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MODEL PREFEASIBILITY STUDY FOR A NATIONAL COMPOSITE FLOURS PROGRAMME

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FOREWORD

In resolutions 3201 (S-VI) and 3202 (S-VI), the United Nations General Assembly adopted, during its Sixth Special Session held in May 1974, a declaration and Programme of Action on the establishment of a New International Economic Order whereby all efforts should be made by the international community to speed up development. These resolutions stress the need for developing countries to use appropriate technologies to promote the production and use of local raw materials in their development efforts.

From its inception, the United Nations Economic Commission for Africa (UNECA) has recognized the primary role that food processing played in the achievement of food self-sufficiency. The planning, formulation and implementation of national composite flour programmes addresses this concern and provides the justification for drafting this model prefeasibility study.

CONCLUSION AND RECOMMENDATIONS

Food habits are changing in Africa towards more dependence on imported products thus sharply reducing the continent's food self-sufficiency. The need to make special efforts in reversing this trend and to consume what is locally produced does not have to be further demonstrated. In this respect, the national composite flour programme (NCFP) becomes a prime tool. This is not another bureaucratic creation but applied research resulting in a production unit using technological advances and designed to generate the resources for financing its own operations.

Every member State is urged to formulate and implement, within the context of its economic development efforts, an NCFP using the guidelines given in Chapter VI of this document. Most importantly, about two years before the programme is instituted, it is highly recommended that:

(i) A study should be conducted on the impact of the wheat system on the national economy, particularly its interaction with the production and marketing of foodstuffs and the changes in food habits that have occurred over the past 20 to 30 years and what is expected to happen over the next 10 years. Such a study would highlight the danger surrounding the management of the wheat system in the country;

(ii) Measures backed by quota restrictions and wheat import taxation should be taken and prices of wheat and wheat derivatives revised upwards in order to reveal the true price of such products to consumer. This will make it possible, at the time of launching the NCFP to have a price structure that is favourable to composite flours and local products; and

(iii) A voluntary strategy prepared for developing the production and marketing of local cereals, tubers and pulses in order to guarantee regular supplies for the NCFP.

CHAPTER I: INTRODUCTION

1. Hunger and malnutrition are today among the most devastating scourges in Africa. While the population has been growing at a mean annual rate of 2.9 per cent since the 1960s, food production has increased by only 1.8 per cent on average making the food self-sufficiency to decline constantly from 98 per cent[1] in 1960 to 81 per cent[2] in 1989. This was the reason for the tragic occurrences of famine and malnutrition which resulted in the massive import of food products.

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[1] ECA estimate.

[2] ECA estimate.

2. Among the imported food product, the share of cereals rose sharply from 24 million tons in 1980 to 32 million tons in 1985. With such a trend accompanied by a decline in export commodity revenue (due mainly to the fall in international prices), African countries found themselves compelled to rely on food aid because they were virtually unable to finance the imports. This situation is all the more unacceptable as the continent has vast potential which, if exploited, should be sufficient to meet the entire food needs of the region. According to the World Bank, industrial production in Africa (for which agro-industries account for more than 50 per cent), has fallen to an annual growth rate of 2.4 per cent over the period 1980-1985 as compared to the average growth rate of 9.7 per cent that prevailed over the period 1965-1980.

3. In this context, the Lagos Plan of Action exhorts African Governments to pursue such policies and strategies as would secure the production and processing of food products that would eventually replace imported products with local products. In this regard, wheat assumes particular importance among the food products imported into the region. Even though, wheat is, generally speaking, difficult to produce in most areas of Africa, its import is becoming increasingly substantial along with its consumption and industrial processing. In contrast, those local cereals and tubers for which most African countries are particularly endowed have not attracted as much interest.

4. Accordingly, the development of composite flour is seen to be a measure that would restore the value of local cereals, tubers and pulses and speed up the pursuit of independent national food policies. The slow rate at which composite flour programmes are emerging in Africa goes to show the magnitude of the constraints with which they have to reckon. In the circumstances, this paper will provide economic operators and national planners with a model for conducting prefeasibility studies on national composite flour programmes with a view to facilitating and making more reliable the preparation of such projects in member countries.

CHAPTER II: NEED FOR NATIONAL COMPOSITE FLOUR PROGRAMMES: TOWARDS A BETTER UNDERSTANDING

A. WHEAT: THE MOST NUISANCE AMONG CEREALS IN AFRICA

5. The historical evolution of human starch consumption has followed three separate routes. The Europeans and Americans developed wheat and rye production for bread making while the Asians people developed rice culture, consuming boiled polished rice grains. The third route concerns the "pasting process" applied to all other starchy materials (maize, sorghum, millet, cassava and yam) by stirring the flours in boiling water up to a thick paste. Unfortunately, through colonial influence, the paste consumers (mainly in the Third World) are eating more and more wheat bread and rice.

6. Established patterns of consumption of processed foods in the local markets have been encouraged by the transition to non-agricultural occupations and urban living which favour the consumption of bread and other "convenience foods" that require less preparation. To respond to the increasing demand of bread, the majority of the African countries have built ports for wheat grain handling, storage and milling; they are now trapped into permanent dependence on wheat even though the domestic production of traditional food staples has increased. Once established, such a dependent consumption pattern is self-reinforcing. Alternative sources of domestic supplies are obstructed by taste preferences and restrictions on imports are resisted by those sections of the population who have incorporated this food into their daily diet.

7. The above pattern is reinforced by the external commercial orientation of the domestic millers. It is easier and more profitable to telex suppliers in the United States of America or Europe than to mobilize supplies from a fragmented and complex domestic production system. Domination of the local milling industry by foreign capital further reinforces a preference for imported solutions to domestic supply problems. The prominence and popularity of wheat among the cereals is due to an absorptive capacity that has been created in its favour in terms of price, convenience in consumption, and organized industrial milling and product marketing infrastructure. The bulk 180 per cent of the imported wheat is consumed in form of bread.

8. Already, the politically sensitive nature of bread, especially among urban consumers, has held its consumer price below that of local non-wheat cereals. In addition, with the various subsidies in exporting countries and the overvalued exchange rates in a number of African countries, the price of bread continue to decline relative to local staples. As a result of these adverse price distortions, bread has become the cheapest food in Africa and consumers have been encouraged to switch to it from their local product staple foods.

