying, conditioning and packaging of dried fruit and vegetables for local urban and export markets. The
companies should be medium sized or large so that they are able to invest in state-of-the-art solar driers and follow processing procedure to comply with international hygiene and food safety standards. For the processors, it might be effective for these companies to be based in the vicinity of the producers so as to maintain quality of fruit and vegetables prior to processing. Exporter can be based elsewhere but preferably Dar es Salaam for logistical reasons.

The study was concluded by recommending short and medium term interventions. Short term (immediate) interventions for SCF and its partners could include:

1) Dissemination of study finding and emphasise on the opportunities
2) Campaign to change/influence consumer behaviour and perception in local urban areas.
3) Developing local market of dried fruit and vegetables (both models could be pursued i.e. exporter model and SME model). Tanzania will be going through a very steep learning curve and could not be competitive enough to access more sophisticated markets especially EU and USA. The initial focus should be on local urban up market and tourism consumers, and once that market segment is successful served, some of the entrepreneurs will explore export markets.
4) Medium and large scale local food (fruit and vegetables) processors could be motivated to invest in few drying facilities along Tanzania northern corridor. One way of motivating processors is linking them to support facilities which will help them to set up outgrower scheme and certify farmers and their processing facilities. Another equally important support to processors could be linking them to buyers abroad. Promote and support development of a joint venture between local processor and foreign exporter. Amfri Farms Limited of Uganda is the emerging partner in this respect. Amfri Farms Limited of Kampala Uganda is ready to give Tanzania processors supply contracts for certain volumes of dried fruits (especially mangoes) and vegetables (especially dried tomatoes).

Medium term interventions could be achieved within two years from now and these could include but not limited to the following areas;

5) Exporting may also provide opportunities though this is not likely to be a short term gain; Kenya and Uganda are ahead of Tanzania in terms of producing dried fruits and on the EU and US market there is (stiff) competition with other dried products. It is yet to be seen if Kavu Natural Food, Claphijo Enterprises and Bonde la Chem Chem will mature; the (market) potential is there, the technology is developed, the (supply chain) ideas are good but what seem to be lacking is an entrepreneurial drive and vision. An entry point for SCF could be to assist them the development of strategic business plans based on identified and committed buyers and on basis of such plans, program for follow-up interventions like rolling out the technology and setting-up protocols and quality assurance systems.
6) SCF together with TBS and other development practitioners active in this sub sector should work together to spearhead development of Tanzania standard for dried fruit and vegetables.
7) Support entrepreneurship education and training development - Tanzanians are less entrepreneurial compared to their counterparts in the region. SCF can support studies which could look on ways to enhance entrepreneurship among SMEs in Tanzania. Conventional entrepreneurship education and training in vocational colleges and institutions of higher learning seems to give no significant positive results. May be what is needed is much more ‘hands on’ entrepreneurial skills development. This could include supporting SMEs’ to gain marketing skills and marketing intelligence (MI).
1. INTRODUCTION

1.1. BACKGROUND TO THE STUDY

Fruit and vegetables, consisting of more than 80 percent of water, are dried in order to stop the multiplication of micro-organisms. These organisms obtain the water and nutrients they need for growth from the fruit or vegetable in which they grow. By drying or dehydrating fruit or vegetables, the water is removed from the food and from the bacterial cell, thus ending the multiplication. The dried fruit and vegetables described in this study are whole, cut, sliced, broken or powdered, but not further prepared. Dried fruit can be divided into vine fruit and tree fruit. The best-known vine fruit species are raisins, sultanas and currants, whereas apples, apricots, bananas, pineapples, mangoes, dates, figs, papayas, peaches, pears and prunes are the most important tree fruits. Dried fruit is mainly used as a snack or a constituent for breakfast cereals, muesli, bakery products, dairy products and desserts. Although some vegetables are sun-dried or field-dried, most vegetables are dehydrated industrially. The main dehydrated vegetables are onions, tomatoes, garlic, carrots and olives. The Netherlands Horticulture Commodity Board’s definition of dried vegetables is used in this study, resulting in the exclusion of dried leguminous vegetables (for example, dried peas and beans). The sauce, soup and ready meal industries are the main users of dried vegetables.

For thousands of years people have sun dried fruit and vegetables to preserve for leaner times. New technologies brought changed techniques, but at present the increasing demand for healthy, low-cost natural foods and the need for sustainable income, are bringing solar drying to the fore as a useful alternative for surplus products. In Tanzania and in the context of this study we will focus more on tropical and temperate fruit and vegetables. These are defined as follows;

Fruits

(i) Tropical fruits- Papaya Carica papaya, Mango Mangifera indica, Pineapple Ananas comosus, dessert banana Musa spp, Annonas Annona spp, Guava Psidium guajava, Grapes Vitis venifera, Carambola Averrhoa carambola, bilimbi Bilimbi Averrhoa, and indigenous fruits such as Tamarind Tamarindus indica, baobab Andasonia digitata, Masuku Uapaca, kirkiana, Mng’ongo Sclerocarya birrea, monkey orange Strychnos spp, sungwi/ntalali Vitex mombassae, Mbula Parinari curatifolia.

(ii) Temperate fruits- Peaches Prunus persica, Pears Malus spp, Apples Malus amygdalus, Strawberries Fragaria spp, Apricots Prunus spp, plums Prunus americana etc. (iii) Subtropical fruits- Citrus Citrus spp, Avocado Persea americana, Lychii Litchi chinensis, Cape gooseberry Physalis peruviana, Tree tomato Cymphomandra betaceae, Pomegranate Punica granatum etc.

Vegetables (including mushrooms)

(i) Exotic vegetables- Tomato Lycopersicon esculenta, Onion Allium cepa, Leeks Allium sativum, Shallots Allium cepa var aggregatum, Chives Allium schoenoprasum, Sweet pepper Capsicum occidentale, Cabbages Brassica oleracea var capitata, Chinese cabbages Brassica rapa, Lettuce Lactuca sativa, Peas Picea, Carrots Daucus carota, Cucumber Cucumis sativum, Water melon Citrullus lanatus, String-less beans Phaseolus spp, Peas Pism sativum, Cauliflower Brassica oleracea var botrytis, Oyster mushrooms etc.

(ii) Indigenous/Tropical vegetables- Cherry tomato Lycopersicon esculenta var cerasiforme, Amaranths Amaranthus spp, Eggplants Solanum melongena, African egg plants Solanum macrocarpon, Okra Abelmoschus esculentus, Collards/mustards Brassica oleracea var viridis, green leafy vegetables such as Nightshades Solanum vilosum, Pumpkin leaves Curcubita spp, sweet potato leaves Ipomoea spp, cassava leaves Manihot esculentum/Manihot glaviozii, and
many more which are yet to be seriously domesticated as well as local mushrooms *tectomycetes* still collected abundantly from the wild and have yet to be domesticated etc.

1.2 OBJECTIVES AND RESULTS OF THE STUDY

The scope and expected outputs of a sub sector/value chain analysis is generally intended to highlight the dynamics of the sub sector/value chain in terms of:

- Actors, roles & interrelationships
- Factors affecting the growth and competitiveness (constraints & opportunities) of the various supply channels
- Market analysis (global, regional & national) in terms of critical success factors
- Analysis of governance and economic benefits
- Identification of potential business solutions that will address constraints and tap the opportunities.
- Selection of key services and analysis of demand and supply side of such services to come up with recommendations of strategies for value chain upgrading (implementation)

The (intermediate) result of the study is a dried fruit and vegetables for urban and export market sub sector/value chain report that has analyzed the dynamics of the sub sector, has addressed the issues raised by SCF and is presenting the way forward with respect to the development of the sub sector in the Northern corridor of Tanzania.

1.3 APPROACH AND METHODOLOGY

A wealth of knowledge and experiences is available in CBI, NRI, AREED, UNIDO, TIRDO, CoET, SIDO, TATEDO, etc and other stakeholders in the dried fruit and vegetables sub sector. Obviously, the starting point was to tap in these sources through interviews and desk top research. Northern corridor is the proposed intervention area but due to limited actors in the area field study included factors, actors, channels and dynamics in the sub sector for the whole country. To get all the data which is important for this research, explorative research of about two months was conducted in Tanzania. Primary data was gathered by interviewing all (possible) relevant actors for the dissemination of solar drying technology, marketing and consumption of dried fruit and vegetables. The following actors were interviewed for this research:

*Farmers involved in fruit/vegetable drying projects*: The interviews with these farmers were important to see how successful current projects were. The farmers in these projects were using various drier types and technologies which are analysed for this study.

*Sokoine University of Agriculture (SUA)*: SUA provided us with technical aspects of food processing in respect to drying fruit and vegetables. The university gave us trends in research agenda in fruit and vegetables drying technologies. This information was used in the analyses of the current situation and options for Tanzania to commercialise drying of fruit and vegetables. Sokoine University of Agriculture (SUA) is established in Morogoro, and is aimed at the developing agricultural sector in the country and beyond. Among other things the university gives academic assistance to farmers and sets up projects. In the field of solar drying they have a particular project in the Uluguru Mountains, where they have provided groups with box dryers, given to them as a loan. They still assist these groups with information (occasionally), and have given them training in food-processing (once, when the dryers were delivered). Most of these projects are to support students learning and most often undertaken as part of their course projects.
SIDO: SIDO was interviewed to see what their predominant role (training) and what could be their other roles in the future, regarding the fruits and vegetable drying.

Support organisations: The discussion with support organisations e.g. AMKA focused on challenges on current solar drying projects and how a future solar drying project should be organised to be successful. It was also important to know which part in the commercialization attempts had been played by these support organisations. These support organisations include TATEDO, TIRDO, TDTC, UNIDO, etc. UNIDO for instance was involved in a fruits and vegetable drying project in Tanzania. They used a different type of technology than other projects. However, this project was also not very successful. The interview showed where the difficulties lied in the project. The interview with TDTC showed the role of this department within the UDSM CoET in developing and transferring the solar drying technology. It also revealed problems with the solar drying projects carried out by the UDSM. TIRDO was interviewed to see how they design solar dryers and how they provide training. It was also to determine if they were complying with any food processing standards.

Ministry of Agriculture: This interview was carried out to establish the role that is played by the ministry and to see which information was known by the ministry concerning training, income of rural farmers and food processing regulation.

Furthermore, due to limited success initiatives in Tanzania, a visit to Uganda was scheduled. There are positive results in Uganda from which Tanzania can draw interesting lessons. After completing the sub sector review, bilateral consultation were undertaken with selected key resource persons for the purpose of selecting the supply chain that is to be analyzed further. The subsequent value chain analysis has focused on the key elements, value addition and critical success factors in the urban and export markets. The draft report was prepared and submitted to the client who in turn generated comments from stakeholders, which were used to finalise the report. For more detailed information about the process flow and activities of this study, refer to the attached contract that guided the consultants (annex I).

1.4 LIMITATIONS
Production, processing, commercialisation and technology adaptation
Despite many dried fruit and vegetables initiatives in Tanzania, during this study it was hard to ‘touch’ a success story. Most of initiatives ended before taking off the ground and some still continue but at a very subsistence/household and or small scale level. Hence, experiences from elsewhere (especially Uganda) and from secondary data has influenced analysis and recommendations presented in this report.

Demand and supply analysis, market segments and sizes
The food processing industry is the largest segment for preserved fruit and vegetables. As the trade in these products takes place on a business-to-business basis, there is very little information available on market sizes and trends. In this sector, preserved fruit and vegetables which include dried fruit and vegetables are used as ingredients in a wide range of food products. Food processors use these ingredients to produce end products in consumer packing for the retail sector and in catering packing for the food service sector. Data on industrial demand for preserved fruit and vegetables are very scarce. The reason is that a large part of preserved fruit and vegetables is
used as ingredients for the food processing industry. Demand in this sector is not monitored; therefore the industry bodies use estimates.

1.5 STRUCTURE OF THE REPORT
The study starts with an overview of the dried fruit and vegetables production and trade worldwide and in Africa and hereafter, it zooms in on production and dynamics in Tanzania (chapter 2, 3, and 4 respectively). The result of the sub sector analysis is presented in chapter 5. The next chapter (6) assesses and analyzes the value chains and hereafter in chapter 7, strategies for sub sector/value chain development and recommendations are presented. The study is completed by discussing the way forward in the final chapter 8.
2. DRIED FRUIT AND VEGETABLES WORLDWIDE

2.1 BACKGROUND

The dried food consumer market in the old EU countries had reached a value of € 7.9 billion and a volume of 3.8 million tonnes in 2003. Unfortunately, there are no data about the specific consumer markets for dried fruit and vegetables as these products are mainly used as ingredients for food processing.

**Dried fruit**

Dried fruit is used in consumer or food service packing, mainly consumed as a snack and as an ingredient for breakfast cereals, healthy ready-to-eat snacks and desserts. Bakeries and breakfast cereal mixes are one of the largest end users of dried fruit. The market for bakery products in the EU had a value of € 70.3 billion and a volume of 26.8 million tonnes in 2003. Considering the imports of dried fruit, sultanas are the most popular (mainly for industrial use) dried fruit in the EU, accounting for more than a quarter of the total imports by EU member countries of dried fruit. Sultanas, other raisins, dates, prunes, apricots and figs are the major imported dried fruit species.

**Dried vegetables**

Dried vegetables are mainly consumed by the dried soup industry. It uses most types of dried vegetables, especially potatoes, onions, tomatoes, leek, carrots and peas. A few large multinational companies dominate the soup industry in the EU. These are Unilever (Knorr, Unox), and Nestlé (Maggi). In most markets, the ratio is moving towards higher relative usage by the industrial sector, reflecting the growing popularity of ready-to-eat healthy snacks, muesli, and processed foods using more healthy ingredients like dried fruit.

2.2 DRIED FRUIT AND VEGETABLES INTERNATIONAL TRADE

In order to avoid misunderstandings the classification of dried fruits in EU; each fruit and vegetables is coded based on the Combined Nomenclature. The Combined Nomenclature (CN) is the 8-digit trade classification system used by the European Union for tariff purposes. The system is directly linked to the 6-digit Harmonized System (HS) used by the vast majority of trading nations throughout the world. However, on January 1, 1988 a unified coding system was introduced to harmonise the trading classification systems used worldwide and to allow for improved international comparability of foreign trade statistics. This system, the Harmonised System (HS), is now based on a ten-digit product classification. The World Customs Organisation (WCO) has introduced alterations to the HS and these were included in the combined nomenclature as of January 1, 2002. When exporting to countries within the EU, it is necessary to state the exact CN number of the specific category of dried fruit and vegetables.

**Food processing industries**

The food processing industry is the largest segment for preserved fruit and vegetables. As the trade in these products takes place on a business-to-business basis, there is very little information available on market sizes and trends. In this sector, preserved fruit and vegetables are used as ingredients in a wide range of food products. Food processors use these ingredients to produce end products in consumer packing for the retail sector and in catering packing for the food service...

---

2 CBI, 2004

3 United Kingdom, Belgium, France, Germany, Austria, Luxembourg, Denmark, and Spain; others include Portugal, Italy, Sweden, Finland and Ireland Republic.
sector. The major food processors, using dried fruit and vegetables, operate in the following sectors:

- **Soup industry:** The soup industry is the largest end-user of dried vegetables. Preserved mushrooms are also used by this industry. The main products are packet soups (dried) including soup bases, instant soups (dried), canned soups and, to some extent, frozen soups.
- **Breakfast cereal industry:** The breakfast cereal industry uses substantial amounts of dried fruit in its production of cereals, muesli and cereals bars.
- **Other food sectors,** like pet food (dried vegetables); confectionery, baby and infant food also use dried fruit and vegetables as core ingredient.

Preserved fruit and vegetables are part of the EU food and drink industry. In 2003 the total production value of the food and drink industry was over € 600 billion. 26,000 companies are active in this sector employing 2.6 million employees. The top EU food processors, ranked on turnover in 2003 and relevant to the preserved fruit and vegetable sector, were as shown in table 1 below.

### Table 1: EU top Food Processors in 2003

<table>
<thead>
<tr>
<th>Company</th>
<th>Country</th>
<th>Turnover in C billion</th>
<th>Product groups</th>
<th>Websites</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nestlé</td>
<td>Switzerland (no EU)</td>
<td>87.9 CHF</td>
<td>Cereals, dairy, beverages, confectionery</td>
<td><a href="http://www.nestle.com">http://www.nestle.com</a></td>
</tr>
<tr>
<td>Unilever</td>
<td>The Netherlands/ UK</td>
<td>42.7</td>
<td>Dairy, beverages, dressings, frozen food, cooking products</td>
<td><a href="http://www.unilever.com">http://www.unilever.com</a></td>
</tr>
<tr>
<td>Danone</td>
<td>France</td>
<td>13.5</td>
<td>Dairy, beverages, biscuits, cereals</td>
<td><a href="http://www.danonegroup.com">http://www.danonegroup.com</a></td>
</tr>
<tr>
<td>Cadbury Schweppes</td>
<td>United Kingdom</td>
<td>9.1</td>
<td>Beverages, confectionery</td>
<td><a href="http://www.cadburyschweppes.com">http://www.cadburyschweppes.com</a></td>
</tr>
<tr>
<td>Ferrero</td>
<td>Italy</td>
<td>4.1</td>
<td>Confectionery, spreads</td>
<td><a href="http://www.ferrero.com">http://www.ferrero.com</a></td>
</tr>
<tr>
<td>Barilla</td>
<td>Italy</td>
<td>Unknown</td>
<td>Fruit and vegetables, Italian products</td>
<td><a href="http://www.barilla.com">http://www.barilla.com</a></td>
</tr>
<tr>
<td>Numico</td>
<td>The Netherlands</td>
<td>1.6</td>
<td>Dietetic food, baby and infant food</td>
<td><a href="http://www.numico.com">http://www.numico.com</a></td>
</tr>
</tbody>
</table>

Source: CBI (2005) page 27

France, Germany and the United Kingdom were the largest food processors in the EU, accounting for 60 percent of total food and drinks production. Apart from the above-mentioned multinational companies with strong pan-European brands, most of the food processing companies in the EU are small to medium sized (SMEs), as highlighted in figures 1 and 2 below which indicates value of imported dried fruit and vegetables. Table 2 shows the main suppliers of dried fruit in EU include Turkey, USA, France, Tunisia and Greece. Others include Germany, Iran Chile and The
Netherlands. Obviously most of the European suppliers may have imported dried tropical fruit and vegetables from developing countries and export to other EU countries.

Figure 1: Imports of dried fruit into the main EU countries, 2001–2003 (in €1,000)

![Graph showing imports of dried fruit into the main EU countries, 2001–2003.]

Source: CBI (2005), page 51

Figure 2: Imports of dried vegetables into the main EU countries, 2001–2003, €1,000

![Graph showing imports of dried vegetables into the main EU countries, 2001–2003.]

Source: CBI (2005), page 53
Table 2: Imports of dried fruit into the EU by leading suppliers, 2001-2003, € 1,000 / tonnes

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>840,709</td>
<td>587,823</td>
<td>889,555</td>
<td>605,307</td>
<td>879,632</td>
<td>611,293</td>
</tr>
<tr>
<td>Extra-EU</td>
<td>614,774</td>
<td>464,203</td>
<td>646,207</td>
<td>478,550</td>
<td>646,271</td>
<td>494,323</td>
</tr>
<tr>
<td>Developing countries</td>
<td>423,028</td>
<td>366,284</td>
<td>470,266</td>
<td>387,706</td>
<td>474,680</td>
<td>395,068</td>
</tr>
</tbody>
</table>

**Leading suppliers**
- Turkey: 259,371, 244,720
- USA: 160,952, 86,398
- France: 58,752, 23,831
- Tunisia: 49,250, 28,598
- Greece: 51,977, 36,437
- Germany: 30,755, 12,325
- Iran: 30,608, 40,277
- Chile: 25,787, 14,462
- The Netherlands: 26,125, 17,840

Source: CBI (2005), page 52.

As depicted in table 3 below dried grapes accounted for 39 percent of total value imports in 2003, followed by dates and dried figs (23%), dates (15%), and bananas (1%). Together these products accounted for nearly 80 percent of total value imports in 2003. Further analysis of non-tropical fruit is done in Annex II.

Table 3: The Leading Suppliers of processed fruit 2003

- The leading suppliers (share of total year 2003 imports in terms of value) of:
  - Dried grapes: Turkey (42%), USA (17%), Greece (10%), Iran (8%), South Africa (6%)
  - Dates and dried figs: Turkey (27%), Tunisia (26%), Israel (12%), France (7%), Algeria (6%)
  - Dried bananas: France (23%), Ecuador (22%), Philippines (11%), Germany (8%), Costa Rica (6%)
  - Dried cashew, lychees, etc.: Germany (61%), The Netherlands (14%), Vietnam (12%)
  - Dried papayas: Thailand (73%), The Netherlands (7%), Brazil (4%)
  - Dried tamarind fruit: Thailand (45%), India (29%), Germany (13%), Philippines (3%)

Source: CBI (2005), page 52.

**Consumer sector**

Preserved fruit and vegetables like canned fruit and vegetables, frozen vegetables, fruit juice and jam are processed and packed in consumer units and sold through retail outlets to consumers. The consumer sector of preserved fruit and vegetables consists mainly of branded products and private labels. Supermarkets in the EU dominate retail sales at the expense of specialised shops, such as greengrocers, bakeries, butcheries and deli shops. A small fraction of dried fruits goes to consumers directly as a snack. Most of the products are fruit and nut mixes, but some tropical fruits are also sold in single-fruit packs. Banana chips are the most common product in the category, used in many nut and fruit mixes and alone. Pineapple and papaya tend to be used in nut and fruit mixes and sometimes together in a two-fruit mix. Ready-to-eat remoistened mango srears, pineapple chunks and luxury fruit medleys are a high-value niche product in this group. Natural
dried tropical fruit is a subgroup of this group, normally sold through specialist outlets in mixes and single fruit packs and is not an industrial or large-scale consumer product. Banana, pineapple and mango are all used alone and in blends, but papaya does not seem to be. While fruit bars are an important category for the organic market, they will only sporadically contain dried tropical fruit.

Recent studies\(^4\) have established that EU importers are less interested in sun-dried product and industrially dried products are very competitive overall. The perception is that the product from small scale processors in developing countries will have too many foreign products (insect fragments, defects, spoilage, microbiological problems, and bacteria) and will not pass hygiene and food safety regulations. Some EU importers are willing to look at the sun dried product and see whether it meets specifications however, all stressed that the market is well supplied and that new entrants must have some comparative advantage in terms of price or presentation. There is a growing demand for organically certified product that is also low in sugar (natural levels). Organic products can reportedly sell for several times the price of regular product.

**Food service sector**
The food service sector has been growing during recent years. Out-of-home consumption increased as consumers saw their incomes rising, especially two-person households where both partners are working. Fast food outlets showed an increasing expansion in most EU countries. The food service sector also includes company canteens and institutional outlets like hospitals, prisons, convalescent homes, schools and universities. The market for preserved fruit and vegetables for industrial use can also be segmented according to whether the products are grown by organic farming or by conventional farming. This is particularly important since the demand for organic food is growing in several EU member countries and can offer interesting market opportunities for developing countries' exporters. Organic products still account for a small share of the total food consumption in most of the EU markets, although the differences are quite large. In Denmark and Austria, for instance, organic products account for about 10 percent of the total food market, while in countries like Spain and France the share is between 0.5 and 1 percent.

Although growth of organic foods reached double digit figures in 2000 and 2001, since 2002 the markets have tended to grow much more slowly (3-4 percent). In some sectors like organic coffee, there is an oversupply, causing prices to drop. Because of its nature, organic production is highly suitable for small and medium-sized farmers working in areas which may not be suitable for large-scale food production. Dried fruits like apricots, bananas and pineapple are important organic products within the preserved fruit and vegetables segment for industrial use.

While the organic market absorbs at least half of the volume of natural dried tropical fruits (about 500 tons), it also uses a significant but unknown volume of deep-fried banana chips. As yet, there are no organic pendants of the dominant conventional category of candied dried fruits. It is uncertain if there would be demand for these products, since the inherently low quality may form a

\(^4\) ADC Commercialization Bulletin #11; ADC Commercialization Bulletins are published by the Agribusiness Development Centre of the USAID-funded Uganda’s Investment in Developing Export Agriculture (IDEA) Project. The bulletins provide potential investors with a quick reference to production and market characteristics for various nontraditional export crops.
constraint. If there is a market at all for this candied organic fruit, the food industry would be the most likely candidate, using it in breakfast cereals or snack bars.

Organic dried fruits are used primarily used as snacks, while the portion that is used by the food industry as an ingredient is small. One factor explaining this is the relatively high price of these natural dried fruits. But limitations in diversity, quality and reliability of supply will also play a role. Organic deep-fried banana chips do find a market in the food-industry, for one reason since these are more competitively priced. They are also sold in single product packages, as a snack.

Like the organic market, the fair trade markets uses natural dried tropical fruit and deep-fried banana chips. These products are offered to the consumer mainly in single product packages. There is hardly any demand for tropical dried fruits as an ingredient for fair trade products. The size of this market is an approximate 50 tons, which is bought directly from source by Alternative Trading Organizations. The products may sometimes be consumer-packed in origin. There is no external fair trade certification hallmark such as Max Havelaar or Fair Trade as yet, but especially UK buyers are making efforts to introduce such a standard soon.

Furthermore, a recent ITC study (ITC/UNCTAD/UNEP, 2006)\(^5\) revealed that after some years in the early 2000s of relative pessimism (at least in most European markets), most major markets seem again to be enjoying healthy growth with very positive outlooks for the years to come, although recent years’ growth rates of about 20% in Canada and the USA and even higher in the UK, for example, are unlikely to continue. Many industry leaders seem to believe that a growth rate of about 10% annually on average is sustainable in most major markets and perhaps even possible for the world market as a whole. This is a fairly enviable situation, considering that the conventional food business is mostly stagnant or, at best, experiencing very little growth.

**Opportunities for exporters from developing countries**

Due to the characteristics of the preserved fruit and vegetable sector, the opportunities for exporters in developing countries lie in the following positions in the supply chain:

- Suppliers of preserved fruit and vegetables ingredients to the food processing industry in the EU
- Suppliers of preserved fruit and vegetables in bulk to packers in the EU, who pack in consumer and food service units
- Subcontractors for the food processing industry and retail organisations. These subcontractors process fruit and vegetables and pack them in consumer and food service units according to strict specifications and under their customers’ labels in the EU.

**Dried fruit from Europe**

There are only a few countries in the EU supplying significant amounts of dried fruit. Greece is a major producer of currants and raisins. France is the second largest producer of dried prunes in the world, after the United States. French prune production is estimated at about 41,000 tonnes. Spain is the only date producing EU member country, with an annual production fluctuating around 7,000

---

\(^5\) The International Trade Centre (ITC), the United Nations Conference on Trade and development (UNCTAD) and the United Nations Environment Programme (UNEP) in 2006 jointly undertook a research project on the potential for export development of organic products from East Africa.
tonnes (FAO 2002). Most of dried mangoes, pineapples and bananas therefore, come from tropical countries including sub Saharan Africa.

_Dried vegetables from Europe_

It is not possible to give an overall view of EU production of dried vegetables, as only a few countries publish production figures on this product group. This is because the quantities are fairly small compared to those of other processed vegetables. However, a large share of dried vegetables originates outside the EU, accounting for about half of the imports by EU member countries (in terms of volume) of dried vegetables in 2002.

Products that grow in tropical or subtropical countries and cannot be grown in the EU offer good opportunities for exporters in developing countries. Further, counter seasonal products are of interest to EU trade partners, as year round supply is increasingly demanded.
3. DRIED FRUIT AND VEGETABLES PRODUCTION

The FAOSTAT provides production statistics for the most important fruit. In 2005, for instance the total world production of the major tropical fruit (fresh) was, as follows:
- Bananas: 72.5 million tons (of which Africa produces: 7.4 million tons – 10.2%)
- Mangoes: 28 million tons (of which Africa produces: 2.7 million tons – 9.6%)
- Pineapples: 15.9 million tons (of which Africa produces: 2.6 million tons – 16.4%)
- Papayas: 6.8 million tons (of which Africa produces: 1.1 million tons – 16.2%)
- Other tropical fruit: 16.5 million tons (of which Africa produces: 0.5 million tons – 3.0%)

FAO publishes production figures for fresh fruit but not for dried fruit. However, drying of fruit takes place in almost all tropical countries, although not always in commercial quantities or of export quality. As far as organic dried tropical fruit are concerned, the following countries are believed to be producers and exporters (list not exhaustive):
- Bolivia, Brazil, Burkina Faso (mango),
- Cameroon, Colombia, Costa Rica, Ecuador, Ethiopia (pineapple),
- India, Peru, the Philippines, Sri Lanka, Thailand, Togo, Uganda (apple bananas, papaya, mango, pineapple, ginger) Tanzania (banana, pineapple) and Zambia. However, many other tropical countries export dried tropical fruit and may enter the organic trade.

Various studies have revealed that apple bananas, pineapples and mangoes were the major fruits dried in Africa. For instance, in Uganda the fruits to be dried were mainly sourced from central Uganda, followed by western and northern regions. Banana production in Uganda is high and competitive within the region. In Uganda banana takes about 95% of the fruit production. Pineapple production also showed to be competitive with a share of 27% in comparison with Kenya and South Africa. The market size of the dried fruit from Uganda alone is estimated at 90 Metric tonnes per annum. This output is mainly from 5 companies involved in fruit drying and export, with Fruits of the Nile enjoying a 76% share, AMFRI Farms Ltd 10%, Masaka Organic Producers 9%, Tefu Ltd 4% and Flona Commodities 1%.

**Drying Technology**

The main characteristics of the solar drying technologies are discussed here in the light of the requirements which are set by the analysis of the potential market. There have been attempts by different R&D organisations to modify on the currently available technologies aiming at either the requirements stated in the potential market or adaptability by potential users. Research in this area has established that the choice of a particular technology will influence what the role of the actors will become, which organisation structure is most suitable and in which location in Tanzania (context) the solar driers will be placed. The outcome of the analyses of the technologies will be the first input for the detailed recommendation in sub sector/value chain development.

**Open-air Drying**

Open-air drying is the most common method and involves simply laying the products in the sun on mats, roofs or drying floors. This simple and basic approach of sun drying has the advantage that it

---

6 This section has drawn most of the technical analysis of solar drying for Tanzania by Vriens and van Diesen, done in 2007 as part of their thesis for fulfillment of the Master program in Technology Development Studies at the University of Technology in Eindhoven.
is very cheap, ideal for products where little or no value is added and the fruits can usually be dried close to home. Unfortunately this technique has its limitations, the produce is open to contamination by dust, the process is totally dependent on good weather, the very slow drying rates of the process create the danger of mould growth and the process may not be able to dry to a sufficient low level of moisture to prevent mould growth. Nevertheless sun-drying remains an economically viable method for preserving foods for the rural poor. Especially for fruits where value is added by drying the fresh product and so may also justify an investment in improved drying technologies. Open-air drying remains the cheapest method of food drying, no investment maintenance or power is required and it is capable of large batch sizes. But the product is exposed to various contamination risks, such as dust, animals, ants, rain, etcetera, resulting in a poor quality of the dried product, and requiring labour to survey the crops. Products that are dried in the open air are not fit for consumption when one regards international standards, like the CAC.

**Solar Driers**

Solar driers are simple machines that can eliminate the negative effects of open-air solar-drying, and can more efficiently make use of the sun's heat. This results in higher drying temperatures which positively effects the drying times and creates the ability to dry to lower final moisture content. The insulated housing of the machines protects the produce from contamination by dust and from rain showers. A suitable solar drier for the rural poor should be low cost and relatively simple to install and to maintain. Several techniques were developed for solar-drying of foods. The most commonly used and appropriate technologies will be discussed here, as well as how they could be used in Tanzania and/or how they could

**Box-Drier**

The drier that requires the smallest investment is the box type (see figure 3). This drier consists of a drying chamber with a transparent cover, this cover must filter the harmful UV radiation, which reduces the loss of colour and vitamins, out of the sunlight, and can basically be made out of glass but because of the fragile nature of this material, Visqueen, a UV resistant polythene sheet, is preferably used.

The chamber has appropriately placed openings to facilitate airflow. The products that are to be dried are spread in a thin layer on wire mesh trays and placed inside the chamber, and are heated by the incident solar radiation. Because of the budget characteristics of this drier type it is seen as the most suitable solution for the poor small scale farmer. The machine can be produced by locals with carpeting skills mainly from locally available materials. Although this drier does not require specialized manpower, the drier should be operated properly to reach a good quality of the dried produce. The conditions in the drying chamber cannot be controlled in any way and are exposed to the incident weather conditions. So drying times, temperatures and moist content may vary.

Figure 3: Box drier
Box dryers can handle medium size batches and are relatively cheap (although more expensive than open-air drying). Drying times are longer than with other dryers, strongly dependent by the sun intensity. Because of the direct heating by the sunlight conditions within the dryer are not identical, the top layer will dry much faster then the lower layers and through the high sun intensity on the top layer there is a risk of “burning” the fruit, which turns it brown. Because of these uncontrolled conditions in the drying chamber product output may vary in moist content, a too high moisture content can result in rotting, with a too low moisture content the product is unfit for direct consumption. All in all one can conclude that the quality of product output will not be consistent. Because of the characteristics of this dryer (cheap, medium batch size, long drying times), they are commonly used in projects to introduce fruit-drying to rural farmers.

Experience from farmers involved in these projects (usually one dryer operated by an entrepreneur that buys fruit from local farmers) shows that food processing conditions are not in line with international standards (CAC), knowledge and training leaves much to be desired, and the value added of the drying is negligible because of the small batch sizes. Because of this small batch size and a lack of infrastructure, dried produce is often assembled over a certain period so that the quantity is large enough to make transport to Dar Es Salaam (packaging) viable, resulting in rotten dried produce (high moisture level) before packaging. The UDSM box dryer is equipped with a solar driven fan which is meant to generate airflow and so create controlled chamber conditions. The UDSM box dryer is meant to handle large batches, although after testing the dryer was not capable of drying the desired quantity (it was meant to process 100 kg instead of 40 kg), so the realized batch size is much smaller.

Because the basic design of a box dryer is kept most disadvantages also stayed, “burning” is still a problem, and even though the fan was installed to make drying conditions in the chamber more consistent, they are still not, resulting in an inconsistent output. Because of the addition of a solar panel and a fan the costs rise considerably in comparison to an ordinary solar dryer also the level of complexity of the machine has raised undoing the low-tech advantage of the ordinary box dryer. The increase in costs and complexity makes it inappropriate as a suitable technology for individual fruit and vegetable drying, when considering the capabilities for individual farmers.

The technical data of the UDSM box dryer is as follows:

<table>
<thead>
<tr>
<th>Batch size:</th>
<th>40 kg of raw material (i.e. peeled, sliced and stoned)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drying time:</td>
<td>2-3 days</td>
</tr>
<tr>
<td>Power requirement:</td>
<td>55 W</td>
</tr>
<tr>
<td>Drive of fan:</td>
<td>solar panel</td>
</tr>
<tr>
<td>Price:</td>
<td>approximately $350</td>
</tr>
</tbody>
</table>

Indirect Solar-Drier

A more complicated and more expensive method of solar drying is indirect solar-drying. The products are not exposed to direct sunlight, but hot air from a separate solar heater passes through the drying chambers containing the products. An indirect solar drier can differ in levels of complexity, resulting in different quality output of the produce. In a small scale drier airflow can be generated to natural convection (figure 4 and 5) or with an air powered fan on top of the chimney.

---

7 Interview with Mama Clara, dried fruit processor based in Kibamba – outskirts of Dar es Salaam, 4th December 2007
More complicated solar driers employ forced air-circulation by using fans or blowers. The camber can be equipped with steering system to control the drying temperature, which varies according to the type of crops. A more controlled environment will lead to a more continuous quality of the dried product. The relatively simple indirect driers can easily be equipped with these features. This principle can be elaborated to a heavy duty drier, with a larger batch-size, as shown in figure 4 and 5. Again the air is heated through sun collectors, but now they have to be much bigger and are usually placed on the roof. The air circulation fan can be AC or DC powered. Rural areas often do not have access to power and if there is power it is not reliable, power-cuts are very common in Tanzania. The advantage of DC power for rural areas is that it can be generated by solar panels.

Small scale indirect solar dryers
Indirect dryers can have controlled chamber conditions and the produce is not directly exposed to sunlight, creating a constant product quality. Indirect driers are able to generate more heat, which shortens the drying time. In addition indirect dryers are less sensitive to weather conditions because other heat sources can easily be added. There are basically two types of indirect dryers, the stand-alone (small) solar dryer, and the heavy duty indirect dryer that is accommodated within a building. The stand-alone indirect solar dryer is relatively expensive and can only process small
batch sizes furthermore the heat collector is placed low and topped with glass making it sensitive for damaging and therefore unpopular with rural farmers.

Figure 6: TIRDO small scale cabinet drier

The technical data of the small scale cabinet dryer by TIRDO is as follows:
- Batch size: 40 kg of raw material (i.e. peeled, sliced and stoned)
- Drying time: 3 to 4 hours
- Price: approximately $1,000

Heavy duty indirect solar dryer
The heavy duty indirect solar dryer, can handle very large batch sizes which can be dried under very controlled conditions. Not only can the drying chambers be controlled but because everything is packed into one building the produce will never contact the open air until it is packed and ready for transport, reducing the risk of any contamination. Because of their size and more complicated technology these dryers are expensive. The heat collectors of this dryer are also topped with glass but due to the high placement of these collectors, chances of damaging are lower.

The technical data of the Hohenheim heavy duty dryer is as follows:
- Batch size: ranging from 40 – 510 kg of raw material (i.e. peeled, sliced and stoned)
- Max capacity per day: ranging from 80 up to 1020 kg of raw material
- Dimensions(LxWxH): from 1,4 x 0,75 x 0,9 to 1,4 x 2,6 x 2,3
- Drying area: from 4 m² to 50,8 m²
- Heating power: from 4 kW to 65 kW
- Installation time: 1 day
- Price: approximately $32,750 including packaging
Tunnel drier
A typical solar tunnel drier (figure 3.5) consists of a solar collector, drying tunnel and axial flow fans that can drive the moist out of the drier. The air is heated in the first part of the tunnel drier, which acts as the solar collector, and is accountable for approximately 45% of the total area of the tunnel drier, this area is exclusively used for air heating so no produce can be placed here. The last part of the tunnel-drier is the drying room. The fresh produce, that is to be dried here, is placed as a single layer inside the drying tunnel. Air entering the solar collector is heated and forced on the products placed in the drying tunnel, using the axial fans at the air inlet of the solar collector. These axial fans can be DC powered, and can therefore be connected to solar panels to generate the required energy. For example in a tunnel-drier, developed at Hohenheim University, five 14W axial flow fans were installed, with an air capacity of 130 m³/hour each, the required power is generated by three solar PV panels (figure 3.6).

Tunnel dryers can handle medium size batches and have controlled chamber conditions (although it is not as controlled as with the indirect dryers). When sun intensity is too high the drying chamber can be covered and when the sun intensity is too low another heat source can be added, the fans controlling the airflow in the tunnel adjust themselves to the sun intensity. Tunnel dryers are more expensive than a box dryer but cheaper than an indirect dryer. Drying times are relatively short although longer than the indirect dryers.