9. The success of bread in Africa cannot be reduced to the machinations of international wheat traders, transnational and their domestic collaborators, including those politicians who have opened up the countries for such trade. The success of bread is as much the success of thousands of indigenous entrepreneurs who operate the bakery business at all levels of society, skilfully making use of a wide range of technologies and exploiting the commercial opportunities created by the transformation of African economies.

10. The flexible bakery technology which allows for combining different ingredients at various cost levels has opened the way to an entire range of investment and facilitated close adaptation to market sizes. In addition, the bakery industry enjoys a favourable position in terms of public support schemes for small-scale industry; ideologically, this is argued with reference to the "rural industrialization", "appropriate technology" and "indigenous entrepreneurship".

11. The massive importation of wheat sustained by powerful foreign economic interests contributes actively to the under-development of African agriculture. It is an easy and cheap way out of the domestic systems of food farming and goes to reduce those activities from which farmers, traders and local nascent industries make a livelihood.

B. THE FACTOR INFLUENCING BREAD CONSUMPTION IN AFRICA

1. What bread is

12. By conventional definition, bread is a food prepared from the dough of wheat, water and salt with some ferment (yeast) added, kneaded, shaped and baked in an oven when the dough has risen. Not all varieties of wheat can be made into bread. Flour is said to have sufficient baking quality (to be made into bread) when it has minimal values such as a W (measured by

Chopin alveograph) of 130 joules and a Hagberg receding time of 160 seconds. The bread made from such a flour shows well-known specific morphological and organoleptic characteristics. In the current African context, bread should be redefined as a product made from maize, sorghum, millet, cassava, yam, rice, fonio or other staple to which wheat has or has not been added.

2. Consumption pattern

13. Bread consumption was virtually unknown in Sub-Saharan Africa at the beginning of this century. It was considered during the 1950s as the food of the intellectual and the urban minorities belonging to the privileged class of society. For some 20 years now, bread consumption has been increasing at a frenetic rate, rising from four (4%) per cent per a year over the period 1950-1960 to eighteen per cent (18) over the period 1960-1975 and by six per cent (6%) from 1975 to 1988. This decline was partly due to the ban imposed on wheat imports into Nigeria from January 1987. Nevertheless, bread remains very popular in Africa and is even considered as a staple food in many countries where it is rapidly gaining ground in the rural areas and among the less privileged members of society.

14. The unfortunate success of bread can also be explained by the substantial stability of supply of imported wheat and its low price in the context of periodic shortages and inconsiderate fluctuations in the prices of traditional foodstuffs. Also, often by exaggeration, people make a case of its nutritional value. Only a few years ago, large advertising boards in Nigeria carried the following message: "Join the energy feast - eat bread". This popular enthusiasm for bread is all the more worrisome as wheat growing is unknown to many Sub-Saharan people. Apart from the practical nature of bread, its consumption in Africa has been subsidized by the wheat exporting countries (of the Organization of Economic Cooperation and Development OECD in particular) and under food aid assistance coming from those same countries.

3. Agricultural subsidies in OECD countries

15. Within the Organization for Economic Co-operation and Development (OECD) the agricultural systems are designed to secure the food self-sufficiency of various member countries. In that context, agriculture has largely remained outside the reach of market forces

and happens to be a protected economic activity. By means of subsidies, farmers have been encouraged to produce more and the wheat supply, to take only that example, has speedily exceeded demand resulting in over-production. The excess wheat on the world market is therefore sold off at prices lower than the production costs. As though that was not enough, some African countries further subsidize wheat on arrival in the country because it was customary to do so during the colonial period.

16. The impact of OECD agricultural subsidies on Third World agriculture and national economies has been critically evaluated. Jean Louis Gombault, in his economic news broadcast on 13 May 1987 at 4:15 universal time over Radio France International received in Kigali put it very humorously by saying that prices were declining with over-production in the face of barely solvent demand. In addition to that, low prices were discouraging the farmers of poor countries who cannot sell at the prices of the rich countries whose farmers were economically subsidized. The OECD figures were illustrative. One quarter of the world's farmers (in the OECD countries) received 80 per cent of world agricultural subsidies. The upshot was that food dependency had become self-sustaining. Obviously, it would be impossible to dismantle the system all at once. It had been calculated that some four and a half million farmers in Europe would be thrown into the streets if the subsidies were withdrawn. The agricultural subsidies would therefore have to be replaced with unemployment allowances which obviously would do nothing to solve the problem. The OECD has therefore proposed to conduct the exercise in stages by reducing subsidies by 10 per cent of their value each year but in this case, just as that of missiles, no one trusts anybody. And so the dismantling exercise must be gradual and simultaneous at the same time which means that the zero option for subsidies is not going to be instituted in the near future.

17. The lesson is clear; agricultural subsidies still have a bright future and will continue to encourage over-production which will, in turn, continue to keep prices low and sustain food aid whose adverse effects are far from being perceived by the public authorities of the recipient countries.

4. Food aid being questioned

18. In principle, emergency food aid, both structural and specific elicits a broad consensus. It is supposed to be immediately effective in relieving the receiving country from an unexpected

natural disaster. Such emergency aid accounts for only 10 per cent of the total food aid provided by the rich countries to the poor countries today and is fraught with many discrepancies. Its benevolent intention seems to be doubtful because of the very fact that emergency aid has continued and has even in cases been imposed on the recipient countries.

19. The following example illustrates one of the ways in which aid is imposed[3]. Lesotho a land-locked country was struck by drought in 1972-1973. The United Kingdom proposed food aid to the country but the Government of Lesotho made it clear that it could absorb only 1000 tons of wheat. Regardless of that, the British authorities made a firm offer of 6000 tons. A beggar has no choice but the unfortunate thing was that in addition to the 6000 tons from Britain, Lesotho had to take delivery of 1000 tons of Belgian flour when it had asked for only 662 tons. The worst was still to come with the excellent harvest of 1973-1974. For months on end, the local administration had to stop working in order to focus on the storage and marketing of the food aid. Inevitably, the bumper harvest of 1973-1974 had to be sold at low prices because of the increase in supply. Obviously, good intentions do create problems for recipient countries.

20. In reality, it has very seldom been necessary to import food from the industrialized countries for disaster relief. One American food aid expert came out clearly on this issue by stating that for most major disasters enough food has always been found in the immediate vicinity of the disaster area and there has never been a need to import food from the industrialized countries.