The technical data of the Hohenheim tunnel dryer is as follows:
- Batch size: 150 – 250 kg of raw material (i.e. peeled, sliced and stoned)
- Length and width: 18 x 2 meters
- Solar collection area: 16 m²
- Drying area: 20 m²
- Air flow rate: 400 - 1200 m³/h
- Air temperature: 30 - 80 °C
Combined Solutions

In the quest for the most suitable solar-dryer for the rural areas, combined solutions emerged, fusing properties of the standard drying methods. One interesting example is the UDSM Box dryer with forced air circulation (figure 8). This dryer is based on the design of a box solar dryer from a Tanzanian NGO named AMKA; the redesigned dryer has a larger batch capacity (40kg versus 25 kg) and reduces the drying time with a day (2-3 days versus 3-5 days). The most important modification on the AMKA dryer, are the two DC fans on top of the dryer, powered by a solar panel. The function of the fans will be to increase air turbulence and circulation in the dryer. The working of the fans will be depending on the solar intensity. Another example is the mixed solar-dryer that is developed by TIRDO (figure 8), this dryer combines the properties of a direct and an indirect solar dryer. Basically the dryer is the same as a usual box dryer with this exception that it has an extra solar collector mounted at the front, through this solar collector extra heat can be inserted into the dryer, generating shorter drying times. An advantage of this dryer over a fully indirect dryer is that it keeps the low cost properties of a direct solar dryer, because it is constructed of the same low cost materials.

In Uganda there is a project with drying of fruits, where farmers use a simple box dryer like the one discussed previously combined with a freeze drying unit which is more centrally located to dry the products further to achieve an appropriate quality.

Drying Method

The most common method for drying is to place the fruit in a cabinet as a single stage drying process. A two stage process may also be used, whereby the fruit is initially immersed in a highly concentrated sugar solution and water is removed by osmosis before being placed in the dryer for the second and final stage. This second stage may not be allowed by buyers who want “all natural” (no sugar added) product -- generally for the health food sector. Typical steps in the production process:

1. Selection and purchase
2. Sorting
3. Washing (1%-10% salt water solution; 0.1%-5% soda water solution, or hot water)
4. Pealing
(5) Coring, removal of stone/seed
(6) Cutting of fruit (according to buyer specifications)
(7) Blanching (using a method that meets buyer specifications - boiling in acidified water or steam, placing fruit over burning sulphur, or immersing in sulphited water solution)
(8) Drying either through solar or conventional means
(9) Cooling
(10) Sorting and Export Grading/Packing
(11) Storage and Transportation (if the product has high moisture content and a preservative has not been used, cold storage may be required)

Depending on buyer specifications, sugar may be added to the dried product to stabilize it (increase its shelf life) and sulphur dioxide may also be added for lightening and to help preserve colour.

**Commercial electric powered driers**

*Drum dryer*

The drum dryer has acquired a unique place among other dryers because it can dry products where other dryers give poor or unsatisfactory results. Like no other dryer, the drum dryer can dry highly-sticky products and/or highly-viscous media, but low-viscous liquids can also be dried on the drum dryer. The crust that is then formed on the drum surface is, in contrast with other dryers, actually welcome. The drum dryer is heated on the inside and turns continuously. In a full-continuous process, the product is applied in a thin film on the outside of the drum and begins to dry immediately. After one rotation, a knife scrapes the dried product off the drum surface as a film or as flakes. The drum dryer is an indirect dryer. Unlike direct drying methods, where hot air is used to evaporate the product moisture, the drum dryer needs no dust recovery. In addition, the thermal results are more favourable than in other methods because no heat is lost in the hot exhaust air. The GMF-Gouda drum dryer (Figure 9) has a wide range of possibilities:

- Tailored models for the food and chemical industries;
- Perfectly suited for sticky and highly viscous products;
- Vacuum operation for temperature-sensitive products;
- Closed process area to protect the product and/or the environment.

![GMF – Gouda drum dryer](image)

When solar energy is not enough to give fruit and vegetables uniform drying – it might be required to complement the solar energy with electric energy. Electric powered driers (Figure 10) are now manufactured in South Africa and elsewhere for commercial fruit and vegetables drying.

![Electric powered batch drier from Republic of South Africa](image)
4. DRIED FRUIT AND VEGETABLES IN TANZANIA

Several actors in Tanzania are more or less involved in the dried fruit and vegetables sector through production, processing and provision of various services including training, information supply and credit. What these actors do and how they interact will be discussed in this chapter.

Generally, during this study it has been established that most of the initiatives around dried fruit and vegetables in Tanzania are geared towards domestic food security. Most technology transfer initiatives have put emphasis on household processing technologies. There is no locally produced drying machine which can have viable throughput for commercial drying of fruit and vegetables. Two initiatives to commercialise the sector has been attempted by international development agency UNIDO and a private company in north western Tanzania called Matunda Mema.

These dryers have been mainly provided by different government organizations to small farmers and cooperatives (see box) for drying tobacco, fruits, fish, and meat products. However, some of the dryers are not functional at present.

Major reasons cited for non-operation and abandoning of renewable energy-based dryers are:

- Destroyed by typhoon or floods or fire,
- Old age and weakened structure,
- Uneconomical or unsatisfactory performance,
- Inadequate biomass fuel supply,
- Poor harvest of crops to be dried, and
- Unfinished construction due to lack of funds

The main operational problems faced by the users are

- Maintenance of plastic sheet and galvanized iron used for construction,
- Often, the products can not be dried to the desired final moisture content in case of solar dryers,
- Insect infestation,
- Problems with operating biomass furnaces,
- Lack of after sale services from small-scale dryer suppliers, and
- Lack of trained people to operate dryers resulting in low quality or damage products.

The survey revealed that there have been a number of researches, development and dissemination efforts related to renewable energy-based drying systems in the Philippines. Major research efforts include improvements to solar dryers and hybrid solar-biomass dryers, and biomass furnaces used for dryers. The organizations involved in these activities are:

- TIRDO
- SIDO
- UNIDO
- TFNC
- CoET – UDSM
- TATEDO
- MATUNDA MEMA
- SNV – FAIDA project
- AMKA
- KAVU NATURAL FOODS
 Despite the dissemination efforts, investments in renewable energy-based drying systems still remain low. As revealed from the survey, major reasons for the non-adoption of such dryers by individual farmers, farmer organizations or cooperatives are:

- High initial cost,
- Price structures of produce which do not reflect the cost of drying,
- Negative publicity due to unsatisfactory performance of some drying systems introduced arising from factors such as poor technical designs, inadequate user training, and incompatibility of dryer capacities with farm production and other processing equipment,
- Lack of awareness about renewable energy-based drying systems, and
- Small volume production

There are no adequate financial assistance packages such as credit or easy payment schemes to facilitate dissemination of drying systems. Although farmers can benefit much from value adding to their products through post harvest processing, they are eager to convert their produce immediately to cash, mainly because of the poverty and traditional practices. The practice of using biomass fired drying systems in coconut and tobacco sectors is already well established. However, there is a considerable potential for commercial application of solar and biomass based drying systems in producing processed fruit products, mainly banana, pineapple and mango, which have already established local and export markets. Post harvest value addition also helps producers to lessen the effect of price fluctuations during high supply seasons. In addition, there is a good potential for application of renewable based drying systems for drying fish.

**FAIDA**

FAIDA\(^8\) was The Netherlands Development Organisation (SNV) project based in Arusha. FAIDA undertook research to promote solar drying technology during the period 1996 – 1999. With the technical support of local technology institutions like CAMARTEC and TEMDO simple dryers were constructed that could be replicated by local craftsmen. After extensive testing they were taken in production but the total number has never exceeded 10. The dryers were introduced to various FAIDA clients, mainly individuals, who started drying fruits and vegetables. FAIDA collected some of the products to analyze its quality and particularly its shelf life. The other part was retained by the producers for the purpose of consumption. The major hindrance and impediment for growth was the erratic sub shine and hence the quality and colour of the product was not very consistent. To address this issue FAIDA started experimenting on small scale with electrical dryers – one of the members of staff managed to get a small machine from abroad – and indeed the quality could be much better controlled. The packaging was extremely simple; a small plastic bag which was sealed by the heat of a candle. Nonetheless, the shelf live was about 3 months. Hereafter, initially the colour and later the taste started changing. FAIDA also undertook a market research by using the samples produced by its staff members and many tourist facilities and tourist companies were visited. Nearly all wanted to order instantly and that provided good evidence that there was a

---

\(^8\) An acronym for Finance and Advice in Development Assistance; a programme initiate by SNV, Netherlands Development Organisation and financially supported by the Dutch Royal Netherlands Embassy (RNE) which started in 1993 and closed its offices in 2003.
market for the dried fruits. During one of the Nane Nane shows FAIDA promoted the business by demonstrating the technology and by sharing the profitability analysis including the results of the market survey. Surprisingly, nobody was interested to take up the business and the initiative had a natural death.

**Matunda Mema (T) Limited**

Matunda Mema (T) Limited is a company registered in Tanzania since October 2001. The company is based in Kayanga Town, Karagwe District in Kagera Region in North Western Tanzania. Matunda Mema started processing (solar drying) fruit in 2001 and organised two groups of (44) smallholder farmers around Nkwenda and Ihanda. The farmers were organised with assistance of World Vision (Nkwenda, app. 45 km north of Kayanga) and MAVUNO (Ihanda, app. 10 km north of Kayanga). Both have active agricultural development departments in the area. The farmers of Ihanda were first inspected in 2001 by IMO and considered as farmers in conversion with twelve farmers being fully certified in May 2002. Mr Siegfried Hermann established his own marketing operation for organic dried and fresh fruits in Germany under the name of Kipepeo Bio & Fair Limited. By 2002, Kipepeo Bio & Fair Ltd was buying all its products from one supplier in Uganda and wished to develop other sources of supply. Mr Hermann’s background and contacts made Kayanga a natural choice to accomplish this. Through EPOPA’s Limited Support to Exporters project, Mr Hermann entered Kayanga. Matunda Mema had already started with the certification process but had not established any system for monitoring the farmers and all the farmers were being inspected as individual units by the external inspector, making the inspection very costly. The company had also installed one solar drier but this clearly did not have the capacity to process all the production from the farmers. This EPOPA project was developed to address these issues and the project was approved in April 2003.

The Limited Support to Exporters project objectives were to purchase a second drier to increase production capacity of Matunda Mema and reach viable volumes of organic exports of dried fruits; to develop an ICS that would reduce certification costs; to train staff in ICS and to give current staff exposure to modern methods of organic control as practiced in other projects. The project took place from 1st April to 30th November 2003. Although generally, the project was successful, the project end report stressed that there is need for Matunda Mema to increase the numbers of project farmers to numbers that would make the operation financially viability and even to explore new production area. There was also need to put more farmers at a centralised location to reduce collection costs. The report urged also that technical support in both maintaining the driers and also obtaining the maximum efficiency from them is important. Continued training to the project staff and the farmers in organic agriculture was seen to make the initiatives of Matunda Mema and Kipepeo sustainable (EPOPA, 2003).

During interview with Matunda Mema Managing Director during this study it was established that in 2004, the company bought two more driers and modified all their driers to be powered by

---

9 If I recall well the 1999 agricultural show in Arusha
10 Sensitivity analysis were performed for various scenario’s depending on the type of technology
11 In hindsight it was not that surprisingly; most of the interested people doubted the viability in spite of the documentation as they were not involved in the research and moreover, they were wondering why such a splendid opportunity was not kept secret and for themselves by the initiators.
12 Hermann worked in Karagwe district as a development worker before starting Kipepeo Bio and Fair Limited based in Germany.
electricity. This reduces the loss from 50% to about 20%. The remained loss levels were mainly
due to fruit quality and not drying process. Matunda Mema has also processed more pineapple
than bananas because of the banana crop disease prevalent in Kagera region. Although mangoes
proved to be very successful fruit for drying, Matunda Mema has remained focused in pineapples
and bananas to build their experience before diversifying to other fruit varieties. So far Matunda
Mema throughput is on average 8 – 9 kg per day per drier although until early 2007; production in
the region has been fluctuating. The company still export 100% of processed/dried fruit to Germany
through their sole buyer Kipepeo Bio & Fair Limited. As a way to improve quality of fruits to be
processed, Matunda Mema has instructed their farmers to harvest in their presence to ensure only
good quality fruit is harvested. Farmers supplying to Matunda Mema are still operating individually
and organic certification is still done for individual farmer. The certification cost is essentially paid
by Matunda Mema but then factored in the farm gate buying price.

**TIRDO/UDSM-CoET**

TIRDO's is an institution that carries out technological research and capability building so as to
facilitate maximum exploitation of locally available natural resources for industrial development and
to become an International Centre of Excellence in conducting R & D activities in the sector of
Industry and Environment. It also conducts research in solar driers and then seeks entrepreneurs
to start producing the machines. TIRDO has indirect, direct and mixed solar-driers. Prices are TShs
1.3 million for an indirect solar drier with a batch-size of 40 kg and a drying time of 3-4 hours, direct
drier costs TShs 800,000. Provided to registered farmers with a clear objective, they will receive a
30 to 50% funding. TIRDO provides training in the drying process, packaging and labelling. With
the current labels it is not possible to trace the produce back to its origin. They also train TOT's
(Trainers of Trainers) for the manufacturing of the machinery. People with the ambition to become
entrepreneurs in the manufacturing of the machinery, can use the well equipped workshop at
TIRDO. Potential farmer-groups are selected by the extension officers, and then appropriateness is
tested by TIRDO by means of executing a survey. The UDSM – CoET - Technology Development
Transfer Centre (TDCU) is, among other institutions, involved in the development of and research
on Solar-driers, working closely together with several institutions dealing with solar drying. Mr.
Osman is the main expert in the field of solar drying and has experiences with several projects
dealing with this issue. TIRDO solar drier project was done with technical support from CoET and
financial support from MKUKUTA. Under MKUKUTA initiative, the recipients of drier meet only 50%
of the cost of the equipment. During this study it was established that TIRDO has managed to
distribute 9 driers i.e. 4 to Kibaha District in Coastal region (self help groups under MKUKUTA), 2
driers were bought by Newala District Council; three driers have been distributed to self help
groups in Kisarawe District in Coastal region (under MKUKUTA), one drier to Kitunda area in Dar
es Salaam (2 groups with total of 55 members under MKUKUTA), and one drier to an entrepreneur
in Tegeta area in Dar es Salaam. Nevertheless, all recipients of TIRDO driers are still on infancy
stage and no conformity check to hygiene and food safety standards has been performed. TIRDO
food technologists only check moisture contents as stipulated in Codex Alimentarius Commission
(CAC) standard

**TATEDO**

Since 1990s TATEDO has promoted direct solar driers *kawanda* type driers in three sizes - small
(10kg) TShs 300,000, medium (20-30kg) TShs 450,000, and large size (50kg+) TShs 800,000+
depending on timber type. The batch-size is varied depending on sun availability i.e. the area.
Most of research projects of TATEDO are funded and the recent one for Ukerewe district was
TATEDO has designed, tested and distributed solar driers to Muheza district in Tanga region and other coastal areas (for mainly fish drying) and Ukerewe (fruit, vegetables, and sardines drying). Some entrepreneur buys from TATEDO directly and SADECO is successful farmers’ association who bought driers from TATEDO and dry fruit and vegetables for local market. SADECO has not managed to export due to limited marketing expertise, but absence of standards for its dried fruit and vegetables. Furthermore, in the design process of TATEDO driers no international standards were met.

**KAU Natura Foods**

Rather recently are the attempts by Kavu Natural Food\(^\text{13}\) to produce and market dried fruits. It started as a cottage industry and the main outlet is Nature Discovery\(^\text{14}\), a safari company based in Arusha. Meanwhile they built a small factory close to their home and the plan is to install 10 electrical dryers. Unfortunately, they were not able to realize their plans yet as they are not connected to the grid yet. Together with some neighbours they imported a transformer and high tension cables from China, which is compliant with the TANESCO requirements, and they expect to be connected in the next three months. The dryers are produced by Foresttac, a local carpentry shop, at a cost of TShs 120,000 per unit on basis of the design provided by Kavu Natural Food, though the heating element is still imported in parts from United Stated at a unit cost of $ 65/=. Drying is taken between 12 to 18 hours at a heat of 120º Fahrenheit (around 45º Celsius). A constant heat is vital for the quality and particularly the colour. The packaging is simple plastic which is not ideal as it is still a bit porous. For storage purpose and adding shelf live vacuum sealed packaging would be much better but no action is taken in this respect. The present shelf live is estimated to be 3 months though the product is probably still consumable until six months. Obviously, the shelf life can also be extended by dipping the fruits in sulphur dioxide but Kavu Natural Food does not want to add any preservatives.

Their master plan is to decentralize the processing of fruits by assisting local producers, such as women groups, with the technology and built their capacity to process a consistent quality. In addition to the proper application of the technology, also the selection of the fruits as well as clean water matters. One mouldy fruit may damage the whole batch and dirty water may cause parasites like Giarda (though due to the drying the chances are very slim). The great advantage of decentralized processing is the reduction of transport costs (fruits is bulky), the decrease of damages (fruits are very susceptible to handling) and the opportunity of adding value in the rural areas. Moreover, the costs of the fruits are much lower at the source compared with the Central market in Arusha. To illustrate the latter; mangoes in Arusha costs around TShs 500/= each and 5 mangoes are needed to get 200 grams of dried material. Note; the selling price of a 25 grams package dried fruits is TShs 1,200=. The master plan is yet to be translated in a business plan, including a comprehensive marketing strategy. The assumption is that the local (tourist) market is by far not satisfied but this is still to be proven. Some safari companies like African Environment are already producing their own dried fruits but with an inferior – ‘fire wood’ based – technology. It is likely that they like others are interested in a consistent supply of a quality product, particularly if the labelling of the product helps them to establish their name/brand.

---

\(^{13}\) The company is initiated by two expatriates and it is in the process of registration

\(^{14}\) The manager of Nature Discovery is the husband of the women who manages Kavu Natural Food
SIDO
SIDO also has a program aimed especially at women-groups (WED), jointly organized with UNIDO, dealing with food-processing. This group is trained, among others in food-drying. They train food hygiene (HACCP standard), food processing, and food safety. They use simple driers, with wooden frames wire mash trays and visqueen plastic, SIDO has these materials in stock. The courses are based on the NRI manual, this UK manual is adapted for Tanzania by SIDO according to their own views, and the training is practical as well as theoretical. The fruits, produced by these groups, were tested by the TFDA and met the required standards, it is however unclear which standards were met because Tanzania has currently no standards for dried fruits. The used driers are available from TShs 200,000, - for the smallest drier with a batch size of 20kg. A recent assessment (Vriens et al., 2007) of sample of SIDO trained processors revealed that the WHO standards for location, drying yard construction etc. described in the recommended international code of hygienic practice for dried fruits (CAC/RCP 3-1969) are not met, because no interest is paid in this subject and experience shows that the driers are randomly placed, sometimes even in reach of cattle. WHO standards are minimum food standards established for countries that currently have no standards in certain areas like dried food production in Tanzania.

In marketing SIDO have managed to train their entrepreneurs on local and export market requirements. The local market has also been promoted by SIDO through trade fairs. Export market has been promoted through SIDO’s popular 22 models of international trade training through access programme. What has been missing in SIDO intervention so far is on facilitating direct (one-to-one) linkages? No attempts has been made to promote medium or large scale entrepreneurs who will pull the dried fruit and vegetables chain for both local and export markets. SIDO has trained over 170 trainers and over 5,000 smallholder entrepreneurs most of whom women.

AMKA/KWANZA COLLECTION COMPANY LIMITED
AMKA (the Swahili word for awareness or awaken) Registered Trustees (hereafter AMKA) is a Tanzanian NGO that provides Business Development Services (BDS) and export markets facilitation to Small and Medium Enterprises (SME’s) in Tanzania. AMKA was sponsored by DFID, APT and USAID. AMKA was involved with the construction of box solar-driers and linking its products to the (national) market. AMKA provided training in the areas of drying, maintenance, selling and business administration and involve local carpenters in the building process so that they are able to construct a solar drier themselves. AMKA was the organization that introduced the technology for the solar drier in Tanzania in 1999. After visiting a trade fair in the UK, where dried fruits were displayed, they got in contact with an organization called Tropical Wholefoods supported by the NRI, which has a similar very successful project in Uganda (Fruits of the Nile). The idea was to start a similar project in Tanzania. The project was mainly aimed at individual rural farmers. The driers were sold for TShs 350,000,- , for a big one, and TShs 150,000,- , for a small one, and were given to rural farmers as an interest free loan, and the pay back period was adjusted to the time it takes to make money out of the machine. The machine and the produce did not however, comply with any standards as this would raise costs, and AMKA was aiming at serving the local market other than at exports. Exports were to be started during the second part of the project, after capabilities in fruit drying would have been built up. Unfortunately, the project stopped because one sponsor (APT, a UK NGO) pulled out of the project, because of “internal problems”.

The Kwanza Collection Company Limited (KCC Ltd) is a private company, established in 1999 that links rural artisans and small-scale producer groups in Tanzania who wish to sell their products to the local regional and export markets. KCC also work towards reviving and promoting traditional culture and skills. AMKA Registered Trustees own KCC although currently KCC is more active than AMKA. Moreover, board members of AMKA are directors of KCC. Although KCC through AMKA project engaged in dried fruit processing and export in 2001, the project was not successful. In 2002/3 season KCC attempted to export dried fruit to Tropical Whole Foods UK but couldn’t meet UK stringent standards/regulations.

During interview with KCC General Manager during this study revealed that the challenges which pushed KCC out of export market include

- Inappropriate packaging material which were not suitable for dry food packaging
- Inappropriate conditioning and storing methods
- Varied quality due to sourcing from fragmented smallholder farmers and processors
- Inexperience in bulk packaging for shipping
- Stringent food safety requirements by British government

Due to above huddles KCC decided to strengthen its local/urban market of dried fruit and even blend some dried fruit with dried nuts (pineapple, banana, mango and groundnuts) to make a popular snack. The company also explored drying of rosella and mushrooms. Rosella became instant success for local market because is much recommended by medical doctor as haemoglobin booster. Pregnant women and people with blood shortage due to endemic of HIV/AIDS have also triggered huge demand of rosella juice. Despite this success, KCC has now focused more on handcraft for export and strategically not promoting dried fruit and vegetables for local and export market. Nevertheless, due to their experience in export they are willing to strategically collaborate with a reputable processor to link to the urban and export markets. Their experience emphasises that the production costs should be kept as low as possible to be competitive in these markets.

KILIMANJARO NATURAL FOOD COOPERATIVE SOCIETY (KNFC)

Kilimanjaro Natural Food Cooperative Society (KNFC) was registered in year 2002 to assist and support women and men in Kilimanjaro region to produce solar dried fruits and vegetables. KNFC was initially supported by AMKA but after end of AMKA project, KNFC is now supported by KWIEKO. There are about 250 farmers with a total of 62 solar driers who are registered with KNFC. This number does not in any way reflect the total number of farmers who process fruit and vegetables by solar drying in the region, because it is a pre-condition to own a solar drier before becoming a member of KNFC. A farmer may, however, own the solar drier jointly with other farmers in a group. Until 2004 KNFC had attracted 9 men members and the rest are women.

The main objectives of KNFC include

- To provide employment for women in rural areas
- To create sustainable income to rural women
- To produce products to improve nutritional standards in diets
- To reduce food wastage and build up food security reserve

KNFC members were supported by AMKA to process rosella – hibiscus and other fruit and vegetables especially mangoes, banana and mushroom. Members of KNFC can sell direct to consumers, market outlets or at times KNFC help to search and market their members’ produce. The main common market outlet of produce, which passes through KNFC, until recently was KCC.
However, due to limited marketing capacity of KNFC and KCC, this volume is significantly low. Other direct market outlets of Kilimanjaro solar dried hibiscus include supermarkets and natural products shops in Kilimanjaro, Arusha and Dar es Salaam. None of KNFC member has reached commercial volume of dried fruit and vegetables except one entrepreneurial group in west Kilimanjaro who have excel in hibiscus solar drying and processing. Nevertheless, the solar drying technology does not meet international standards so the produce cannot be exported to EU and beyond.

**UNIDO**

UNIDO describes itself as a specialized agency of the UN that works towards improving the quality of the life of the world’s poor by helping countries achieve sustainable industrial development. UNIDO views industrial development as a means of creating employment and income in order to overcome poverty. It helps developing countries produce goods they can trade on the global market, and helps provide the tools (training, technology and investment) to make them competitive. UNIDO simply used to provide SIDO with funds and they would then execute projects for sustainable industrial development.

UNIDO programmes have embarked on the establishment of food processing pilot centres (FPPCs) in Africa. While functioning as commercial operations linking agricultural production to markets through business networking, FPPCs are used for demonstration and training purposes for technology transfer and dissemination. Some FPPCs have developed training and consulting services as income-generating activities and helped in further strengthening awareness and disseminating good practices at farm and food processing levels. In most cases, FPPCs have managed to increase the income of thousands of families along the food production chain. UNIDO has established 27 FPPCs so far in Africa have a total production capacity of more than 300 MT monthly (3,600 MT yearly). They have trained 1,882 people and increased the income of 5,500 people, improving the life of around 35,000 family members. These figures do not include jobs created around the food chain, particularly in the distribution and marketing sectors (UNIDO, 2007).

Through FPPCs, UNIDO now has experiences in solar drying in Tanzania; it has implemented a centralized FPPC in Muheza with a big indirect solar drier with forced air-circulation (Figure 11), in cooperation with the Sokakine University of Agriculture (SUA) and SIDO. This drier is valued at 25 million TShs, and was fully sponsored by UNIDO including training (one day with little or no practice) and installation. Training in machine maintenance was not provided, so in case of a break down an external expert has to be called. MUWAMU15 is a group of 30 people (8 men and 22 women) who operate the facility at the moment. Although they started in a group of 80 people the business was not very lucrative and few dropped on the way. Currently, MUWAMU runs a small local retail shop of what they produce in Muheza. UNIDO also named a manager for the plant with experience in food-processing. The drier was placed in an already existing building and has batch-size of 100 kg of fresh fruits and a drying time that varies from 8 hours (vegetables) to 15 hours (oranges). Chamber temperature is regulated with the help of a thermostat. The drier has 77 stainless-steel trays with non-fixed wire-mesh. The required heat-collectors are placed on the roof together with solar panels that can generate power for the fans. The fresh fruit is washed in a separate washroom and cut on plastic cutting-board with stainless-steel knives, after cutting the

---

15 MUWAMU – Muungano wa Usindikaji wa Mboga na Matunda Muheza stands for Swahili acronym for cooperation of fruit and vegetables processors
produce is washed again and placed on the trays and shoved into the drier. When the produce is dried it is weighed packed and sealed.

After packaging, the products are labeled with a universal label (one label for all products) with no possibility for tracing, although this is currently in progress. The employees are equipped with special clothing (apron, hat and shoes) that are washed after every process. The required fresh fruits, which are packed in woven baskets, are collected from the local rural farmers at the plant itself with a truck (the plant is owned by a group and not by a cooperation of farmers). The dried fruits are sold locally, no produce is exported and no hygiene and international food safety standards are met.

This UNIDO FPPC approach revealed itself to be an appropriate response and has played a dynamic role in terms of technology transfer and dissemination within the African environment and consequently in improving the revenues of the beneficiaries. Conceptually and practically, the FPPCs play a central role in the food industry value chain as they reinforce and manage the fundamental linkage between agriculture and the industry/market through technological upgrading, business networking and market access improvement, thus creating a more favorable environment for business development.

Each FPPC established under UNIDO signs a 3-5 year Memorandum of Understanding (MOU), where it commits itself to function as a demonstration and training facility as required within the framework of the UNIDO project or within the activities of the main national counterpart of the project.

The objectives sought through the FPPC are to:
- Support the transfer and dissemination of proven food technologies, in particular to micro- and small-scale enterprises, and their adaptation to local agro-ecological and social conditions.
- Create the basic foundations for product development and innovation through technological improvements including processing, preservation, packaging, safety/quality, etc.
- Develop qualified human resources in the fields of food processing technology, business management and marketing through vocational and in-plant training based on the concept of “learning by doing”;
- Promote (internally and externally) business partnerships for joint management of technical and common trade issues;
• Establish credible and sustainable food processing operation networks and strengthen the priority segments of the value chain and their linkages from production to the market.

The rural FPPCs have been at the core of the Integrated Programme (IP) in several African countries such as Burkina Faso, Cameroon, Kenya, Madagascar, Mali, Morocco, Senegal, Uganda and United Republic of Tanzania. FPPCs have a direct impact on the beneficiaries involved along the food chain and have outcomes such as:
• Increased value added of local agricultural products;
• Post-harvest losses reduced;
• Increased employment and incomes;
• Reduced poverty and food insecurity.

The FPPC approach has been attracting the interest of governments and the private sector in recipient countries as well as among donors.

**River Cottage**

Another recent venture in drying of vegetable and fruits is River Cottage, owned by Mike Patterson who has successfully initiated various commercial ventures in the last decade (before he was a farmer in Zimbabwe). He is mainly processing tomatoes through purely sun drying, which due to the micro climate of his venue\(^{16}\) is possible the whole year around. On a pilot scale he is also drying mangoes and pineapple. The tomatoes are produced on his farm; the (seed) varieties are Kwawata and Domingo which he is able to procure from Trican in Arusha. These varieties produce 90 to 120 tons per hectare\(^ {17}\). Presently, he processes 100 kg of dried tomatoes\(^ {18}\) per month but he could easily extend it to 500 kg per month. He is only selling locally, mainly to supermarkets and specialty shops like Shoprite, Pick and Pay, Meat King but he also sells directly to tourist companies. The shelf life of his product is not scientifically tested but based on his own findings it is close to 12 months. He would like to extend his market, particularly to enable him to engage small farmers in his village. There are many good farms of 3 to 5 hectares in Kwa Ogoro Village and he would wish to contract 20 to 50 farmers for tomato production. The processing will be done centrally at his farm. The scheme is rather attractive: he mentions he is willing to offer TShs 1,200/= per kg tomato while the open market prices differ between 200 – 600 TShs per tomato. However, the business proposition is still to be validated as his selling price is TShs 1,200\(^ {19}\) per kg dried tomatoes for which he need 10 kg of fresh tomatoes. For a price of TShs 1,200 per kg there would be no margin for processing, packaging, transporting et cetera. In spite of the unclear business proposition\(^ {20}\) the scheme may be interesting to support by:
- assisting the farmers to access appropriate irrigation equipment;
- supporting River Cottage to conduct an international market research;
- enabling the farmers to become EurepGAP compliance;
- supporting the farmers to form/register a producer cooperative.

---

\(^{16}\) The company is situated at the lower part of Dolly estate where is much dryer and hotter than on the slopes of Mount Mweru.

\(^{17}\) Still to verify as Alpha Seed claims that their Tanya and Tengeru 97 varieties produce average 18 tons per acre

\(^{18}\) Parallel to this study MMA has conducted Tomato sub sector quick scan- Tanzania were more details on dried tomatoes are explored

\(^{19}\) In Nairobi 100 grams of dried tomatoes cost KShs 250/= 

\(^{20}\) It will be sorted out on Monday 10\(^{th}\) December during a follow-up visit at his farm
**FADECO**

FADECO (Family Alliance for Development and Cooperation) is a local development NGO in the Karagwe district, Kagera region, North-Western Tanzania, striving to promote sustainable socio-economic development of the grassroots communities. FADECO is involved in developing, transferring and adapting low cost technologies that are appropriate, cost effective and affordable to poor rural communities; technologies that are environmentally friendly. FADECO has concentrated her efforts on agricultural development, low cost housing and renewable energy technologies.

FADECO is a local registered development NGO with a charitable status. It works directly with family groups at the grassroots / village level. It has a membership of 56 as of 2001. It started as a self-help group in 1993 and received official registration with the Ministry of Internal Affairs on the 12th February 1996. Its registration number is SO 8737 under the societies Ordinance of Tanzania. One of its greatest achievements has been the introduction of the post-harvest solar fruit drying technology for micro and medium scale enterprise development.

In 2004, FENERCA\(^{21}\) supported FADECO with technical assistance for the development of a market study and assessment of additional market niches with the objective of fostering FADECO's sustainability. FENERCA also sponsored 2 workshops on solar dryers attended by 60 farmers. A handbook on Solar Drying Technology was developed in Swahili, the native language. FENERCA's support with next stage financing led to a US$25,500 E+Co investment in FADECO for the scale up its operations. These funds were used to build commercial solar driers, improve its packing and processing equipment and source solar dryer materials.

**Policy and regulatory environment**

The Tanzanian government is involved in the dissemination of the technology. Regarding the link between Tanzania, its responsibility lies in the regulatory services for dried fruit and vegetable products between Tanzania and the international world. The government consists of various ministries of which the ministries of Agriculture, Food and Cooperatives (MAFC) and Industries, Trade and Marketing (MITM) are most important for the dried fruit and vegetable sector. The MAFC provides services such as training in food processing and crop cultivation. The MITM is responsible for regulating the imports and exports which are important to the dried fruit and vegetable sector. Universities involved in the solar drying project are set up by the government and they are in charge of providing education in entrepreneurship, business administration, food cultivation, design of machinery etc. Currently the University of Dar es Salaam (UDSM) and Sokoine University of Agriculture (SUA) in Morogoro are actively involved in the development of dried fruit and vegetables sector in the country. The government also helped to set up different development organisations within Tanzania to help its rural population, to alleviate poverty and to promote entrepreneurship. The government assisted in the establishment of these organisations through funding and policies.

\(^{21}\) The Increased Use of Renewable Energy Resources Program, known as FENERCA for its Spanish acronym (Financiamiento de Empresas de Energía Renovable en Centro America), was a US $5.3 million/5 year USAID Leader with Associates Cooperative Agreement that was awarded to E+Co and initiated in April 2000. FENERCA's objective was to promote the development of renewable energy enterprises and projects, while increasing the capacity of financial institutions, entrepreneurs, and NGOs to support the advancement of the region’s renewable energy sector.
5. DRIED FRUIT AND VEGETABLES IN THE NORTHERN CORRIDOR
5.1 DEFINING THE SUB SECTOR
For the purpose of a sub sector analysis, the sub sector is to be defined by its product and its end market. In the case of dried fruit and vegetables there are multiple alternatives for sub sector choice. A too narrow definition may exclude attractive channels and a too broad definition may complicate the analysis. Dried fruit is edible as snack locally whereas dried fruit and vegetables can have various industrial uses when exported. Hence, the sub sector in this study is broadly defined by its raw material – dried fruit and vegetables – and all applications and dynamics of dried fruit and vegetables (end products) will not be considered in the analysis.

5.2 KEY ACTORS AND FUNCTIONS
Table 5: Main characteristics per actor

<table>
<thead>
<tr>
<th>Actor</th>
<th>Activities</th>
<th>Remarks</th>
</tr>
</thead>
</table>
| Input supply           | • Supplying various inputs e.g. seeds, seedlings, pesticides, fertiliser, etc  
                        | • Supplying farm implements including irrigation scheme equipment          | • SUA – are conducting research on improved variety of fruit and vegetables and also supply to farmers by demand. Irrigation is not promoted extensively, but few input suppliers of irrigation equipment are present in urban centres |
| Production             | • With exception of handful emerging commercial farmers, most producers of fruit and vegetables in Tanzania are smallholders – especially in the north corridor | • There is no focus on certain varieties for drying process. Most farmers can sell their fruit and vegetables to whoever come to buy and some with technology and equipment attempt to dry themselves. In the north corridor Tanga is known for (mangoes, pineapples), Kilimanjaro (mangoes, banana, tomatoes) Arusha (banana and vegetables), Manyara (onions) |
| Small scale (homestead) processors | • Drying fruit and vegetables using small direct solar driers at home  
                        | • Use dried fruit and vegetables during dry season and sell surplus directly to local consumers  
                        | • Some wholesale some to local kiosks and shops                          | • Some smallholder farmers have been supported to acquire solar drying technology and driers. Most of technologies are on trials and adaptation is weak (replication of tested model/prototypes is not accurately done). Most farmers have limited knowledge and do not meet international hygiene and food safety standards. Most support to smallholder farmers in this category comes from among others TFNC, CoET, TIRDO, TATEDO and SIDO. Most support is focused on food preservation, food security and nutrient preservation. Farmers without driers can sell to farmers with driers or pay for drying services. The bulk of produce from smallholder farmers still passes through middlemen and brokers. |
| Brokers,               | • Buying fresh fruit and vegetables from                                | • Most brokers, traders and middlemen have established relationships with processors                                                                                                                                 |

Dried fruit and vegetables Sub Sector/Value Chain Analyses MMA January 2008
traders and middlemen | farmers and selling to processors | whom they supply regularly. Few farmers manage to sell directly to processors but brokers still manage to bulk and sell to processors though not in large quantities in the solar drying industry due to quality requirements. Brokers and traders tend to sell more to secondary processors especially women groups, but medium scale processors establish their own supply chain direct with farmers.

Small and medium scale secondary processors | • Buy from traders and farmers and solar drying | • Most women economic groups fall under this category. These have decided to process food products for income generation. Most of these groups received support from NGOs, Church Organisations (WAWATA, CARITAS, ELCT, etc), NGOs (e.g. TATEDO, etc), and research and development organisations (e.g. UNIDO, TFNC, TIRDO, CoET, and SIDO). Such self help groups include *Bonde la Chem Chem* in West Kilimanjaro, KNFC, FADECO, SIDO self help groups and entrepreneurs, etc. main focus has been technology adaptation and awareness for local market. Still most of these products do not meet international hygiene and food safety standards. UNIDO owns a facility in Muheza and tried to supply local urban market. Some processors have established links with supermarkets through which urban upmarket consumer buy. Tourists market has not been explored much in Tanzania so far. *Mama Clara* an entrepreneur and processor from Kibamba on the outskirts of Dar es Salaam seem to be the main supply of urban supermarkets and hotels in Dar es Salaam.

Medium scale processors and exporters | • Buying bulk from farmers and central solar drying | • Exporting | • Only one exporter of dried fruit was recognised during this study. Matunda Mema has been exporting dried organic fruit to Germany since 2001 although they have managed to get modest results as they still supply one buyer in Germany (Kipepeo Bio and Fair). Matunda Mema has established relationships with farmers in its facility vicinity who supplied them on a regular basis.

The sub sector map to show relationships and interaction between various actors is depicted in figure 12 below. During this study it was evident that dried vegetables are not exported from Tanzania so far and mainly banana and pineapples are the only dried fruit exported. Local urban market attract pineapples, banana, mangoes (dried fruit) and mushrooms (dried vegetable). Tomatoes, onions and green vegetables are not popularly dried in Tanzania at commercial level. Dried dates, raisins and currants sold locally are imported from South Africa, Turkey and UAE.
5.3 SUB SECTOR MAP

Figure 12: Dried fruit and vegetables Sub Sector Map - Tanzania

Key:
- Seedlings/ improved variety
- other inputs
- Dried fruit which does not comply with Codex standards
- Dried fruit meeting Codex standards
- Fresh fruit and vegetables
- Dried vegetables which does not comply with Codex standards
5.4 PROFITABILITY ANALYSIS

The main variable costs of production in drying fruit and vegetables include: purchase of raw material; labour (for washing, cutting, and placing in and removing from solar drier); packaging; and transport. Processors should also budget for solar drier maintenance costs and replacement of cutting tools. Exporters may have further costs in meeting buyer specifications, including application of sugar and/or sulphur dioxide, repackaging, and other items.

In 1997, the Kawanda Agricultural Research Institute in Uganda assessed the profitability of fruit drying using a standard small scale solar drier in Mukono district. The results for dried pineapples and bananas are provided below.

**Assumptions:**

1. Fruit is dried 2 times per week which is equivalent to four times in a 2 week operating period.
2. Dried fruit is sold to Fruits of the Nile Company at the end of each two week period.
3. Labour is provided by the family and is not paid for.
4. 3 fresh large sized pineapples of 3.2 kg each yield 1 kg of dried pineapples; 4.5 medium sized pineapples of 2.2 kg each yield 1 kg of dried pineapples; 7 small sized pineapples of 1.4 kg each yield 1 kg of dried pineapple.
5. Seven clusters each of approximately 800 g (3/4 bunch) of medium sized banana yield 1 kg of dried bananas.