21. And yet, the rich countries strive to impose food aid because they know that, in this business, vested interest outweighs humanitarian considerations. As the venerable Centre Français du Commerce Extérieur (CFCE) pointed out in 1981 food aid could constitute for donor countries a sort of investment in the recipient countries both commercially and otherwise. It is non the less a long-term investment which requires, at least in the medium-term, a degree of continuity and regularity in its extension to countries considered to be strategic or starving after the example of United States policy.

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[3] Les marchés de la faim, Editions La Découverte, Paris, 1984.

22. Under the heading of the commercial impact of food aid, CFCE stated that the idea is most often to facilitate the sale of agricultural, grain or dairy surpluses. This solution is economically and politically-speaking more profitable than the alternative of expensive storage, destruction or curtailment of production. The introduction of products unsuited to the basic needs of Third World people can eventually create a demand which so increases commercial imports that commercial flows gradually replace aid flows as can be seen in the case of the United States.

23. This substitution phenomenon is well illustrated by the International Monetary Fund in its 16 November 1981 Bulletin which states that grain food aid has become an effective means of selling off surplus resources to food deficit countries (...). During the last 10 years, the volume of grain food aid had in fact diminished while the total grain import of developing countries has more than doubled, exceeding 100 million tons. Clearly, the more you give, the more chances you have of selling and that costs you less than if you had to store needlessly and expensively what you overproduce.

24. In the United States itself, an official evaluation report of Public Law 480[4] dated 1986 indicates that food aid has improved the diet of more than 40 million school children throughout the world (...) and created increasingly substantial markets for American agricultural produce. It is almost as though the undernourished countries of the world are doing America a service by allowing it to give them or to sell them at special prices the agricultural surpluses for which it has no use. Through the "food for peace" programme, American foodstuffs have been introduced into countries which will one day become America's trading customers. The major agricultural markets of the future are those regions where vast numbers of people are learning, through the food for peace programme, to eat American products. Those who now receive American aid today will become its future customers.

25. Need it be recalled that former President Reagan stated not so long ago that in time of war food resources become a weapon? Put differently, by accustoming other people of the world to consume foodstuffs that they cannot produce, commercial outlets and an awesome weapon are being fashioned.

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[4] Public Law 480 enacted in 1954 governs United States food aid programmes.

26. In this regard, Public Law 480 which has several titles has scored an undeniable success for America. The first title is the essentially humanitarian component of the programme. From 1958 to 1980 a little less than seven billion dollars were distributed through this conduit. Such aid was channelled through such American charitable organizations as the Co-operative for American Relief Everywhere (CARE) or the Catholic Relief Services. This first phase of food aid was mainly a way of clearing the way and hooking the recipient country and its population on to the habit of consuming wheat, milk, soybean oil and other American farm products.

27. The second phase of the law, coming under title II, created a two-tier international market on which payments could be made in local currency. The mechanism was simple: The Government agency or importers in the recipient country issue bid for tender to American exporters. Once the agreement has been concluded between the two parties, an American bank mandated by the United States Government acts as broker and pays the American exporter the dollar value at international market rates. The importing country pays to the United States Government in local currency under the terms of a long-term loan. This translates into commercial exports under particularly favourably conditions to the importer.

28. In 1966, the law was amended and all sales under title II had to be gradually settled in US dollars. By 1971 this had became a fact. Enter the third phase. At the time, the volume of exports coming under food aid had diminished in favour of commercial exports paid for in dollars. From 1967 to 1976, American agricultural exports to developing countries increased 400 per cent. The food aid given had fulfilled its role in keeping with the law. It had primed the pump, cleared the way, hooked the customers and the market place was now open for trade. From 1961 to 1965, wheat food aid accounted for 65 per cent of total American exports of that cereal. In the early 1980s, aid accounted for no more than five per cent. All products taken together, food aid accounted in 1964 for 23 per cent of agricultural exports but for only three per cent of it in 1980.

29. In this context, Suzane-George[5] notes that in 1954 Japan received 400 million dollars in American food aid. By 1974, it was buying 20 billion dollars of agricultural products from the

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[5] Sudan, Mauritania, Senegal, Mali, Niger, Nigeria, Chad, Burkina Faso, Tanzania (in Comment meurt l'autre moitié du monde published by Robert LAFFONT).

United States. In Korea, annual imports of maize rose from 300 tons in 1967 (under PL 480) to more than 4.5 million tons in 1972. In the Middle East, all the countries show a large surplus of commercial purchasing over food aid received from 1967 to 1975. For nine African countries[5], the value of food aid received from 1972 to 1975 increased by $US 110 million while exports increased by more than $US 300 million.

30. In conclusion, the Centre de Recherche sur l'Amérique Latine et le Tiers Monde (CETRA)[6] rightly notes that the development of agriculture in countries receiving assistance has been deeply influenced by American programmes.... It is no exaggeration to suggest that by signing a food aid contract, those countries have signed a contract to support the American agricultural sector and to disorganize their own agricultural system.

31. In terms of food aid, donors have obviously been aware of what they stood to gain. Recipients find themselves in a difficult position. In most cases, they give way to economic logic and grab by the armful what they have been receiving for sometime. Meanwhile criticism grows. At the end of their meeting held on 14 and 15 June 1982, the Permanent Inter-State Committee for Drought Control in the Sahel (CILSS) and the Sahel Club issued a categorical statement to the effect that food aid which had initially been designed to supplement production shortfalls was beginning to become a permanent feature and this was at variance with the CILSS strategy for food self-sufficiency. The availability of aid at any time and under any terms was disrupting the food produce market shifting farmers away from the sound practice of crop husbandry with the offer of free food. In brief, food aid was having adverse effects on the production and pricing of local food crops.

32. On 26 November 1983, the Director-General of FAO stated that food aid was becoming a real problem. It was organized to get rid of wheat and milk surpluses. It was not given in the form of such products as cassava, yams, maize, millet or sorghum which constitute the staple food of Africans. What was needed was cash to pay for South-South trade.

33. It would be no exaggeration to conclude that food aid has been a disaster for African farmers. It competes with their fragile production base by capturing part or all of a market

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[6] CETRA: Centre de Recherche sur l'Amérique Latine et le Tiers Monde.

which is already narrow; It pushes down already low prices and takes up all the already limited storage available. In the final analysis, it discourages farmers from producing. It perverts the mentality of people by transforming them into assisted persons. It radically and abruptly changes the food habits of local people since the national production system cannot provide the new products. It is expensive since it has to be imported from outside. Such aid doubtless by boosts wheat importation and impedes both the development of local raw materials and the institution of national composite flour programmes.

C. WHEAT IMPORTS INTO AFRICA

34. Wheat and wheat flour imports into Africa (see annex I) increased 10 per cent per year in real terms, rising from 4.7 million tons in 1970 to 19.7 million tons in 1985. They increased 17.6 per cent per year in value from $US 327 million in 1970 to $US 3721 million in 1985. The import volume of 1970 increased four and a half times during the first half of the 1980s. All the coffee export earnings of Africa in 1985 amounting to $US 3 billion was far less than the $US 3.8 billion allocated for wheat imports.

35. Taking sub-Saharan Africa alone, the 6.3 million tons of wheat imported in 1985 cost more than 1 billion US dollars.

36. The mirage of bread becomes very visible in the capital cities of Africa. In Libreville, Gabon for instance, bread is less expensive than cassava or plantain and some 200 grammes of bread is consumed daily per person which is more than the average consumption in the industrialized countries[7].

37. And yet, bread is not a staple food in Africa. A consumption survey conducted in 1979 in Senegal (one country in which more than the average per capita volume of bread is consumed in Africa) revealed that only 30 per cent of the people ate bread daily and that was mainly for breakfast. The figure can be as low as five per cent in certain countries. It may be concluded therefore that a small proportion of the population imposes on the country a huge amount of foreign exchange spending on the importation of wheat which affects not only the trade balance

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[7] Blé, Minoteries et Boulangeries en Afrique, "Europe-Outremer". No. 640-641.

but also disorganizes agricultural production and management of the national economy. In the circumstances, some people are wondering why enough wheat is not produced in Africa.

D. PROBLEMS OF WHEAT PRODUCTION IN AFRICA

38. The Mediterranean countries of North Africa (Morocco, Algeria, Tunisia, Libya and Egypt) have a long tradition of wheat production and consumption. They produce in total, about 7 million tons per year (1980-1987) contributing to 65 per cent of the total African wheat production. However, they have to import from the international market more than twice their production to meet their consumption requirements estimated at 22 million tons in 1988.

39. In a few sub-Saharan African countries (Ethiopia, Kenya, Nigeria, Tanzania, the Sudan and Zimbabwe), wheat is a traditional crop which is grown also in some areas having marginal ecological conditions. Production was estimated at 1.6 million tons in 1987 (with the six countries accounting for 93 per cent of it) and covered about 20 per cent of an estimated demand that could be paid for of about 4.7 million tons in 1988 - excluding food aid[8]. Table 1 below provides statistics on production over the period 1960-1988.

[8] FAO Production Yearbook and FAO Trade Yearbook.

Table 1: Production of wheat in Africa (1000 t)

	1965	1965	1970	1975	1980	1985	1988
World	244 800	267 369	318 437	355 824	446 107	505 729	509 952
Africa	4 030	6 492	7 984	9 706	8 919	10 181	13 630
Algeria	1 509	1 325	1 435	1 848	1 511	1 478	1 150
Angola	20	20	12	10	10	3	2
Botswana	-	-	-	1	1	1	1
Burundi	4	8	13	13	4	8	17
Cameroon	-	-	-	-	1	1	1
Chad	2	4	7	2	6	5	4
Egypt	1 499	1 272	1 519	2 033	1 796	1 872	2 839
Ethiopia	650	693	808	734	522	774	825
Kenya	129	172	221	158	216	275	240
Lesotho	58	55	60	50	28	18	21
Libya	33	57	21	70	141	149	193
Malawi	-	-	-	1	1	1	1
Mali	4	4	4	2	2	3	2
Mauritania	-	-	-	-	-	1	1
Morocco	974	1 580	1 801	1 575	1 811	2 050	4 035
Mozambique	9	10	9	3	3	5	5
Namibia	1	1	1	1	1	1	1
Niger	1	1	1	2	2	7	8
Nigeria	16	15	7	6	24	40	75
Rwanda	1	1	1	2	3	5	7
Somalia	-	-	-	1	1	1	1
South Africa	774	669	1 396	1 792	1 470	1 680	3 400
Sudan	25	56	115	269	231	79	181
Swaziland	-	-	-	-	1	1	1
Tanzania	12	23	61	56	68	83	79
Tunisia	439	520	449	976	869	1 380	225
Uganda	-	-	-	14	17	12	9
Zaire	2	3	3	2	6	20	20
Zambia	1	1	-	1	10	18	35
Zimbabwe	1	4	40	85	164	205	250

Source: FAO Production Yearbooks.

40. In total, 11 countries produce 98 per cent of Africa's total wheat output which was estimated at 13.6 million tons in 1988. Some countries have made substantial efforts to identify, formulate, finance and implement wheat development projects in order to replace their wheat imports by locally-grown wheat. This is the case of Nigeria, Cameroon, and Burkina Faso, especially.

41. The case of Nigeria is worth mentioning. Since the 1970s, the basic objective of the National Development Plans of Nigeria has been the attainment of self-sufficiency in food. In the case of wheat for which annual imports averaged 1.5 million tons per year, the Federal Government has massively invested in several wheat development projects with the involvement of FAO, USAID, the Commonwealth Development Corporation (CDC) and the World Bank. The studies of these organizations concluded that wheat can be grown in the northern part of the country in the dry season and with irrigation. The feasibility studies of the early 1970s gave shape to the first set of projects already identified in the preliminary studies of the 1960s.

42. There were three projects to start with: The first 20,000 ha Mano River Project (Phase I), is irrigated with water from the Tiger Dam. This project entered into production in the early 1970s and is considered the best of the three. And yet, the 1982 harvest did not exceed 5,000 tons. The second project is that of Bakolori, with its area planned for irrigation substantially bigger at 23,000 ha. and drawing water from a huge dam on the Sokoto River. Less than 2,000 tons of wheat was produced in the 1981-1982 season and a negligible amount in 1982-1983.

43. The third project, the South Chad Irrigation Project (SCIP), is at the extreme east of northern Nigeria. The first stage of the project covered 22,000 ha and was irrigated with water pumped from Lake Chad. Only some 1,200 tons of wheat were produced in the 1980-1981 season. All three projects are small-holder schemes and the land prepared for irrigation has been handed back to its original owners.

44. In 1985, the total wheat production in the country was 40,000 tons against a projection of 300,000 tons. Already in 1987, the US Cultural Attaché in Lagos noted that barring an extraordinary technological breakthrough, Nigeria would never become a significant wheat producer because of its unfavourable natural environment. This is also the view expressed in international literature on wheat growing in the tropics. It would seem, however, that the Government's decision to ban wheat imports in January 1987 gave a new impetus to wheat growing which is currently yielding something in the neighbourhood of 300,000 tons.