These figures refer to small-scale processors but clearly the return of less than $200 per month is very low. Figures are not available for large scale operations, but unless there are dramatic economies of scale to be achieved, the products do not appear to be attractive as export investments. This Uganda experience is summarized in table 4 below.

<table>
<thead>
<tr>
<th></th>
<th>Pineapple</th>
<th>Apple banana</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Large</td>
<td>Small</td>
</tr>
<tr>
<td>Direct cost</td>
<td>46,000</td>
<td>32,400</td>
</tr>
<tr>
<td>Selling price</td>
<td>108,000</td>
<td>86,400</td>
</tr>
<tr>
<td>Gross profit</td>
<td>62,000</td>
<td>54,000</td>
</tr>
<tr>
<td>SGM</td>
<td>57.4%</td>
<td>62.5%</td>
</tr>
</tbody>
</table>

The main assumptions in these calculations include:

- No significant waste
- Fixed buying price
- All dried fruit are sold - bulk
- Packaging materials cost is therefore insignificant and included in the total direct cost

**Observations**

- Although the SGMs look lucrative, drying of fruit and vegetables is labour intensive and the utilities (electricity and water supply) and direct labour costs could be much higher for Tanzania. Generally, if the processor is not cost effective he could easily get negative margins.
Table 5: Profitability analysis of dried pineapples and apple bananas – experience of Uganda

<table>
<thead>
<tr>
<th></th>
<th>Pineapple</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Large Size (3.2 kg)</td>
<td>Small Size (1.4 kg)</td>
<td>Medium Size (8 cluster bunch)</td>
</tr>
<tr>
<td>A. COSTS</td>
<td>300</td>
<td>100</td>
<td>400</td>
</tr>
<tr>
<td>1. Cost of Fruit</td>
<td>30</td>
<td>56</td>
<td>12</td>
</tr>
<tr>
<td>a. Price of fruit/bunch (Ushs)</td>
<td>9,000</td>
<td>5,600</td>
<td>4,800</td>
</tr>
<tr>
<td>b. Number of fruits/bunches that fill solar dryer with 12 trays</td>
<td>36,000</td>
<td>22,400</td>
<td>19,200</td>
</tr>
<tr>
<td>c. Cost of filling the dryer (Ushs)</td>
<td>36,000</td>
<td>22,400</td>
<td>19,200</td>
</tr>
<tr>
<td>d. Cost of fruit per two week drying cycle (Ushs)</td>
<td>36,000</td>
<td>22,400</td>
<td>19,200</td>
</tr>
<tr>
<td>2. Cost of Transport</td>
<td>5,000</td>
<td>5,000</td>
<td>5,000</td>
</tr>
<tr>
<td>a. Return trip to Kampala (Ushs)</td>
<td>5,000</td>
<td>5,000</td>
<td>5,000</td>
</tr>
<tr>
<td>3. Cost of repairs and maintenance</td>
<td>5,000</td>
<td>5,000</td>
<td>5,000</td>
</tr>
<tr>
<td>a. Repair and cleaning of solar dryer (Ushs)</td>
<td>5,000</td>
<td>5,000</td>
<td>5,000</td>
</tr>
<tr>
<td>TOTAL COSTS (Ushs)</td>
<td>46,000</td>
<td>32,400</td>
<td>29,200</td>
</tr>
<tr>
<td>B. REVENUE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Quantity of dried fruit per drying cycle (kg)</td>
<td>10</td>
<td>8</td>
<td>14.4</td>
</tr>
<tr>
<td>b. Quantity of dried fruit per two week drying cycle (kg)</td>
<td>40</td>
<td>32</td>
<td>57.6</td>
</tr>
<tr>
<td>c. Price received per kg dried fruit (Ushs)</td>
<td>2,700</td>
<td>2,700</td>
<td>1,500</td>
</tr>
<tr>
<td>d. Revenue per two week cycle (Ushs)</td>
<td>108,000</td>
<td>86,400</td>
<td>86,400</td>
</tr>
<tr>
<td>GROSS MARGIN</td>
<td>62,000</td>
<td>54,000</td>
<td>57,200</td>
</tr>
</tbody>
</table>

Source: Kawanda Agricultural Research Institute

5.5     SUB SECTOR DYNAMICS

5.5.1     DRIVING FORCES

Worldwide

Mintel International Group Ltd\textsuperscript{22} last examined the market for nuts and dried fruit in July 2001. Since that time healthy eating has established itself as a driving force behind many sectors of the UK food market, a trend which has benefited demand for premium nuts, mixes and dried fruit, and given rise to the emergence of seeds as a mainstream snacking food. Retail sales of nuts, seeds and dried fruit increased by 34% between 2001 and 2005 to stand at £449 million and exceeded £500 million by the end of 2006. To date manufacturers have focused on achieving growth through NPD and improvements in merchandising and distribution.

\textsuperscript{22} www.mintel.com
The U.S. nuts and dried fruit market showed strong growth from 2001 to 2006, riding favourable health and diet trends. Manufacturers also contributed to growth with successful product innovation that sustained consumer interest as health trends shifted and evolved. This report helps industry professionals navigate important issues relevant to untapped potential in the nuts and dried fruit market: The impact of government action and legislation relating to consumer awareness of healthy snacking The effect of media promoting recent scientific research supporting nuts and dried fruit as functional foods Portion-control packaging, promotional efforts and, most importantly, health-related positioning claims to stimulate consumer interest Consumers’ desire for healthier lifestyles, and how that correlates to rising sales and opportunities for occasion-based marketing Influence and activity of private label in relation to market performance Product trends, including a comprehensive look at new product launches and the subsequent impact on market sales. Who in the household is buying nuts, as well as usage, brand, and frequency comparisons by demographic profiles. Discovering attitudes and opinions of consumers, including flavour preferences and usage habits.

**Tanzania**

The driving force is technology transfer (project driven) and emphasis is food security and income generation activity for poor women self help groups. Most organisations active in this sub sector are engaged using project/research fund to promote skills (SIDO, TIRDO, FADECO), drying technologies (SUA, TIRDO, TDTC-CoET, TATEDO, FADECO), design and piloting drying equipment (TIRDO, UNIDO, TATEDO, CoET – CPE, FADECO) and promote food preservation for the purpose of food security and food nutrient (TFNC, TIRDO, TATEDO, FADECO).

Even the emerging entrepreneurs – Matunda Mema, Claphijo Enterprises and KNFC have received initial support from project fund i.e. Matunda Mema (EPOPA); Claphijo Enterprises (Rockefeller Foundation – UDSM CPE) and KNFC (AMKA – APT/DFID and now KWIECO). Contrary to our counterpart – Uganda, the private sector in Tanzania has been very much inactive in this sub sector.

**5.5.2 CONSTRAINTS AND OPPORTUNITIES**

*Production and input supplies constraints*

Production of horticultural crops is characterized by low productivity due to use of disease and pests ridden planting materials, use of nondescript varieties of low yield potential, coupled with low investment in production inputs and production techniques. Production of horticultural crops in Tanzania is not export oriented and the high potential has not been exploited and is not given the right priority at the high decision making level until the late 1980’s. Production for local market also leaves much to be desired in terms of quality, efficiency, agronomical practices employed, yields and cost effectiveness. Diseases such as early and late blight in tomatoes and purple blotch in onion cause substantial losses particularly during the rainy season. Pests such as aphid American bollworm, cutworms and grasshopper seem to be mostly severe during the dry season. Production is not targeted to any planned market leading to production of similar/uniform crops that end up in gluts during peak season. Gluts may also be caused by lack of choice of varieties i.e. early, mid and late varieties that could stagger or lengthen harvest season. Easier to grow crops such as amaranths, tomatoes and onions are overproduced leaving out empty niche of other high value crops such as Coriander and string-less beans.
Production is characterized by large post harvest losses due to pests and diseases attacks, mishandling and delayed harvesting for lack of market. During this study it was not possible to get the figure of produce losses just before harvesting but it is quite substantial.

Inadequacy of quality seeds and planting material also was noted to be prohibitive to increased production and productivity. Seeds seemed to be too expensive for the farmers, this coupled with large volume packaging instigated repackaging by village stockists hence affecting viability and provoking adulteration. There is high demand for fruit planting materials (seedlings and/or propagates) but these are in short supply and where found were of undesirable quality. Indiscriminate use of planting materials has an impact on tree productivity and later fruit quality. Existing citrus fruit trees are highly attacked by gummosis (\textit{Phytophthora} spp or micronutrient deficiency), citrus stem borer, scale insects and aphids as well as some unknown diseases (bacterial, \textit{tristeza}, and micronutrient deficiency).

Before decentralization fruit propagule production was the responsibility of research centers and central district nurseries supervised by district horticulturists. Root stocking materials and bud wood were obtained from the research and district mother tree orchards. From these centers, individual nurseries obtained bud wood for multiplication. This arrangement ensured adherence to nursery ethics of propagating materials that are true to type, disease and pest free. Decentralization has caused demise of the central nurseries. A total of 25 mother tree orchards and corresponding nurseries were in existence in the 1970’s including 1 spices/herbs collection at Zigi in Amani-Tanga. This number has dwindled to only 6 namely 1 each at Igurus i in Mbeya; Mpiji in Dar es Salaam; Songa in Muheza; Bugaga, Kasulu for tropical fruits and 2 in Lushoto for temperate and tropical fruits.

The list of varieties in each of these mother tree orchards could not be immediately obtained but it is evident that these mother tree orchards are in bad condition due to lack of funding and rehabilitation needs. Some of the varieties have long been lost and overgrown by rootstock shoots. The orchards are old and needs replanting/replacement. There is need to upgrade the orchards to cater for the growing demand of fruit tree propagates with a wide variety of choices such as extending the harvesting period, processing requirement and for fresh market. There is a big operational gap between mother tree orchards and mini nurseries now managed by individuals or communally based nurseries. There is need to revive the central nurseries, invest in training pomologist/virologist who should oversee that materials to be distributed are really clean by conducting virus indexing. Farmers should be sensitized to invest into nursery plant production and be offered necessary training.

SUA orchard and nursery is currently multiplying 9 varieties of mangoes including exotic varieties (Alphonso, Tommy, Keith, Red Indians, etc). The nursery has annual capacity of multiplying between 15,000 – 20,000 seedlings. Few private nurseries have mushroomed as a spin off effect of this university initiative.

Since 2003 Tanzania is also invaded by \textit{Bactrocera invadens} a quarantine fruit fly. In Eastern Africa, the insect was first reported by Kenya in 2002, then Tanzania in 2003 and West Africa in 2004. \textit{Bactrocera invadens} is indigenous pest in Far East but with natural enemies, but in Africa it is recommended to use cultural prevention mechanisms and use of technical traps and baits. SUA has been implementing a project titled: “Fruit Fly pest control in small scale orchards in Tanzania
from 2004-2008”. The objective of the project is improvement of fruit production at SHF level through gathering of baseline data on biological aspects pertaining to fruit fly pest species, development of awareness programme for local farmers and strengthening research and training capacity at SUA. The university has spent most of its time to understand *Bactrocera invadens* and to assess the situation in the country and almost all areas have been invaded. Although proposed prevention methods can work, to be effective the prevention campaign should be national or rather region wide movement. This project was conducted jointly by SUA and Royal Museum of Central Africa (RMCA) Tervuren Belgium.

It may seem that a lot of the information derived from research has not been properly packaged and disseminated for use by the majority of smallholder mango growers. Furthermore, due to a lack of locally validated information on best control options for the key insect pests and diseases, agribusiness oriented mango growers rely on the use of broad-spectrum synthetic pesticides for control of the key pests in order to produce blemish-free fruits.

**Technology availability and adaptation constraints**

A recent study by AREED (2005) established that the barriers and risks for penetration of the solar driers among SMEs and smallholder farmers in Africa are identified as follow:

**Barriers**
- No established effective trade payment systems, which are essential for smooth trade transaction
- Unavailable initial investment capital or loan facilities
- Limited production capacity
- Poor marketing (limited entrepreneurial drive)
- Unavailability of marketing information and poor information dissemination where available
- Poor training of local entrepreneurs and technicians

**Major Risks**
- Lack of rainfall to produce agricultural products
- Natural catastrophes like floods and storms
- Unskilled entrepreneurs
- Failed export marked due the poor quality related to the poor hygiene during drying process
- Poor drier quality and lack of warranty
- High product losses experienced during drying,
- Lack of appropriate driers that ensure consistent quality and large volumes,
- Unpredictable weather patterns that affect drying regimes,
- Seasonality of the raw materials,
- Poor infrastructure development, lack of pack houses, cold rooms, collection centres, and poor road networks,
- High cost of capital finance,
- High costs of organic certification fees,
- High freight and local transport costs,
- Lack of information on alternative markets,
- Competition from imported processed food flavours in confectionery, dairy and drink industries.
Market and product development constraints

- Absence of local standard make Tanzania dried fruit and vegetables of varied qualities. Currently the only overriding standard for dried fruit and vegetables is Codex Alimentarius Commission - CAC (Annex IV) standard which is very stringent for smallholder processor to comply.
- Almost all initiatives in Tanzania are farm-level/homestead ‘small scale’ processing which cannot be commercialised. Most initiatives were not scaled up after pilot stage.
- Absence or limited access to marketing information makes it difficult for entrepreneurs to be interested in dried fruit and vegetables for local and export markets.

Opportunities

- Fresh mangoes market is becoming stringent due to quarantine fruit fly ‘bactrocera invadens’ affecting fresh mangoes, oranges, paw paws and guava. According to research by SUA and RMCA - drying mangoes kills all pests and could be exported\(^{23}\).
- Tanzania produces most tropical fruit and vegetables which could be dried for urban and export markets
- Various drying technologies have been successful piloted and ready for scaling up (commercialisation)
- Successful supply chains of dried fruit and vegetables have been established in Uganda and recent in north-western Tanzania – this shows possibility of exploring export opportunities.
- UNIDO drying facility is Muheza is underutilised – there could be a possibility to engage an entrepreneur to manage and operate the facility commercially.

These and other specific constraints and opportunities are summarised below in table 6;

---

Table 6: Constraints and Opportunities in drying fruit and vegetables for urban and export market

<table>
<thead>
<tr>
<th>Constraints</th>
<th>Opportunities</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Production/Management</strong></td>
<td><strong>Presence of supporting agencies (Kilimo Trust, etc.) that can support setting up of outgrower schemes.</strong></td>
</tr>
</tbody>
</table>
| - *Bactrocera Invadens* remains a major threat and it will wipe out production in some of the high productive areas and result in insufficient supply of fruits especially mangoes and oranges.  
- Most farmers have small plots – 2 to 3 hectares per household – and have little ability to increase their acreage under (fruit and vegetables) crop.  
- Where family labour is constrained and hiring of labour becomes necessary, opening of (new) land is limited by the cost of labour and inadequate money by the poor households. | |
| - Deficits in mangoes and desert bananas varieties in neighbouring countries – Kenya and Uganda – provide ample opportunities for Tanzania to serve unmet demand by Uganda markets in EU.  
- The demand by supermarkets in urban centres and tourist companies give opportunity for potential commercial processors to serve local markets as well. | |
| **Marketing** | |
| - Poor (feeder) roads results in inaccessibility and high transportation costs and hence farmers can not sell their surpluses or only at low prices.  
- Inadequate organisation by farmers, e.g. through PMG, complicates marketing and increases transaction costs. Such costs are normally transferred to the farmers and hence decrease the (farm gate) price.  
- The absence of large scale processing of dried fruit and vegetables in Tanzania, either for local or export markets, makes the farmers depend on the ad-hoc marketing arrangements and fluctuating demand and prices of fresh fruit and vegetables. | |
| - The training and R&D in solar drying by few training and development organisations (SIDO, TIRDO, UDSM/CoET/CPE, UNIDO, TATEDO, SUA, FADECO, etc.) creates accessibility to appropriate technologies for the entrepreneurs.  
- Possibility of complementing solar energy with electrical energy will improve quality of dried fruit and vegetables significantly. | |
| **Finance & Risks** | |
| - Inadequate accessibility to solar drying equipment and tools reduce the chances of entrepreneurs to engage in drying of fruit and vegetables  
- Low adaptability of improved fruit and vegetables drying technology due to capital constraints results in low quality dried fruit and vegetables and loss of value addition. | |
| - Inadequate access to capital limits entrepreneurs’ ability to invest in appropriate drying technology and as a result they are only able to produce low to medium quality dried fruit and vegetables for local markets. | |
| - The promotion of innovative financial services systems by various NGO like KILIMO TRUST, AAC and hence access to loans makes it possible for entrepreneurs to set up drying facility and outgrowers’ scheme. | |
| Others | |
| - Government policy on minimum wage and tremendous increase in utility costs could influence the motivation of entrepreneurs to develop fruit and vegetables drying project. | |
| - The successful experiences of Uganda enterprises like Fruits of Nile, Amfri Farms, St Jude, etc who are successfully applying good solar drying technologies, offer great potential for replication in the Tanzania, especially for the production and drying of organic mangoes and desert bananas, and may open new markets for the Tanzania entrepreneurs and farmers. | |
6. VALUE CHAIN IDENTIFICATION

In this chapter we shall identify value chain development opportunities as they have presented themselves during the study. Value chain development entail identifying strategic collaboration opportunities for firms to work together from inception to consumption targeting a specific market in a competitive manner. Value chain development assumes that there are market leaders that are willing and able to work in pulling the chain. Equally important is to identify support organizations that are willing to provide leverage support towards upgrading activities of the weaker links in the identified chain.

As mentioned earlier, dried fruit and vegetables sub sector dynamics in Tanzania is still predominantly driven by technology transfer research, food security and very limited marketable surplus is building up. On contrary, worldwide coordinated supply chains of dried fruit and vegetables are rapidly increasing in importance especially in global food markets. These global value chains are commercial tools for competitive strategies, assuring quality food safety and better logistics. They serve high end markets, especially in industrial/developed countries, but increasingly also in developing countries in urban areas with relative high incomes. However, the share of production in developing countries marketed through coordinated supply chains is still small.

There is a widespread fear that smallholder farmers will be excluded from coordinated supply chains. Empirical evidence is mixed; there are abundant examples of successful inclusion (Uganda, northwestern Tanzania – Matunda Mema) as well as of painful exclusion (dried fruit and vegetables processors and marketers in most places in Tanzania e.g. Morogoro, Tanga, Kilimanjaro, Arusha, Coastal belt, north corridor, etc). In some cases, economies of scale and scope are such that only large enterprises can compete successfully in global markets (Uganda enterprises like Fruits of Nile and Amfri Farms, etc), but in many other cases there is no level playing field. Analysis of forces that contribute to inclusion or exclusion in global chains indicates that there are market failures i.e. quality (Codex Alimentarius Commission standard), quantity and consistence contributed by (relative) weak competitiveness of smallholder farmers.

Uncontrolled quality and availability of seeds and quality fruit and vegetables has also lead SHFs (Smallholder farmer) to use poor quality seeds which results in poor quality harvest. Unreliable supply of inputs has lead to rampant use of inferior quality seeds, uncontrolled pesticides, fertilisers, etc. Most of SHF in Tanzania are exposed to expensive integrated pest management techniques, mainly because of the ecological factors or use of inferior seeds or improper land use patterns e.g. horticultural producers in (especially tomatoes in Kilimanjaro and Arusha regions) use strong pesticides because of prevalent diseases. Stringent standards for EU and USA markets i.e. pesticide regulations, HACCP, EurepGAP24, quality, etc make it difficult for SHF to be accepted in such markets. There is less specialised extension service providers especially from the government (i.e. agronomy skills, business skills, ‘process-specific’ abilities) in regard to newly promoted high value crops, e.g. hibiscus, drying techniques, as well as in pest management e.g. bactrocera invadens in mangoes to mention but a few. In some cases for instance in Uganda

24 The EurepGAP protocol defines the elements of good agricultural practices (GAP). It includes topics such as Integrated Crop Management (ICM), Integrated Pest Control (IPC), Quality Management System (QMS), Hazard Analysis and Critical Control Points (HACCP), worker health, safety, welfare and environmental pollution and conservation management.
buyers offer extension services themselves as embedded services (e.g. spray pesticides, supply of harvesting carriage equipment and packaging materials, etc) into farmers’ fields and installing own drying equipment at village levels.