45. Cameroon also has a wheat promotion project in the Adamawa highlands being conducted by the Societé pour le Développement du Blé. (SODEBLE). In spite of substantial investments made in the 1970s and 1980s, the yields have been poor (less than 1.5 tons per hectare) and the 1985 output was barely 1,000 tons.

46. The introduction of triticale in Africa has not significantly changed the characteristics of production even though that cereal is more indigenous than wheat. The most it has done is to arouse albeit vague hopes given of the complexity of the agricultural and technical problems concerning its baking quality as an artificial cereal.

47. In conclusion, a recent survey on the development of wheat production in the Third World noted that wheat production in sub-Saharan Africa and South-East Asia will long remain insignificant relative to demand because of the unsuitable production environment. All the same, research should continue for adapting suitable varieties to the local conditions of the pockets of available wheat growing areas. Good results could be obtained as was the case in Sourou region of Burkina Faso where wheat is grown under irrigation with an acceptable yield per hectare of 45 quintals as compared to 80 quintals in France and a CFAF 66,000 production cost similar to what is normally incurred by co-operatives in France[9].

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[9] Marches Tropicaux et Mediterranees: No. 2225, 1 July 1988.

E. WORKABLE ALTERNATIVES FOR REDUCING OR ELIMINATING WHEAT IMPORTS

48. Given the aforementioned circumstances and the need to institute policies that make for food self-sufficiency, several alternatives can be envisaged:

(i) The outright banning of wheat imports which would be the ideal solution for a country. Consumers would then see how they can get along by switching to local staples. A number of Governments would hesitate to make such a move because of the politically sensitive nature of bread;

(ii) The development, production and marketing of new ready-to-eat foods that will replace bread. Such foods would be made exclusively from local raw materials. Research to be conducted along the lines of this alternative has been set forth in most national, economic development plans but has yielded no tangible results to date;

(iii) The use of pre-gelatinization, as a technique for baking non-wheat flours;

(iv) The pure and simple baking into bread of local flours other than wheat flour and/or composite flours containing a high proportion of local flours with starchy and other additives. This is the case in Nigeria where research findings are already being tried out industrially and commercially;

(v) The use of pentosan as a gluten substitute in local flours to be made into bread. Experiments conducted at the University of Louvain in Belgium and in Togo have yielded a product similar in texture to bread. However, the import of pentosan derived from rye, a cereal seldom grow in sub-Saharan Africa, would lead to another form of

dependency. Had there been local sources of cheap pentosan, its use would have been recommended;

(vi) The procurement of wheat gluten or the production of synthetic gluten that would make it possible for non-wheat flours to be made into bread. Such a synthesis, unfortunately, has not been possible at the current stage of research and the use of wheat gluten would both be expensive and lead to another form of dependence;

(vii) The introduction of gluten into the genetic composition of maize, sorghum, millet, cassava and other crops through genetic engineering. This is a far-fetched theory because the bonding of glutenins and gliadines to form what is known as the gluten network is so complex a process that no applicable discovery can be foreseen in the near future; and

(viii) The composite flour option.

49. As can be seen, the outright banning of wheat imports or the pursuit of alternative (i) would encounter resistance in member States because of the food habits acquired whereas options (ii) to (vii) offer no immediate prospects. In contrast, the composite flour approach could offer consumers bread in acceptable quantities and of acceptable quality while at the same time significantly reducing wheat imports.

CHAPTER III: THE COMPOSITE FLOUR APPROACH

A. DEFINITION AND ADVANTAGES

50. Composite flour programmes can be seen as part of the effort a number of countries are making to reduce their dependence on one or several imported products or of the general effort being made to improve the food and nutrition of people.

51. In many African countries which are overly dependent on imported wheat, this would mean partial or total substitution of wheat with other locally-produced materials for the preparation of bread, pasta, biscuits, baby and other foods.

52. The use of composite flours becomes one way of developing local cereals, tubers and pulses with the effect of setting up small- and medium-scale industries and developing other branches of agricultural activity.

53. Generally speaking, the development of composite flours provides the following benefits to a country:

- More use is made of local materials;
- A greater degree of food self-sufficiency is achieved;
- Substantial foreign exchange savings are secured with the reduction of wheat imports;
- Industrial investment is intensified and expanded, thus creating more jobs; and
- The nutritional value of grain crops that are poor in lysine but rich in methionine is sufficiently enriched through the addition of pulse flours that are rich in lysine but are poor in methionine.

54. In the specific area of bread-making, the composite flour option may be occasioned by several factors:

- For traditional wheat-producing countries, dwindling supplies of wheat may compel them to use a substitute product;
- For non-wheat producing countries which consume bread, it may be the need to reduce expensive imports and to economize; and
- Since bread is an every day consumer item, it may be used to achieve a better balanced diet.

55. In such a context, the local flours to be added to wheat flours should so be chosen as to compensate for dietary deficiencies. Furthermore, the development of composite flours contributes greatly to the achievement of food self-sufficiency, a top priority in the Lagos Plan of Action, the Industrial Development Decade Programme and the United Nations Programme of Action for African Economic Recovery and Development. Accordingly, the ninth meeting of the Conference of African Ministers of Industry, held from 29 to 31 May 1989 in Harare, Zimbabwe, adopted resolution 10 (IX) paragraph 6 in which it was recommended that member States should develop national composite flour programmes in order to reduce wheat imports and save foreign currency which will be used to stimulate the production of local staples.

56. Well before resolution 10 (IX), the Fifth Conference of the African Ministers of Industry had adopted on 20 October 1979, Resolution 3 (V) which, inter alia, called for the production and publication of a Technical Compendium on Composite Flours. This Compendium was prepared by the United Nations Economic Commission for Africa in 1985 and widely circulated in 1986 among the African countries. Prior to the Compendium, the FAO composite Flour Programme, Volume I, was published in 1973 and widely circulated.

B. THE TECHNICAL COMPENDIUM ON COMPOSITE FLOURS

57. The Technical Compendium has been compiled by a team of experts drawn from both African and overseas research and development institutions that specialize in flour processing and flour utilization technology. FAO's international experience on the subject of composite flours and its findings in technical and

economic studies conducted in the African region during the 1960s and 1970s, are fully reflected in the publication for which financial assistance was kindly provided by the Netherlands.