In Africa, and Tanzania in particular, the financial sector considers some activities putting them on high risk exposure when offering loans. These activities include food processing. Banks are risk averse and cost of capital especially for Small and Medium Enterprises (SME) and SHF is very high. The banks interest rates in Tanzania are among the highest in the region. Most SHF and SMEs, therefore, find it difficult to access credit facility and always lack collateral if the facility is available. Linking to global value chains through exporters is difficult due to almost all above mentioned factors but also due to the high risk involved by the chain leader when deciding to include financially weak SHF and SMEs into the chain. Issues of concern for drivers of coordinated supply chains include;

- Cost, benefits and risk
- Control and management
- Food safety
- Economies of scale and scope
- Investment climate i.e. Governance and geography (cost, benefits and risk), logistics (infrastructure)
- Sectoral focus: agriculture (food chains), manufacturing, etc.

6.1 SUPPLY CHAINS ASSESSMENT
What we are assessing here is the current status of the dried fruit and vegetables supply channels for the market as identified in the sub sector map. Dried vegetables (tomatoes, onions, mushrooms and traditional vegetables) supply chain is insignificant in Tanzania due to absence of food processing industries in the country. Most processors of dried vegetables supply to food service organisations especially tourism hotels. However, due to tourism sector growth in the country and demand for ‘natural’ products by upmarket urban consumers; it is therefore expected that the dried vegetables supply chain would grow and may warrant further analysis and development. Dried tropical fruit will continue to be demanded by developed countries food processing industries as these fruit range are not available from processed fruit suppliers from north (USA, Turkey, Middle East and France).

Dried fruit and vegetables supply chain
Apart from the success story of Matunda Mema who dries organic pineapple and bananas for export to Germany, most drying of fruit and vegetables in Tanzania is done through spot transaction relationships between traders, middleman and farmers. Claphijo Enterprises in Kibamba in Coast region process a number of dried fruit (mangoes, paw paws, bananas) and vegetables (tomatoes, African egg plant, traditional green leafy vegetables, etc) for upmarket urban consumers; however, the volumes of both enterprises are still very small. Most processors have hardly any long term business relationship built among actors. A supply chain that has potential to be strengthened into a value chain is characterized by among others its market focuses and long term win-win business relationships among actors. DABAGA\textsuperscript{25} is currently undertaking feasibility

\textsuperscript{25} Dabaga is a registered Public Limited Company in Tanzania since 1979 and processes tomatoes as main product. The company has grown to 3 factories producing 40 products.
study to establish dried fruit and vegetable supply chain from Tanzania. This initiative could be very timely.

In order to develop the commercialization thrust of dried fruit and vegetables supply chain from Tanzania, there is a need to investigate into potential value chain development through a step by step approach. The following factors are taken into account in identifying potential value chains:

- **Building on what exists today.** Dar es Salaam (upmarket consumers) has a growing market for dried fruit and vegetables. This market should be further developed as the market conditionalities are less stringent. Start working with progressive enterprises e.g. Matunda Mema and Claphijo Enterprises. Working in the vicinity of production base seems to work in Uganda and Matunda Mema in north-western Tanzania (see Figure 13 below) and DABAGA could join in by putting drying facilities (at least two) in the northern corridor.

- **Market expansion and deepening for the existing dried fruit and vegetables into other cities (mainly Mwanza and Arusha) and the tourism industry (hotels and airlines) as well export to the neighbouring countries (mainly Kenya).** Again this builds on rather informal trade relationships that exist by aggressively analyzing and developing deliberate business relationships in the neighbouring countries where comparative advantage can be realized. A further study on the demand and supply on this market may be necessary.

- **Adding value to existing product by adopting high quality processing regime and hence penetrating more sophisticated EU and USA markets.** Here hygiene and food safety standards and packaging requirements (Codex Alimentarius Commission – Annex IV) may become apparent.

- **Seeking for new food industry market opportunities in the country that could drive the sub sector.** The instant soup and cereal industries seem to be feasible.

The next section deals with identification of potential value chain.

Figure 13: Matunda Mema Outgrower’s Model.
6.2 VALUE CHAIN MAPPING AND FEASIBILITY

Based on an emerging outgrower scheme in Kagera region (Matunda Mema) and experience from Uganda it is proposed here to explore possibility of developing local exporter, foreign exporter and SME models. The challenge will be to identify private sector companies ready to undertake the role of bulking, drying, conditioning and packaging of dried fruit and vegetables for local urban and export markets. The companies should be medium sized or large so that they are able to invest in state-of-the-art solar driers and follow processing procedure to comply with international hygiene and food safety standards. For the processors, it might be effective for these companies to be based in the vicinity of the producers so as to maintain quality of fruit and vegetables prior to processing. Exporter can be based elsewhere but preferably Dar es Salaam for logistical reasons.

6.2.1 LOCAL EXPORTER MODEL

For the exporter model, the proposal is that producers will be contracted by the processor to supply fresh fruit and vegetables of specified type, variety and quality. In the other hand, the processor will have supply contract to sell all its products to the marketing company which will specialise in identifying lucrative urban and export markets for the products. Emerging partners for this function is Kwanza Collection Company Limited – KCC (local marketing and exporting), Bonda la Chem Chem (West Kilimanjaro), KNFC (with support from KWIECO), Claphijo Enterprises (Kibaha) and UNIDO facility (if will be under entrepreneur management). The emphasis could be to promote local markets directly with SMEs and support KCC to identify and access export markets. The local processors have to be supported on making strategic business plans and setting operational and management systems. FAIDA MaLI could be approached to support setting up the organic outgrower schemes and train farmers on business skills ‘Farming is business’; whereas CoET/TIRDO can support SMEs on drying R&D and setting up business operations and management system. PASS/CRDB could offer financial services to acquire equipment and export financing.

Figure 14: Dried fruit and vegetables for local and cross border market - local exporter model
6.2.2 FOREIGN EXPORTER MODEL

For the foreign exporter model, the proposal is that producers will be contracted by the local processor to supply fresh fruit and vegetables of specified type, variety and quality (figure 15). In the other hand, the processor will have supply contract to sell all its products to the foreign/international marketing company which will specialise in identifying lucrative export markets for the products. Emerging partners for this function is Amfri Farms Limited (Uganda marketing and exporting company). Amfri Farms is ready to partner with Tanzanian processor (medium scale) and together develop a supply chain of quality organic dried fruit and vegetables from Tanzania. Amfri Farms will support the processor in technology development, procurement and installation of drying facility as well as training of farmers and processing facility staff for organic certification. Amfri Farms is ready to discuss with interested enterprises to go for this joint venture. The local processors have to be supported on making strategic business plans and setting operational and management systems. Kilimo Trust and similar organisations could be approached to support setting up the organic outgrower schemes and putting in place the internal control systems (ICS).

Figure 15: Dried fruit and vegetables for local and cross border market – foreign exporter model
6.2.3 SME MODEL

For the SME model, the proposal is that producers will be contracted by the processor (SME) to supply fresh fruit and vegetables of specified type, variety and quality (figure 16). In the other hand, the processor (SME) will market and sell all its products through supermarkets and natural food shops and identify and supply lucrative urban, tourism and export markets for the products. Emerging partner for this function is Claphijo Enterprises, KAVU Natural Foods and River Cottage. More work is required to identify and access credibility of potential SMEs in the Northern corridor. UNIDO facility in Muheza is quite underutilised and may be its time to approach UNIDO and discuss ways to make it profitable – for instance by letting to a processor with more entrepreneurial drive. The local processors have to be supported on making strategic business plans and setting operational and management systems. Kilimo Trust and similar organisations could be approached to support setting up the organic outgrower schemes and putting in place the internal control systems (ICS). This model seems to be a spin off from the two above models and only feasible when local SMEs become more competitive.

Figure 16: Dried fruit and vegetables for local and cross border market – SME model
6.2.4 CRITICAL SUCCESS FACTORS

In assessing the opportunities for all three value chains development as identified in section 6.2.1, 6.2.2 and 6.2.3 above, the market actors and eventual consumers have expressed their desired requirements that should be fulfilled. Table 7 below indicates some of the main critical success factors that were highlighted for both chains.

Table 7: Critical Success Factors (CSF)

<table>
<thead>
<tr>
<th>Supply Chain</th>
<th>Critical success factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>DRIED FRUIT AND VEGETABLES FOR URBAN MARKET</td>
<td>Quality, quantity and consistent supply Centralised drying facility for certification and quality control</td>
</tr>
<tr>
<td>HIGH QUALITY DRIED FRUIT AND VEGETABLES FOR EXPORT (EU) MARKET</td>
<td>Quality in terms of hygiene and food safety standards (Codex Alimentarius Commission) Quantity and consistency in supply Centralised drying facility for certification and quality control</td>
</tr>
<tr>
<td>TOURISM AND REGIONAL MARKETS</td>
<td>Quality in terms of hygiene and food safety standards (Codex Alimentarius Commission) Quantity and consistency in supply Centralised drying facility for certification and quality control</td>
</tr>
</tbody>
</table>

It is clear that Quantity, Quality and Consistency (QQC) which is an obvious success factor invariable in this sub sector and hence to the value chains crafted. What this means is that the value chain actors would have to put together a strategy to monitor these success factors in order to remain competitive on the market.

The next chapter dwells with proposed strategies to develop the sub sector and in particular the specific value chains.
7. SUB SECTOR/VALUE CHAIN DEVELOPMENT

7.1 GENERIC (SUB SECTOR) INTERVENTIONS

Broad based interventions that address the (sub-) sector wide constraints and unlock its potential are often a pre-requisite for value chain development. Such interventions need to go hand in hand with specific value chain development strategies to make a lasting impact. The most essential generic (sub-sector) interventions are listed below and to a large extent they build on already existing initiatives and programmes.

- **Infrastructural improvements**, particularly the feeder roads, are vital in connecting the (high) productive areas with the markets.

- **Distribution of disease tolerant and high yielding planting material** to the farmers is another key intervention area. Though such planting material are becoming sufficient available, it is yet to become accessible for farmers in all corners of the northern corridor. Obviously, these farmers will also greatly benefit from the improved varieties e.g. mangoes improved varieties from SUA. The challenge is to facilitate (commercial) nurseries close to the farmers instead of having ample stocks in centres far away from the farmers. The DCs are responding to this challenge but taking into account their scarce resources, will need additional support. For the case of mangoes it is worth to note that indicative calculations show that nurseries can be very profitable, even more profitable than producing mangoes for the market. Hence, it is suggested to involve farmers’ group and individual farmers to set-up these nurseries.

- **Producer Marketing Groups (PMGs)** are imperative in any value chain development; they enable the farmers to bulk, to reduce post harvest losses, to apply quality assurance methods, to market large volumes, and to negotiate good prices. To the processors, it might be useful to work with organised outgrowers who will comply to quality, quantity and consistent supply requirements.

- There are also various initiatives to **improve farmers’ financial ability** in order for example to buy better planting material. Though such schemes may enable farmers to access inputs, they do not provide a (financial) solution for capital investments that farmers may wish to undertake.

- Marketing of dried fruit and vegetables, especially for local market, is affected by the negative **consumer perception**. Fruit and vegetables are considered to be a ‘luxurious’ delicacies and with exception of urban elite population who know better, many local Tanzania families will not spend money to buy fresh fruit and vegetables, leave aside dried fruit and vegetables which is far more expensive. The shops and supermarkets selling dried fruit and vegetables all mentioned that dried fruit and vegetables are slow moving items as they are expensive (much more expensive than fresh fruit and vegetables). Changing consumer perception and hence behaviour is challenging but can be done through e.g. road shows, advertisement and programmes on radio and television. The challenge is most consumers prefer fresh fruit and vegetables; although potential upmarket urban buyers are in Dar es Salaam, the city is the only city in the country which is consistently supplied with fresh fruit and vegetables throughout the year.

7.2 VALUE CHAIN DEVELOPMENT STRATEGIES

Two potential value chains have been identified in section 6. None of these chains is in existence today in the northern corridor. In section 7.1 above a number of sector wide intervention strategies have been proposed which hopefully will set a fundamental base upon which the proposed value chains could be built. Public – private initiatives are inevitable in realizing the proposed value chains. During the study it became apparent that the government and a number of (international)
development agencies are very concerned about food security and they are working tirelessly on research and development of drying technologies for homestead drying equipment. However, the public, civil organizations and private sector active in the sector have not worked together on developing value chains.

What seem to prevail are a “wait and see” attitude and generally an information flow asymmetry about demand and supply. The would-be major private sector investors are complaining that there is no adequate market to warrant investments into industrial drying of fruit and vegetables. The farmers are crying for reliable market outlet which is a disincentive for putting more efforts into production of these highly perishable products (fruit and vegetables). But also farmers are price takers and feels that they are unable to meet their costs and realize a fair return to their labour and investments. Small scale farmers are consequently unable to mobilize the necessary technical, managerial and financial capabilities to make fruit and vegetables farming a business. This vicious cycle would require a breakthrough for commercialization in dried fruit and vegetables to be realized in Tanzania and in the Northern corridor in particular.

The task for commercialization is immense. It would require a careful and gradual process towards promoting the sector and identified value chains.

In this respect it is the opinion of the research team that the priority should first go into addressing the sector wide issues and then start gradually with one chain of dried fruit and vegetables for urban and export markets. The market requirements for local urban consumers are less stringent and there is a basis to build upon with respect to the Codex Alimentarius Commission standards. Interesting emerging joint ventures should be supported to get off the ground and be used as a learning experience for supporting partners. With respect to the industrial uses it is proposed to stagger until sufficient groundwork has been set and private sector initiative have been stimulated.
8. WAY FORWARD
Proposed way forward for SCF and its partners can be categorised in three stages i.e. Short term interventions, medium term interventions and long term interventions.

SHORT TERM
Short term interventions should be realised in a few months after completion of this study. These could include but not limited to;
5) Dissemination of study finding and emphasise on the opportunities
6) Campaign to change/influence consumer behaviour and perception in local urban areas.
7) Developing local market of dried fruit and vegetables (both models could be pursued i.e. exporter model and SME model). Tanzania will be going through a very steep learning curve and could not be competitive enough to access more sophisticated markets especially EU and USA. The initial focus should be on local urban up market and tourism consumers, and once that market segment is successful served, some of the entrepreneurs will explore export markets.

To achieve the three interventions above, SCF might work with its partners through Trade Fairs, etc. AMAGRO was thinking of having a ‘mango testing week’ – maybe this could be a good opportunity to promote dried mangoes.

8) Medium and large scale local food (fruit and vegetables) processors could be motivated to invest in few drying facilities along Tanzania northern corridor. One way of motivating processors is linking them to support facilities which will help them to set up outgrower scheme and certify farmers and their processing facilities. Another equally important support to processors could be linking them to buyers abroad. Promote and support development of a joint venture between local processor and foreign exporter. Amfri Farms Limited of Uganda is the emerging partner in this respect. Amfri Farms Limited of Kampala Uganda is ready to give Tanzania processors supply contracts for certain volumes of dried fruits especially mangoes) and vegetables (especially dried tomatoes).

SCF can be more proactive at making this opportunity work and support the documentation of the experiences in this project. Tanzania is yet to climb the ladder of commercial production and marketing of dried fruit and vegetables. Surely, this ill be a steep learning curve for the next few years. SCF cannot achieve this by themselves but they can work with strategic partners e.g. Kilimo Trust (who may offer grant to support setting up of organic outgrower scheme and internal control systems) while SCF can offer matching grant for the local processors to put up a strategic business plan and operations and management systems.

MEDIUM TERM
Medium term interventions could be achieved within two years from now i.e. and these could include but not limited to the following areas;
7) Exporting may also provide opportunities though this is not likely to be a short term gain; Kenya and Uganda are ahead of Tanzania in terms of producing dried fruits and on the EU and US market there is (stiff) competition with other dried products. It is yet to be seen if Kavu Natural Food, Claphijo Enterprises and Bonde la Chem Chem will mature; the (market) potential is there, the technology is developed, the (supply chain) ideas are good but what seem to be lacking is an entrepreneurial drive and vision. An entry point for SCF could be to
assist them the development of strategic business plans based on identified and committed
buyers and on basis of such plans, program for follow-up interventions like rolling out the
technology and setting-up protocols and quality assurance systems.

As elaborated above, this study revealed few potential enterprises which could do better in fruit and
vegetables drying. They however, need huge support to bring them to the league. The challenge
will be to identify and getting commitment of potential buyers on the market side and getting the
standard to the required quality on the production side. This is thus, not SCF own activity, but the
role of SCF is to see to it that all support providers are aware of the needs and the linkages are
established based on well articulated strategic business plans.

8) SCF together with TBS and other development practitioners active in this sub sector should
work together to spearhead development of Tanzania standard for dried fruit and
vegetables.

SCF support to standards development (including traceability) cannot be overemphasised. TBS
has mandate and can play its role with impetus from SCF. Traceability T could be involved in this
exercise.

LONG TERM
8) Support entrepreneurship education and training development - Tanzanians are less
entrepreneurial compared to their counterparts in the region. SCF can support studies which
could look on ways to enhance entrepreneurship among SMEs in Tanzania. Conventional
entrepreneurship education and training in vocational colleges and institutions of higher
learning seems to give no significant positive results. May be what is needed is much more
‘hands on’ entrepreneurial skills development.

During this study it was evident that what worked in Kenya and Uganda could have worked in
Tanzania – only if Tanzanian SMEs could have been more entrepreneurial. Why Tanzanian SMEs
are less entrepreneurial compared to their counterparts in the region? Is there a possibility of
enhancing entrepreneurship among SMEs in Tanzania? If so, what are the challenges and
considerations? Is there a causal linkage to lack of entrepreneurship development? And if so, what
are the necessary entrepreneurial skills and support needed in order to enable SMEs to participate
in economic growth through (self-) employment? Training already offered through SIDO, NGOs,
and vocational training colleges and through institutions of higher learning seems to offer limited
positive results. What could be the role of SCF?

9) Support access to marketing information system (MIS), marketing intelligence (MI) –

Why are Kenya and Uganda importing fruit and vegetables from Tanzania before re-packing and
export to Middle East, European and US markets? How do they identify markets and keep them
‘secret’ – is it knowledge management issue? What could be the role of SCF to support SMEs in
Tanzania?
REFERENCES


AREED (2005) Improving the welfare and increasing the income generation by the commercialization of Sustainable Energy Technology Commercialization of Solar drier for Agricultural Products

UNIDO (2007) *Food Processing Pilot Centres: An approach to productive capacity-building for trade and poverty alleviation in Africa*. Document prepared by Dr. A. Ouaoouich, Chief of the Food Processing Unit, Agro-Industries and Sectoral Support Branch

ITC/UNCTAD/UNEP (2006) *Demand for Organic Products from East Africa*; Report by Mr. Rudy Kortbech-Olesen, ITC-Consultant

MAFC (2002) *Study on the Horticulture Development in Tanzania* - The study was conducted by Dr. Francis M. Shao (Leader), Dr. Agnes M. S.Nyomora, Mr. Erasto E. Mlay and Mr. Neemak E. Kasunga on behalf of MAFC.
ANNEXES

ANNEX I: NON TROPICAL DRIED FRUIT

Raisins:
As previously reported, the supply of raisins from California this 07/08 season is extremely good at 278,000mts with a reported carry in of some 128,000mts. Additionally, the Californian-based RAC (Raisin Advisory Council) has agreed a new season policy to allocate a percentage of total production for both domestic and export raisin sales specifically, which should ensure supply throughout the season and avoid any potential imbalance created by excess demand for fresh grapes and winery stock. That said, U.S. prices have firmed over the past few weeks as the grave situation in Turkey continues to dominate news. As reported in Sultanas (below), replacement prices for Turkish vine fruit continue to rise although Turkey may be starting to realise that these prices must be difficult to sustain since there are now cheaper offers and stocks available from California (for the first time ever!), Iran and even China periodically.

Comment: although California will be anxious to win back as much business as they can from Turkey, it will be interesting to see how Turkey itself reacts on-going to losing some of their own market share. If Turkish vine fruit prices do weaken at the turn of the year, then the risk is that by then they will have missed much of the business for the remainder of the season yet it also seems unlikely that California will be able to resist the temptation to increase her own prices in the short to medium term faced by substantial increased raisin demand. With Iranian raisins also available at a discounted rate to Turkey, some of this new crop is already heading into Turkey to offer some relief to the tight local supply there, with additional Iranian sales soaking up much of the nearby demand at a albeit narrowing discount below Turkey.

Sultanas:
The past month has seen further problems in Turkey which has resulted in yet more increases on replacement prices from origin. Fundamentally the problems are these: First, without question the crop is reduced this year following the long hot and dry Turkish (and Greek) summer(s) and although some reports have hinted total Turkish production falling even below 200,000mts, it is still likely to be approximately 200-220,000mts across all the growing regions. When set against the earlier estimates in May/June which were counting (and producing aggressive forward offers based) on 300,000mts, clearly this is a huge shortfall. With sultana sales last year in the region of 250,000mts, on paper we have a significant shortfall with supply lower than demand. However, as mentioned in Raisins (above) although destinations like the UK are largely dependent upon Turkish quality, for a lot of other countries they will buy on price and when prices climb exponentially, demand on-going will be closely linked to prevailing pricing. Already over September and October, Turkey is reporting a drop in sales around 25% on the same period last year and this is purely down to prevailing pricing. Second, with such a rapid increase in export and international pricing, the farmers/growers have opted to trickle feed their stocks to the processors on the simple basis that they can obtain better prices the longer they wait to sell. This has created enormous problems to the processors who largely independent of the farmers are clearly dependent upon the supply from them and from the Bourse which is also light on supply for the same reason. The extent to which the farmers can hold out without buckling to the pressure of selling stocks for cash has surprised many, but the bottom line is that for a lot of the smaller processors particularly who pre-sold forward at much lower levels and for whom the local price is now catastrophically higher than their planned input stock pricing, the price difference is too large to bridge and they have already defaulted - some trying to claim force majeure on supply, which is not the case.
Third, the Turkish Lira has increased from 1.34 to 1.20 over the past 3 months and this equates to an increased export Dollar price by 12% in local terms. This is more Dollar weakness (as we see against Sterling and Euro) than Lira strength but currency is a major factor in supporting the increased export pricing. Whether an escalation of the cross border Turkish-Kurdish fighting will lead to a wholesale Turkish invasion remains to be seen but should this happen, other than the humanitarian context, this might at least reverse the present Lira strength, but this clearly cannot be guaranteed.

Comment: with the drop in export sales from Turkey to alternative origins and with growing pressure on the farmers to sell stocks for cash against diminishing buyers, there is a growing strength of opinion that the realisation will eventually dawn on Turkey that they are losing market share on a reduced but not non-existent crop, and this will being renewed pressure on origin to sell. The question has to be “when” not “if”, but for now at least, Turkey seems hell bent on squeezing as much mileage out of this firm market as they can. It should also be noted that a somewhat alarming cause for concern until recently, was that the prolonged drought looked set to cause even longer term concerns on the prospects for the 2008 crop. Water table levels in western Turkey have been perilously low but fortunately the weather has turned in the past few weeks and heavy rains have reversed this scenario to some extent with more regionalised rains forecast ongoing.

**Currants:**
The lack of offers from Greece also remains a concern as origin sellers seem to be taking the path of ultra-caution and preferring to largely sit on their uncommitted stocks rather than offering under the present circumstances. Varying reports continue to circulate on the definitive new crop total as well as the extent to which key areas were adversely affected by the fires, although the Greek government at the start of October intervened to attempt to adjudicate which volumes from where can be retained domestically and resold for export. Fortunately, the quantities of currants at destination and specifically in the UK are still a match for demand, although this is not likely to be the case during Q1 2008 once demand currants for Easter typically picks up. Comment: while the Euro remains strong against Sterling, the increases at source are squeezing replacement pricing higher and once the UK stocks (bought and shipped earlier) are all but exhausted, we would expect to see the market firming into 2008. That said, and as previously reported, there is a growing sense of exasperation from within the bakery and manufacturing sectors that origin is unfairly monopilising and dominating supply and pricing to such an extent that alternatives should be found. Whether this comes in the form of Californian midget raisins (although this is not a great year for a substantial discount) or whether developmental pressure will move away from this traditional ingredient, but either way where key markets dominate and can clearly manipulate pricing so dramatically (hazels, sultanas, etc), a time must surely come where these origins over-play their hand and it may and probably should spectacularly backfire on them if and as buyers turn away to more stable, alternative and possibly more interesting products.

**Apricots:**
A combination of strong demand, reduced new crop and reluctant sellers in origin (encouraged by the continued strength of the Lira) is creating further strength on replacement prices from origin. Given the huge and unfortunate reduction in supply this year from Turkey, there is a growing conviction that much of the remaining balance of this new crop has now already been forward sold and the impact of any new demand for additional supply is having the inevitable effect pushing
prices higher still. Comment: that said, as often the way, there might be more stocks “squirreled” away in Turkey and which might yet emerge as the season progresses and as and if the price continues to rise! For the next 2-3 months however, we are looking at the strong likelihood for increased prices and with some possible respite at the start of the 2008 which can be a seasonally quiet period.

Prunes:
As previously reported, the disappointing Californian prune new crop has established an imbalance on supply for the coming season and which will quite possibly ensure firmer pricing at least this side of the South American new crops in May 08. Chile in particular has thrown huge resources and increased planted acreage into expanding their own production and weather permitting should be looking to produce 50,000mts in 2008 weather permitting. With excellent quality and competitive pricing, South American prunes are gaining in market exposure and share and this particularly when one of the key origins in California has a disappointing crop.

Comment: …however, with diminishing physical stocks, an increased U.S. dependence on imports to supplement their own short crop and with France meantime able to monopolise supply, it is expected that the prices will remain firm nearby and into the first quarter of 2008.

Table A1: Imports of dried fruit into the EU, 2001-2003, € 1,000 / tonnes

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total EU-25</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extra-EU</td>
<td>840,709</td>
<td>587,823</td>
<td>889,555</td>
<td>605,307</td>
<td>879,632</td>
<td>611,293</td>
</tr>
<tr>
<td>Developing</td>
<td>614,774</td>
<td>464,203</td>
<td>646,207</td>
<td>478,550</td>
<td>646,271</td>
<td>494,323</td>
</tr>
<tr>
<td>countries</td>
<td>423,028</td>
<td>366,284</td>
<td>470,266</td>
<td>387,706</td>
<td>474,680</td>
<td>395,068</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>220,282</td>
<td>149,820</td>
<td>222,427</td>
<td>147,419</td>
<td>220,565</td>
<td>150,020</td>
</tr>
<tr>
<td>Germany</td>
<td>162,970</td>
<td>116,370</td>
<td>177,399</td>
<td>125,125</td>
<td>168,360</td>
<td>119,549</td>
</tr>
<tr>
<td>France</td>
<td>100,690</td>
<td>64,353</td>
<td>116,324</td>
<td>73,620</td>
<td>113,428</td>
<td>68,500</td>
</tr>
<tr>
<td>Italy</td>
<td>68,567</td>
<td>44,443</td>
<td>73,740</td>
<td>46,064</td>
<td>75,984</td>
<td>51,051</td>
</tr>
<tr>
<td>The Netherlands</td>
<td>67,747</td>
<td>57,856</td>
<td>72,573</td>
<td>59,200</td>
<td>75,666</td>
<td>63,458</td>
</tr>
<tr>
<td>Belgium</td>
<td>35,072</td>
<td>24,625</td>
<td>38,190</td>
<td>24,864</td>
<td>39,749</td>
<td>25,756</td>
</tr>
<tr>
<td>Spain</td>
<td>35,667</td>
<td>20,883</td>
<td>33,993</td>
<td>21,833</td>
<td>33,021</td>
<td>21,871</td>
</tr>
<tr>
<td>Poland</td>
<td>22,080</td>
<td>21,866</td>
<td>22,108</td>
<td>20,954</td>
<td>21,174</td>
<td>21,351</td>
</tr>
<tr>
<td>Denmark</td>
<td>20,874</td>
<td>12,375</td>
<td>21,623</td>
<td>12,681</td>
<td>20,961</td>
<td>13,034</td>
</tr>
<tr>
<td>Sweden</td>
<td>20,394</td>
<td>10,328</td>
<td>20,757</td>
<td>10,526</td>
<td>19,226</td>
<td>10,547</td>
</tr>
<tr>
<td>Austria</td>
<td>18,039</td>
<td>11,144</td>
<td>17,247</td>
<td>10,112</td>
<td>18,483</td>
<td>10,610</td>
</tr>
<tr>
<td>Greece</td>
<td>7,488</td>
<td>4,919</td>
<td>7,793</td>
<td>3,429</td>
<td>10,695</td>
<td>6,768</td>
</tr>
<tr>
<td>Finland</td>
<td>11,154</td>
<td>5,757</td>
<td>11,943</td>
<td>5,922</td>
<td>10,533</td>
<td>5,629</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>9,434</td>
<td>9,431</td>
<td>9,962</td>
<td>8,697</td>
<td>8,536</td>
<td>8,637</td>
</tr>
<tr>
<td>Ireland</td>
<td>9,223</td>
<td>6,773</td>
<td>10,700</td>
<td>8,598</td>
<td>8,534</td>
<td>6,657</td>
</tr>
<tr>
<td>Portugal</td>
<td>6,442</td>
<td>5,436</td>
<td>6,608</td>
<td>4,890</td>
<td>7,253</td>
<td>4,844</td>
</tr>
<tr>
<td>Slovakia</td>
<td>4,269</td>
<td>3,465</td>
<td>5,415</td>
<td>3,566</td>
<td>5,819</td>
<td>4,212</td>
</tr>
<tr>
<td>Lithuania</td>
<td>4,251</td>
<td>5,047</td>
<td>4,497</td>
<td>4,786</td>
<td>4,798</td>
<td>5,349</td>
</tr>
<tr>
<td>Hungary</td>
<td>4,296</td>
<td>4,267</td>
<td>4,876</td>
<td>4,740</td>
<td>4,495</td>
<td>4,431</td>
</tr>
<tr>
<td>Slovenia</td>
<td>3,363</td>
<td>2,137</td>
<td>3,450</td>
<td>1,996</td>
<td>3,646</td>
<td>2,140</td>
</tr>
<tr>
<td>Latvia</td>
<td>3,283</td>
<td>3,132</td>
<td>3,098</td>
<td>3,049</td>
<td>2,900</td>
<td>2,854</td>
</tr>
<tr>
<td>Estonia</td>
<td>1,474</td>
<td>1,439</td>
<td>1,492</td>
<td>1,390</td>
<td>2,108</td>
<td>1,894</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>1,669</td>
<td>479</td>
<td>1,255</td>
<td>456</td>
<td>1,715</td>
<td>709</td>
</tr>
<tr>
<td>Cyprus</td>
<td>1,117</td>
<td>773</td>
<td>1,155</td>
<td>770</td>
<td>1,071</td>
<td>786</td>
</tr>
<tr>
<td>Malta</td>
<td>864</td>
<td>707</td>
<td>933</td>
<td>621</td>
<td>893</td>
<td>638</td>
</tr>
</tbody>
</table>
Table A2: Imports of dried vegetables into the EU, 2001-2003, € 1,000 / tonnes

<table>
<thead>
<tr>
<th></th>
<th>2001</th>
<th></th>
<th>2002</th>
<th></th>
<th>2003</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>value €</td>
<td>volume</td>
<td>value €</td>
<td>volume</td>
<td>value €</td>
<td>volume</td>
</tr>
<tr>
<td>Total EU-25</td>
<td>475,955</td>
<td>200,277</td>
<td>507,708</td>
<td>219,993</td>
<td>466,061</td>
<td>209,921</td>
</tr>
<tr>
<td>Extra-EU</td>
<td>253,940</td>
<td>85,276</td>
<td>267,648</td>
<td>97,834</td>
<td>229,494</td>
<td>98,358</td>
</tr>
<tr>
<td>Developing</td>
<td>154,724</td>
<td>55,631</td>
<td>170,965</td>
<td>68,121</td>
<td>147,204</td>
<td>71,031</td>
</tr>
<tr>
<td>countries</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Germany</td>
<td>125,853</td>
<td>45,696</td>
<td>139,078</td>
<td>50,786</td>
<td>113,259</td>
<td>45,013</td>
</tr>
<tr>
<td>The Netherlands</td>
<td>57,671</td>
<td>38,292</td>
<td>65,571</td>
<td>45,454</td>
<td>70,374</td>
<td>51,137</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>60,123</td>
<td>29,313</td>
<td>60,085</td>
<td>24,902</td>
<td>58,170</td>
<td>24,619</td>
</tr>
<tr>
<td>France</td>
<td>56,144</td>
<td>15,144</td>
<td>60,199</td>
<td>17,809</td>
<td>58,087</td>
<td>19,939</td>
</tr>
<tr>
<td>Italy</td>
<td>61,668</td>
<td>11,496</td>
<td>57,338</td>
<td>14,208</td>
<td>51,354</td>
<td>15,636</td>
</tr>
<tr>
<td>Poland</td>
<td>17,001</td>
<td>5,723</td>
<td>17,022</td>
<td>6,994</td>
<td>15,265</td>
<td>8,586</td>
</tr>
<tr>
<td>Belgium</td>
<td>14,130</td>
<td>8,325</td>
<td>17,947</td>
<td>9,392</td>
<td>14,410</td>
<td>7,326</td>
</tr>
<tr>
<td>Austria</td>
<td>12,839</td>
<td>4,183</td>
<td>14,282</td>
<td>4,723</td>
<td>13,565</td>
<td>5,287</td>
</tr>
<tr>
<td>Spain</td>
<td>13,498</td>
<td>16,088</td>
<td>14,985</td>
<td>19,519</td>
<td>11,177</td>
<td>8,323</td>
</tr>
<tr>
<td>Hungary</td>
<td>8,264</td>
<td>2,654</td>
<td>8,099</td>
<td>1,849</td>
<td>9,765</td>
<td>2,570</td>
</tr>
<tr>
<td>Denmark</td>
<td>8,457</td>
<td>2,621</td>
<td>10,617</td>
<td>3,326</td>
<td>9,718</td>
<td>3,631</td>
</tr>
<tr>
<td>Sweden</td>
<td>10,054</td>
<td>3,020</td>
<td>10,198</td>
<td>3,091</td>
<td>9,277</td>
<td>3,312</td>
</tr>
<tr>
<td>Ireland</td>
<td>8,222</td>
<td>2,239</td>
<td>8,288</td>
<td>2,156</td>
<td>8,603</td>
<td>2,241</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>5,321</td>
<td>2,243</td>
<td>5,828</td>
<td>2,127</td>
<td>4,700</td>
<td>2,092</td>
</tr>
<tr>
<td>Greece</td>
<td>3,513</td>
<td>8,571</td>
<td>4,498</td>
<td>8,564</td>
<td>4,631</td>
<td>4,892</td>
</tr>
<tr>
<td>Finland</td>
<td>3,903</td>
<td>1,309</td>
<td>3,741</td>
<td>1,256</td>
<td>3,779</td>
<td>1,434</td>
</tr>
<tr>
<td>Slovakia</td>
<td>2,633</td>
<td>850</td>
<td>3,033</td>
<td>958</td>
<td>3,053</td>
<td>1,110</td>
</tr>
<tr>
<td>Portugal</td>
<td>2,013</td>
<td>1,032</td>
<td>2,223</td>
<td>1,106</td>
<td>2,046</td>
<td>1,021</td>
</tr>
<tr>
<td>Slovenia</td>
<td>1,969</td>
<td>483</td>
<td>1,682</td>
<td>474</td>
<td>1,445</td>
<td>437</td>
</tr>
<tr>
<td>Lithuania</td>
<td>724</td>
<td>355</td>
<td>1,027</td>
<td>573</td>
<td>1,186</td>
<td>621</td>
</tr>
<tr>
<td>Estonia</td>
<td>774</td>
<td>273</td>
<td>711</td>
<td>244</td>
<td>774</td>
<td>292</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>681</td>
<td>143</td>
<td>673</td>
<td>157</td>
<td>747</td>
<td>168</td>
</tr>
<tr>
<td>Latvia</td>
<td>224</td>
<td>142</td>
<td>299</td>
<td>214</td>
<td>265</td>
<td>180</td>
</tr>
<tr>
<td>Cyprus</td>
<td>154</td>
<td>49</td>
<td>132</td>
<td>66</td>
<td>111</td>
<td>26</td>
</tr>
<tr>
<td>Malta</td>
<td>121</td>
<td>27</td>
<td>153</td>
<td>45</td>
<td>92</td>
<td>28</td>
</tr>
</tbody>
</table>
## ANNEX II: ITINERARY

<table>
<thead>
<tr>
<th>Date</th>
<th>Task</th>
<th>Remarks</th>
</tr>
</thead>
</table>
| 19 - 21/11/2007 | Literature review  
Setting appointments                                    |                                                                         |
| 22/11/2007   | Interviews with  
Mr. Francis Modaha TFNC  
Mr. Osman –CoET UDSM.  
Mr. L. Muze – AMKA/KWANZA Collection Co | R&D and Training  
R&D and Training  
Processing and export experience |
| 23/11/2007   | Interview with  
Mr. Andrew Kazimoto – MATUNDA MEMA | Exporting company of dried fruit |
| 26/11/2007   | Interview with  
Mr. Deus Mwita – TaTeDo  
Mr. Tarimo - TIRDO | R&D and Training  
R&D and Training |
| 27/11/2007   | Progress meeting with colleagues - MMA |                                                                         |
| 03/12/2007   | Travel to Morogoro and interview with  
Dr. P. Mamiro – SUA  
Interview with Mr. Mustad Macha and Mr. Frank J. Senkondo | R&D and Training  
SUA Horticultural Orchard |
| 04/12/2007   | Interview with Prof. Maerere  
(Head SUA Department of Crop Science and Production)  
Interview with dried fruit and vegetables entrepreneur – Ms. Clara A. Ibihya | Mangoes varieties and pests  
Processing and urban market |
| 05-08/12/2007 | Analysis and draft report writing |                                                                         |
| 10/12/2007   | Travel to Kampala and meeting with TRIAS  
(Peter van Erum) and BSMD Project Manager  
(Peter van Bussel) | Experiences and Lessons from dried fruit and vegetables sub sector in Uganda |
| 11/12/2007   | Visit to Amfri Farm  
Meeting with FIT Uganda | Exporter of organic dried fruit and vegetables  
BDS Provider – lessons for Tanzania |
| 12/12/2007   | Meeting with Kilimo Trust  
Travel to Arusha – preparation for presentation | Challenges and lessons for Tanzania |
| 13/12/2007   | Discussion with SCF Board and selected stakeholders |                                                                         |
| 14/12/2007 to 24/01/2008 | Analysis and draft report writing |                                                                         |
ANNEX III – USEFUL CONTACTS

National Microfinance Bank (NMB)
Contact: Bas Nierop
Chief Commercial Officer
Address: Head Office, bank House
Samora Avenue
P.O. Box 9213
Dar es Salaam – Tanzania
Telephone: Gen.: +255 (0)22 2118785/8
Dir.: +255 (0)22 2124060
Cell: +255 (0)756 444262
Fax: +255 (0)22 2110077
E-mail: Bas.Nierop@nmbtz.com

Tanzania Industrial Research Development Organization (TIRDO)
Contact: Mr. Tarimo
Position: Senior Research & Development Officer
Address: P.O. Box 23235
Dar es Salaam – Tanzania
Telephone Gen.: +255 22 2668822
Cell: +255 0754 680 182
Fax.: +255 22 2666034
Email: tirdo@intafrica.com
justarimo@gmail.com
Web: www.sndp.undp.org/tirdo