58. The primary objective of creating awareness and disseminating information on the feasibility of combining wheat with local cereals, roots and tubers into flour-based products has been well accomplished. Instructions of procedures to follow to achieve the required standards of processing and product manufacture have been effectively organized in Chapter VI. This presentation has been further clarified in Chapters III to V, with a lucid analysis of the required raw material properties and descriptions of processing procedures. The Technical Compendium is a useful guide to commercial flour millers and bakeries.

59. For the scientific reader, the physical and chemical properties of such raw materials as sorghum, maize, rice and cassava are described without going too much into theoretical detail. This part provides a basic understanding of the technology involved, and readily serves as training and instruction material in classroom, the laboratory, the flour mill and the bakery.

60. The Technical Compendium has come out at a time when the need, in the African region, for substituting imported food with local foods has become paramount in order to conserve foreign exchange for other essential imports that are indispensable to economic development. This, precisely, is what the book intends to achieve. It therefore deserves the widest readership and the closest study by policy makers, administrators, industrialists and the small-scale food processing entrepreneurs. As a result of these efforts, the concept of composite flours has become known in most African countries but its application has yet to achieve the expected success.

C. AFRICAN AND OTHER EXPERIENCES

61. Many research institutions in Africa and elsewhere have done important work in the use of composite flours. The objectives pursued are varied:

- To develop local cereals, tubers, pulses and other crops; and
- To develop dietary material for vulnerable groups such as children and old people or those affected with such diseases as diabetes.

62. Annex II shows the research institutions which have done work on composite flours and the products they have developed. The results of the work done have been commercially exploited in a number of countries.

1. African experiences

63. It would seem to be an established fact nearly everywhere in Africa that bakers mix wheat flour with other types of local flour any time the price ratio shifts in favour of such flours. By doing this, the bakers break those laws which stipulate that bread should be made only out of wheat. The bakers in those countries, therefore, operate clandestinely. Those laws should be reviewed and amended with a view to making it lawful to use composite and non-wheat flours in bakeries (see paragraph 12).

64. It is just as well that a number of countries have already taken action to promote composite flours. The countries having done so may be classified into several categories depending on their type of experience.

(a) Experience crowned with success in Ethiopia, Tunisia, Zimbabwe and Burkina Faso

65. In Ethiopia, the national programme on composite flour has been a remarkable success. The success is due to rigorous planning of the various operations involving production, storage and provision of the substitute raw material (maize), a sensible price policy, production of composite flour and its distribution to the bakers concerned. Since 1981, Ethiopia has been producing composite flour containing 80 per cent wheat and 20 per cent maize to meet 40 per cent of the baking flour needs and with this the country saves about $US15 million on its annual wheat import. A second project is currently being studied for production of wheat/sorghum flour. This project will enable Ethiopia to replace 80 per cent of baking flour with composite flour.

66. The Tunisian composite flour programme should have been launched in 1974 by the Government of that country following a chronic shortage of wheat in the country and its inability to undertake massive importation. Today, Tunisia exports the costly hard wheat grain and imports soft wheat grain at a cheaper rate, thus making a substantial profit on the bargain. Also, bread made from composite flour containing 10 per cent maize is always marketed in the country along side 100 per cent wheat bread which is sold at a much higher price than that containing maize.

67. Zimbabwe and Burkina Faso currently market bread containing 5 to 10 per cent for the first grade bread and 20 to 30 per cent for the second.

(b) Failure of the Senegalese and Tanzanian projects owing to lack of raw materials

68. By decree 79-665 of 7 June 1979 which came into force on 26 August of the same year, the Government of Senegal made compulsory the production and sale of pamiblé (bread containing 15 per cent

millet and 85 per cent wheat). The foreign-exchange savings from this programme was estimated at CFAF 1 billion ($US 4 million) at that time. Regarding the flour mills responsible for the production of composite flour, the Government achieved price balance by taxing imported wheat and using the revenue to subsidize local millet. The Institut de Technologie Alimentaire has trained millers and bakers all over the country in new technologies for producing and using composite flour. The programme took off successfully and pamiblé was well accepted by consumers. Unfortunately, the programme was discontinued after a few months for the following reasons:

(i) Unfavourable agricultural sitaution resulting in a virtual disappearance of millet from the market due to drought and changes within the Office National de Coopération et d'Assistance au Développement (ONCAD) [10].

(ii) The reluctance of bakers who were unwilling to switch from their routine and who were little open to innovations since most of their workers were illiterate;

(iii) Opposition from cereal trade lobbies which were very concerned about the risk of a decline in their turnover should there be a reduction in bread consumption;

(iv) Difficulties faced by bakers who had refused to participate in training seminars organized prior to the launching of PAMIBLE since they could not guarantee quality bread to their customers;

(v) Increase in prices including those of bread during the launching period.

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[10] ONCAD Office National de Coopération et d'Assistance au Développement (dissolved in 1981-1982).

69. For a launching of composite flour based bread, it is necessary to:

(i) Train bakers adequately;

(ii) Secure the effective and total approval of the milling and baking professions;

(iii) Provide bakers with quality flour.

70. Since these conditions are difficult to provide in many African countries, it is preferable to introduce the new composite flour - based bread gradually. Launching, as in the second experiment currently in progress in Senegal, may initially involve only a limited number of bakeries.

71. Tanzania experiences too often shortages of maize, sorghum and cassava, for some of these foodstaffs to be set aside for mixing with wheat flour. In spite of the advanced stage of applied research, the National Composite Flour Programme could not be launched.

(c) Projects that failed for lack of adequate price policy: The first experience of Burkina Faso

72. The Grands Moulins du Burkina (GMB) has under the same roof three flour mills for wheat, maize/sorghum and millet respectively. In order to reduce wheat import expenditure, the GMB launched, in 1974, the "Blegho" operation which combined (70 per cent wheat and 30 per cent sorghum) with an extensive programme for the training of bakers in the techniques of making "blegho" flour into bread. The "blegho" bread, well accepted by consumers, was launched at a time when sorghum was abundant and cheaper than imported wheat. Later on, the price of sorghum rose but "blegho" survived for a few months afterwards with the help of subsidies granted by the Office National des Cereals (OFNACER). Such subsidization was ad hoc and

not integrated into a co-ordinated whole through organized and planned decisions. Thus, the financial cost of the subsidies became unbearable for the Office which freed itself from the burden towards the end of 1975. That dealt the final blow to "Operation Blegho" which is said to have resumed in 1987-1988.