Kwanza Collection Company Limited /(AMKA)
Contact: Lawrence Muze
Position: General Manager
Address: SIDO-Small Business House
1st floor Bibi Titi Mohamed Road
P.O. Box 75870
Dar es Salaam - Tanzania
Telephone: Gen.: +255 22 21 50232, +255 22 21 52756
Fax: +255 22 21 53531; +255 22 21 50100
Cell: +255 754 377124; +255 784 377124
Email: kwanza@africaonline.co.tz

SME Competitiveness Facility (SCF)
Contact: Sosthenes Sambua
Position: Manager
Address: Msasani Peninsula, Hamza Aziz Road, Plot Number 1018
P.O. Box 5789
Dar es Salaam – Tanzania
Telephone: Gen.: +255 (0) 22 260 1501
Cell: +255 (0) 784 547 405, +255 (0)713 254 226
Fax: +255 (0) 22 260 1502
E-mail: sambua@marketaccess.or.tz
Web: www.caribro.com
Small Industries Development Organization (SIDO)
Contact: Linus C. Gedi
Position: Agro-Food Specialist
SIDO HQ’s; Mfaume/Fire Road, Upanga
P.O. Box 2476 Dar es Salaam – Tanzania
Telephone: Gen.: +255 22 2151383
Cell: +255 754 026652
Fax: +255 22 2151383
gedili@yahoo.com
Web: www.sido.go.tz

SIDO Training and Production Centre
Contact: Ms. Happiness Mchomvu
SIDO HQ’s; Mfaume/Fire Road, Upanga
P.O. Box 2476 Dar es Salaam – Tanzania
Telephone: Gen.: +255 22 2151383
SIDO Industrial Estate
Vingunguti Dar es Salaam - Tanzania
Telephone: Gen.: +255 22 2860077
Email: wed@sido.go.tz
happymchomvu@yahoo.co.uk
Web: www.sido.go.tz

Ministry of Agriculture Tanzania
Contact: Karim Mtambo
Position: Asst. Director Post Harvest Management Services
Min of Agriculture Food Security and Cooperatives
P.O. Box 9192 Dar es Salaam – Tanzania
Email: Kmtambo04@yahoo.com

UDSM Technology Development and Transfer Centre (TDTC)
Contact: Mr. M. Osman
Expertise: Food Processing Engineering
Email: moshejam@hotmail.com
Telephone: Cell: +255 71 34 64 623

Hamish I Brebner (Designer & Contractor)
Driers for Africa, P.O. Box 12418 NELSPRUIT, 1200 WHITE RIVER, Mpumalanga,
Republic of South Africa
Tel/Fax: +27 013 733 3854
Cell: +27 82 925 4396
E-Mail: hbrebner@mweb.co.za

Clara A. Ibihya
Managing Director – CLAPHIJO Enterprises
Dehydration of fruit and vegetables
PO Box 30247 Kibaha Pwani
Cell: +255 754 477 629
E-Mail: claphijo@yahoo.com
Andrew Kazimoto
Managing Director – Matunda Mema (T) Limited
Processors of Organic Produces
PO Box 5 Karagwe Tanzania
Tel: +255 222 2965
Cell: +255 754 856 301, +255 784 856 301,
E-Mail: ankazimoto@hotmail.com

Dr Peter Mamiro
Department of Food Science and Technology
Sokoine University of Agriculture (SUA)
PO Box 3007 Morogoro Tanzania
Cell: +255 754 462 006
E-Mail: petermamiro@suanet.ac.tz

Prof. Maerere
Department of Crop Science and Production
Sokoine University of Agriculture (SUA)
PO Box 3007 Morogoro Tanzania
Cell: +255 754 863 202
E-Mail: maerere@yahoo.co.uk

Mr. Vikram Desai
Dabaga Vegetable & Fruit Canning Company
P.O Box 1957, Dar es Salaam, Tanzania
Tel: +255 222 130 651 or +255 222 121 960
Cell: +255 756 888 812
E-mail: vikramdesai@dabaga.co.tz

FADECO
The General Manager
Contact: Sekiku Joseph Mtabazi
Rift Valley Foods
P. O. Box 223, Karagwe- Kagera region Tanzania
Tel: +255 28 2223024
Cell: +255 754 605 682
Email: fadeco@satconet.net
ANNEX IV: Codex Alimentarius Commission (CAC)

RECOMMENDED INTERNATIONAL CODE OF HYGIENIC PRACTICE
FOR DRIED FRUITS
(CAC/RCP 3-1969)

SECTION I - SCOPE
This code of practice applies to all fruits that have been dried by natural or artificial means or a combination of both. The fruit is dried to the extent that the greater part of the moisture has been removed, and in addition the fruit may be subjected to a safe and appropriate treatment in preparation and packing, to permit marketing in normal trade channels. Fruits covered by this code include apples, apricots, peaches, pears, nectarines, prunes, figs, dates, and vine fruits such as raisins and currants. Fruits other than vine fruits prior to drying, if desired, and applicable for the particular fruit, may be cored, or pitted, sliced, diced, quartered, halved, or otherwise subdivided. This code does not apply to fruits commonly known as "dehydrated fruits" with a moisture content not exceeding 5%.

SECTION II - DEFINITIONS
None considered necessary for this code of practice.

SECTION III - RAW MATERIAL REQUIREMENTS
A. Environmental Sanitation in Growing and Food Production Areas
1. Sanitary disposal of human and animal wastes. Adequate precaution should be taken to ensure that human and animal wastes are disposed of in such a manner as not to constitute a public health or hygienic hazard and extreme care should be taken to protect the fruit from contamination with these wastes.
2. Sanitary quality of irrigation water. Water used for irrigation should not constitute a public health hazard to the consumer through the fruit.
3. Animal, plant pest and disease control. Growing areas should be kept free from rotten or decomposing fruit that is attractive to insects, rodents and birds. Where control measures are undertaken, treatment with chemical, biological or physical agents should be done only in accordance with the recommendations of the appropriate official agency, by or under the direct supervision of personnel with a thorough understanding of the hazards involved, including the possibility of toxic residues being retained by the fruit.

B. Sanitary Harvesting and Food Production
1. Equipment and product containers. Equipment and product containers should not constitute a hazard to health. Containers which are reused should be of such material and construction as will facilitate thorough cleaning, and should be so cleaned and maintained as not to constitute a source of contamination to the fruit.
2. Sanitary techniques. Harvesting and production operations, methods and procedures should be lean and sanitary.
3. Removal of obviously unfit materials. Unfit products should be segregated during harvesting and production to the fullest extent practicable and should be disposed of in an appropriate manner. The harvested fruit should be examined by competent persons to ensure that it is fit for further processing into food.
4. Protection of product from contamination. Suitable precautions should be taken to prevent the raw fruit from being contaminated by animals, insects, vermin, birds, chemical or microbiological contaminants or other objectionable substances during handling and storage. The nature of the fruit and the methods of harvesting will indicate the type and degree of protection required. The raw or dried fruit should be moved to suitable storage, or to the processing area for immediate processing, as soon as possible after harvesting or drying. Where fruits are likely to have become infested with insects or mites during or after harvesting or drying as a preventive measure, suitable treatment such as fumigation should be applied. Fruit held for processing should be stored in closed containers, buildings, or under suitable type of covering that protects it from rodents, insects, birds, debris and dust. Fumigation methods and chemicals used should be approved by legal authorities having jurisdiction.

5. Drying yards. Where fruit is dried by the sun in drying yards, such yards should be recognized as food processing yards whether drying is carried out on a grower's property or as a commercial operation. Such yards should as far as possible comply with such of the provisions of Section IV of this code as are applicable, and in particular with the following requirements.

a) Location. Drying yards should in all cases be located a sufficient distance from cattle feed lots, settling pods and/or other waste collection areas to prevent contamination from these sources. They should also be so located that they have proper and adequate drainage.

b) Construction. The drying yard should be so surfaced that it will permit maintenance of clean yard surfaces and prevent contamination of drying fruit. The drying yard should be fenced, where necessary, to keep out animals as far as practicable, and the area around the drying yard should be kept clean, free from weeds and other debris that can blow into the yard. Cutting sheds in which fruit is pitted, cut or otherwise prepared and spread on trays for drying should preferably be closed buildings with screened windows that do not permit access by rodents, insects, or birds. Where cutting is done in open sheds, adequate precautions should be taken to protect against insect, rodent and bird contamination or harbourage. The sheds should be adequately lit and ventilated, and adequate, clean toilet and hand-washing facilities should be provided. Both fresh fruit for processing and the dried fruit should be stored in areas where it is protected from rodent, insect and bird depredations, and storage time should be kept to a minimum consistent with good manufacturing practice. There should be an adequate supply of clean potable water for hand-washing, equipment cleaning, and raw product washing. Standards of portability shall not be less than those contained in the “International Standards for Drinking Water”, World Health Organization, 1971.

c) Hygienic operating requirements. Drying trays, cutting equipment, and storage bins should be kept clean and free from fruit residue and foreign substances that may cause contamination of the fruit.

C. Transportation

1. Facilities. Conveyance for transporting the harvested crop or raw product from the production area, place of harvest or storage should be adequate for the purpose intended and should be of such material and construction as will permit thorough cleaning and should be so cleaned and maintained as not to constitute a source of contamination to the fruit.

2. Handling procedures. All handling procedures should be such as will prevent the product from being contaminated. Extreme care should be taken in transporting perishable products to prevent spoilage or deterioration. Special equipment - such as refrigeration equipment - should
be used if the nature of the product or distances involved so indicate. If ice is used in contact
with the fruit, it should be of sanitary quality as required in Section IV - A (2c).

SECTION IV - PLANT FACILITIES AND OPERATING REQUIREMENTS

A. Plant Construction and Layout

1. Location, size and sanitary design. The building and surrounding area should be such as can
be kept reasonably free of objectionable odours, smoke, dust, or other contamination; should
be of sufficient size for the purpose intended without crowding of equipment or personnel;
should be of sound construction and kept in good repair; should be of such construction as to
protect against the entrance or harbouring of insects or birds or vermin; and should be so
designed as to permit easy and adequate cleaning. In areas experiencing high concentrations
of air-borne pollutants, equipment should be used to remove pollutants from the air blown
across or through the product.

2. Sanitary facilities and controls:
   a) Separation of processes. Areas where raw materials are received or stored should be so
      separated from areas in which final product preparation or packaging is conducted as to
      preclude contamination of the finished product. Areas and compartments used for storage,
      manufacture or handling of edible products should be separate and distinct from those
      used for inedible materials. The food handling area should be completely separated from
      any part of the premises used as living quarters.
   b) Water supply. An ample supply of cold water should be available and an adequate supply
      of hot water where necessary. The water supply should be of potable quality. Standards of
      portability shall not be less than those contained in the "International Standards for
   c) Ice. Ice should be made from water of potable quality and should be manufactured,
      handled, stored and used, so as to protect it from contamination.
   d) Auxiliary water supply. Where non-potable water is used - for such purposes as fire control
      – it must be carried in completely separate lines, identified preferably by colour and with no
      cross connection or back-siphonage with the lines carrying potable water.
   e) Plumbing and waste disposal. All plumbing and waste disposal lines (including sewer
      systems) must be large enough to carry peak loads. All lines must be water-tight and have
      adequate traps and vents. Disposal of waste should be effected in such a manner as not to
      permit contamination of potable water supplies. The plumbing and the manner of waste
      disposal should be approved by the official agency having jurisdiction.
   f) Lighting and ventilation. Premises should be well lit and ventilated. Special attention
      should be given to the venting of areas and equipment producing excessive heat, steam,
      obnoxious fumes or vapours, or contaminating aerosols. Good ventilation is important to
      prevent both condensation (which may drip into the product) and mould growth in
      overhead structures – which growth may fall into the food. Light bulbs and fixtures
      suspended over food in any step of preparation should be of the safety type or otherwise
      protected to prevent food contamination in the case of breakage.
   g) Toilet-rooms and facilities. Adequate and convenient toilets should be provided and toilet
      areas should be equipped with self-closing doors. Toilet rooms should be well lit and
      ventilated and should not open directly into a food handling area. They should be kept in a
      sanitary condition at all times. There should be associated hand-washing facilities within
the toilet area and the notices should be posted requiring personnel to wash their hands after using the toilet.

h) **Hand-washing facilities.** Adequate and convenient facilities for employees to wash and dry their hands should be provided wherever the process demands. They should be in full view of the processing floor. Single-use towels are recommended, where practicable, but otherwise the method of drying should be approved by the official agency having jurisdiction. The facilities should be kept in a sanitary condition at all times.

B. **Equipment and Utensils**

1. **Materials.** All food contact surfaces should be smooth; free from pits, crevices and loose scale; nontoxic; unaffected by food products; and capable of withstanding repeated exposure to normal cleaning; and non-absorbent unless the nature of a particular and otherwise acceptable process renders the use of a surface, such as wood, necessary.

2. **Sanitary design, construction and installation.** Equipment and utensils should be so designed and constructed as will prevent hygienic hazards and permit easy and thorough cleaning. Stationary equipment should be installed in such a manner as will permit easy and thorough cleaning.

3. **Equipment and Utensils.** Equipment and utensils used for inedible or contaminating materials should be so identified and should not be used for handling edible products.

4. **Drying equipment.** Equipment used for drying should be so constructed and operated that the product cannot be adversely affected by the drying medium.

C. **Hygienic Operating Requirements**

While additional and more specific requirements may be established for certain products, the following should apply as minimal in all food production, handling, storage and distribution:

1. **Sanitary maintenance of plant, facilities and premises.** The building, equipment, utensils and all other physical facilities of the plant should be kept in good repair and should be kept clean and maintained in an orderly, sanitary condition. Waste materials should be frequently removed from the working area during plant operation and adequate waste receptacles should be provided. Detergents and disinfectants employed should be appropriate to the purpose and should be so used as to present no hazard to public health.

2. **Vermin Control.** Effective measures should be taken to protect against the entrance into the premises and the harbourage on the premises of insects, rodents, birds or other vermin.

3. **Exclusion of domestic animals.** Dogs, cats and other domestic animals should be excluded from areas where food is processed or stored.

4. **Personnel health.** Plant management should advise personnel that any person afflicted with infected wounds, sores, or any illness, notably diarrhoea, should immediately report to management. Management should take care to ensure that no person, while known to be affected with a disease capable of being transmitted through food, or known to be a carrier of such disease microorganisms, or while afflicted with infected wounds, sores, or any illness, is permitted to work in any area of a food plant in a capacity in which there is a likelihood of such person contaminating food or food contact surfaces with pathogenic organisms.

5. **Toxic substances.** All rodenticides, fumigants, insecticides or other toxic substances should be stored in separate locked rooms or cabinets and handled only by properly trained personnel. They should be used only by or under the direct supervision of personnel with a thorough understanding of the hazards involved, including the possibility of contamination of the product.
6. Personnel hygiene and food handling practices:
   (a) All persons working in a food plant should maintain a high degree of personal cleanliness while on duty. Clothing including suitable headdress should be appropriate to the duties being performed and should be kept clean.
   (b) Hands should be washed as often as necessary to conform to hygienic operating practices.
   (c) Spitting, eating and the use of tobacco or chewing gum should be prohibited in food handling areas.
   (d) All necessary precautions should be taken to prevent the contamination of the food product or ingredients with any foreign substance.
   (e) Minor cuts and abrasions on the hands should be appropriately treated and covered with a suitable waterproof dressing. Adequate first-aid facilities should be provided to meet these contingencies so that there is no contamination of the food.
   (f) Gloves used in food handling should be maintained in a sound, clean and sanitary condition; gloves should be made of an impermeable material except where their usage would be inappropriate or incompatible with the work involved.

D. Operating Practices and Production Requirements

1. Raw material handling
   (a) Acceptance criteria. The raw material should not be accepted by the plant if known to contain decomposed, toxic or extraneous substances which will not be removed to acceptable levels by normal plant procedures of sorting or preparation.
   (b) Storage. Raw materials stored on the plant premises should be maintained under conditions that will protect against contamination and infestation and minimize deterioration.
   (c) Water. Water used for conveying raw materials into the plant should be from such a source or suitably treated as not to constitute a public health hazard and should be used only by permission of the official agency having jurisdiction.

2. Inspection and sorting. Prior to introduction into the processing line, or at a convenient point within it, raw materials should be inspected, sorted or culled as required to remove unfit materials. Such operations should be carried out in a clean and sanitary manner. Only clean, sound materials should be used in further processing.

3. Washing or other preparation. Raw materials should be washed as needed to remove soil or other contamination. Water used for such purposes should not be re-circulated unless suitably treated to maintain it in a condition as will not constitute a public health hazard. Water used for washing, rinsing, or conveying final food products should be of potable quality.

4. Preparation and processing. Preparatory operations leading to the finished product and the packaging operations should be so timed as to permit expeditious handling of consecutive units in production under conditions which would prevent contamination, deterioration, spoilage, or the development of infectious or toxigenic microorganisms.

5. Packaging of finished product
   (a) Materials. Packaging materials should be stored in a clean and sanitary manner and should not transmit to the product objectionable substances beyond limits acceptable to the official agency having jurisdiction and should provide appropriate protection from contamination.
   (b) Techniques. Packaging should be done under conditions that preclude the introduction of contamination into the product.
6. Preservation of finished product. Methods of preservation or treatment of the finished product should be such as to kill any insects or mites remaining after processing and to result in protection against contamination, deterioration, or development of a public health hazard. The finished product should be of such moisture content that it can be held in the localities of origin and distribution under any normally foreseeable conditions for those localities without significant deterioration by decay, mould, enzymatic changes, or other causes. In addition to applicable drying, the finished product may be treated with chemical preservatives at levels approved by the Codex Alimentarius Commission, as referenced in the Codex Commodity standards, heat processed and/or packed in hermetically sealed containers so that the product will remain safe and will not spoil under normal non-refrigerated storage conditions.

7. Storage and transport of finished products. The finished products should be stored and transported under such conditions as will preclude the contamination with or development of pathogenic or toxicogenic microorganisms and protect against rodent and insect infestation and deterioration of the product or of the container.
   (a) The product should be stored under suitable conditions of time, temperature, humidity, and atmosphere, to prevent significant deterioration.
   (b) Where dried fruits are stored under conditions in which they may become infested by insects and mites, appropriate methods of protection should be used regularly. Dried fruits should be stored in such a manner, that they can be fumigated in situ or so stored that they can be removed elsewhere for fumigation in special facilities (e.g. fumigation chambers, steel barges, etc.). Cold storage can be used, either to prevent infestation in localities where insects are likely to be present in ordinary storage or to prevent insects damaging the fruit.

E. Sanitation Control Programme
It is desirable that each plant in its own interest designate a single individual, whose duties are preferably divorced from production, to be held responsible for the cleanliness of the plant. His staff should be a permanent part of the organization and should be well trained in the use of special cleaning tools, methods of disassembling equipment for cleaning, and in the significance of contamination and the hazards involved. Critical areas, equipment for cleaning and materials should be designated for specific attention as part of a permanent sanitation schedule.

F. Laboratory Control Procedures
In addition to any control by the official agency having jurisdiction, it is desirable that each plant in its own interest should have its own or access to laboratory control of the sanitary quality of the products processed. The amount and type of such control will vary with the fruit as well as the needs of management. Such control should reject all fruits that are unfit for human consumption. Analytical procedures should follow recognized or standard methods in order that the results may be readily interpreted.

SECTION V - END PRODUCT SPECIFICATIONS
Appropriate methods should be used for sampling, analysis, and determination in the following specifications.
A. To the extent possible in good manufacturing practice the products should be free from objectionable matter.
B. The products should not contain any pathogen microorganisms or any toxic substance originating from microorganisms.
C. The products should comply with the requirements set forth by the Codex Alimentarius Committees on Pesticide Residues and Food Additives as contained in permitted lists or Codex commodity standards.