(d) Projects that have not taken off for lack of insufficient will:

The case of the Sudan, Ghana and Kenya

73. The three countries mentioned above, although having undertaken intensive applied research activities on composite flour, have yet to implement their national programmes. In the Sudan, the Food Research Centre in Khartoum produces daily, a few hundred round loaves of bread containing 20 per cent sorghum. This is the best bread in the city. However, despite Government licences granted in 1980-1981 to enable promoters to import and install sorghum flour mills for the manufacture of composite flour, the national programme has yet to get off the ground. The programme was replaced in 1982 by USAID aid project which was meant to promote composite bread in the Sudan. After the USAID project failure which was observed only in 1989, the Government now appears to have decided to take concrete measures aimed at the production and use of composite flour. In this context, financing by ADB of a first groupof seven sorghum flour mills was secured in 1990 and the programme is to be supervised by the Food Research Centre in Khartoum.

74. In Ghana, the Food Research Institute and the Department of Nutrition, Science and Food Technology, the University of Ghana, Legon has published scientific documents on various aspects of the production and use of composite flour. During hard times, it was common for the bakeries to adulterate the small quantities of wheat flour available with all sorts of local flour including cri

(produced from cassava). However, there has been no project of national magnitude to date.

75. The Kenyan Industrial Research and Development Institute (KIRDI), has for several years experimented with the concept of composite flour using funds from the National Council of Science of Technology. The very positive results obtained since the begining of the 1980s had not, however, been implemented until 1988 when the Government was to include in the 1989-1993 plan the implementation of a national composite flour programme.

(e) Projects that have not taken off for lack of an institutional framework: The case of Zaïre, Togo, Benin and Tanzania

76. These four countries have at one time or the other carried out experiments on production and use of composite flour. In the agro-food centre of Lubumbashi in Zaïre, a certain amount of composite bread is produced daily and sold in the cities. The project is supported by a maize research and production centre. The experiments observed to be replicated nation-wide.

77. In Togo, pentosan bread experiments were carried out in 1979 under the joint sponsorship of France and Belgium. It demonstrated the possibility of making bread with 100 per cent cassava, sorghum or maize flour when ont to four per cent of rye pentosan extract was added. Because no appropriate institutional framework exists the replication of the experiement under a national programme has not been possible.

78. Experiments to make bread with composite flour took place in Benin in 1979 and 1982 at the initiative of the directorate of food and applied nutrition of the Ministry of Health. It was not followed up.

79. In the United Republic of Tanzania, four different institutions were working separately on composite flour at the beginning of the 1980s without any co-ordination among them. They are theDepartment of Food Science and Technology of the University of Dar-es-Salaam at Morogoro, the Tanzanian Food and Nutrition Centre, the National Milling Corporation and theSmall industry Development Organization. The result of the research had not been followed up at the national level.

(f) Projects that were not initiated because of the control of flour mills by foreign interests and/or pressure exerted by wheat-exporting powers

80. A large number of countries south of the Sahara belong to this category.

(g) National plan projects, those already formulated or those under formulation

81. Benin, Burundi, Rwanda, the Niger, Central African Republic, the Congo, Angola, Zambia, Mozambique, Sao Tome and Principe, Equatorial Guinea, Uganda and many other countries belong to this [illegible] feasibility has already been conducted for Angola, Zambia and Mozambique between 1982 and 1985 by FAO. Similar studies have been conducted for Benin, the Niger, Burundi, Rwanda, Sao Tome and Principe and Guinea in 1988 and 1989 by ECA.

(h) Using pure flour, other than wheat for making bread:

The case of Nigeria

82. In Nigeria, wheat imports which accounted for about $US600 million per annum during the first half of the 1980s, were banned

with effect from January 1987 and an Inter-Ministerial Committee was set up by the Federal Government to plan, execute and control projects for the production into bread and making of local flours which may or may not contain wheat. The Federal Institute of Industrial Research, at Oshodi (FIIRO), which has been responsible for developing appropriate formulas for using these flours in bread-making has already disseminated some of its findings. Training courses for bakers on new bread-making techniques are organized regularly by the Institute.

83. It is advisable to gradually replace imported wheat with local cereals and bubers over a period of five to tem years. The advantage of such a strategy is that consumers, on eating bread containing more and more of other products, would be more willing to accept wheatless bread in the long term. Furthermore, since increasing amounts of local raw materials are necessary for the substitution, producers should be allowed more time to fulfil their responsibility.

84. In Nigeria, wheat imports which accountred for about $US600 million per annum during the first half of the 1980s, were banned with effect from January 1987 and an Inter-Ministerial Committee was set up by the Federal Government to plan, execute and control projects for the production and baking of local flours which may or may not contain wheat. The Federal Institute of Industrial Research, at Oshodi (FIIRO), which has been responsible for developing appropriate formulas for using these flours in bread-making has already disseminated some of its findings. Training courses for bakers on new bread-making techniques are organized regularly by the Institute.

2. <u>The experience of the developed countries</u>

85. Most industrial countries, including OECD countries, have long been making bread and other products from composite flour. Maize

bread (broa) is a traditional product common in Northern Portugal and Yugoslavia, while rye-bread is fairly widespread in Europe. In Japan, bread often contains rice or maize.

3. The Central American experience

86. During the 1970s, Costa Rica produced and marketed biscuits containing 10 to 15 per cent cassava flour, an operation which was only stopped with the rise in the price of cassava. In Jamaica, 16 tons of cassava flour were produced every day and used as composite flour in bakeries. The operation was stopped after the bankruptcy of the Jamaïca Flour Mills following a hike in the price of cassava. In Panama, a law promulgated in 1976 made it compulsory to incorporate 10 per cent cassava flour in baking flour.

4. The South American experience

87. The "Andean Pact" countries namely Bolivia, Columbia, Ecuador, Peru and Venezuela began to explore collectively the technological aspects of composite flours as far back as 1967. In principle, the industrial production, use and marketing of the flour were accepted by the countries, including the various commercial agents concerned. Only the non availability of substitute raw materials and their high prices relative to imported wheat delayed, indeed, stalled the take-off of national programmes. However, in 1978, the Pact approved the implementation of a set of projects one of which was on the development of composite flours in each of the five member States. Of these, only the Columbian experience finally resulted in the permanent marketingof bread containing 30 per cent maize. Pasta containing maize is alos marketed on a permanent basis.

5. The experience of Asia and the Midle-East

89. In India, Sri-Lanka and Pakistan, millet-, sorghum-, rice-and chick-pea-based composite flours ar in everyday use In India and

Thailand, wheat/maize-based composite bread production is compulsory under the law. In the Philippines, under Republic Act No. 657, all bakeries are compelled to use wheat/cassava flour. In Sri Lanka, the State Flour Milling Corporation and Prima (Cey.) Ltd. daily produce a composite flour containing 20 per cent rice and 3 per cent oil-free soya bean flour for bakeries.

6. Conclusions

90. In conclusion, the above-mentioned experiences show that certain conditions should be fulfilled to secure the success of a national composite flour programme.

D. OPTIMUM MIXTURES OF WHEAT FLOUR WITH OTHER FLOURS

92. Those who have conducted studies on the use of millet or maize in bread-, pastry- and biscuit-making have noted that it was impossible to obtain from these cereals pastas comparable to those produced from wheat flour and that the pastas obtained after dehydration of tropical cereals is not visco-elastic.

93. The obstacles tothe use of tropical cereals in bread-biscuit- and food pasta-making industries are essentially the fact that their proteins do not form gluten which is a lipoprotein and a visco-elastic compound obtained by leaching five flour paste under tap water in order to give the dough its necessary quality for bread-making.

94. Such cereals as millet and sorghum which lack this quality, need to be mixed with wheat flour. The maximum rate of mixture with wheat flour is 15 to 20 per cent for bread-making without much changes in the usual baking techniques and in the nature of the bread, and up to 30 or 40 per cent, in which case special kneading techniques involving separate intensive kneading or tin baking is adopted.

95. Studies conducted by the Institute de Technologie Alimentaire in Dakar,Senegal, have shown that it is possible to achieve a 30 per cent rate of mixture by using the intensive kneading system which consists in preparing two dough, one with gluteness flour, with water only and the other with wheat flour containing all the necessary ingredients (water, salt, yeast...). Two minutes before ending the kneading of the wheat dough, the dough without gluten is incorporated.

96. The studies conducted by TNO Institute inWageningen, Holland, showed that bread-making with glutenless flour is possible by using substances capable of making the starch cohesive. These are generally emulsifying substances or surfactants whose efficiency is especially perceptible in the case of tin-baking.

97. Even if, technically, it is possible to make bread from composite flour containing 30 per cent and more of glutenless flour, it is recommended that a commercial operation should begin from a low rate of mixture, say 10 to 15 per cent, moving gradually upwards to the maximum rate [11]. Such an approach will minimize the risks of rejection, both at the level of consumers and within the professional circles (millers and bakers). This approach is especially recommended for Africa so as to enable the supply system to be organized for the production of the required quantity and quality of local raw mateirals.

98. A National Composite Flour Programme (NCFP) should take into account the supply of non-wheat raw material. It is advisable that the non-wheat raw materials are selected by economic criteria and on the basis of acceptability to consumers. Besides, their processing into flour should be sufficiently mastered.

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[11] Maximum rate may reach 100 per cent non-wheat flour.

99. In the case where there is no operational industrial unit for the production of local non-wheat flours, it is recommended that with the help of competent research centres, small production units should be set up for the production of non-wheat flours to be mixed with wheat in existing flour mills.

100. In the second operation currently being carried out in Senegal, which is based on the marketing of a bread called PAIN RICHE (15 per cent millet/85 per cent wheat), the five bakeries involved directly receive supplies of millet flour from a small processing plant installed in one of them.

E. PROMOTION AND USE OF COMPOSITE FLOURS

101. The importance of the use of composite flour for non-wheat producing countries, especially most African countries, cannot be overemphasized, from both the economic and nutritional points of view. It is in the interest of these countries to promote the use of local cereals, tubers and pulses for bread-, pastry- and biscuit-making or for preparing diets for vulnerable groups such as children old people and sick people.

102. With regard to the use [illegible] countries will need to do more promoting than others in the introduction of composite flour-based bread.

103. For French-speaking African countries such as Senegal, given the specific constraints to the French type of bread to which consumers are accustomed, a good mastery by bakers of the techniques of preparing composite flour-based flour is necessary. In that regard, the obtention of a good composite flour-based bread required much more patience and care on the part of the baker. It requires his making a break from the habits acquired in wheat flour baking, at a certain level of substitution.

104. One of the conditions for success in the promotion of composite flour is the provision of good technical assistance to bakers through an institution experienced in composite flours. Such an institution will be required to organize training seminars for bakery workers and also be responsible for the taker-off and follow-up of composite flour-based bread production. Consumer education and some publicity will also be indispensable.

1. Consumer education

105. Since consumers often regard the quality of a composite flour-based product as inferior, it is necessary to inform and sensitize them with regard to its economic and nutritional advantages as well as certain aspects of its taste and preservation.

106. In the case of composite flour-based bread, one of the reflexes of consumers is to try to find in it all the characteristics of wheat bread to which they are accustomed. They should, therefore, be prepared psychologically to see the product as different and having its own characteristics. Specialists on the promotion of new products recommend, moreover, that a specific form should be chosen and new catchy trade names adopted for the new products.

2. Publicity

107. The publicity should contribute to preparing consumers to better receive the product. It should be well implemented and centred onthe advantages to be derived from widespread consumption of composite flour-based bread.

It is necessary to recommend the adoption of a sufficiently attractive publicity slogan, such as:

"For better growth, eat Rich Bread".

As for the gradual introduction of the new product, priority should be given to publicity at the points of sale.

F. INSTITUTIONAL FRAMEWORK

108. On the global composite flour programmes, it has been noted that very few such programmes have resulted in the marketing of the products ona permanent basis at the national level. Among the reasons advanced for this is lack of Government support and of programme co-ordination at the ministerial level.

109. The economic stake in promoting composite flour is such that it is necessary to make the importance attached to it by the State felt at all levels. To this end, it is advisable:

- To set up an Inter-Ministerial co-ordinating Committee (ICC) for the NCFP; and

- To identify an executing agency for the programme.

110. The ICC should be chaired by a high official from the Office of the President of the Republic and should be entrusted with the review of [illegible] and the objectives of the NCFP and with giving overall guidance as the programme progresses. The Committee should help to strengthen the political commitment of the Government and ensure that once adopted the programme would benefit from the continuous support necessary for its execution.

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111. The ICC will be made up of decision-makers selected from the Ministries responsible for industries, trade, planning, finance and agriculture as well as from among such cereal trade professionals as millers and bakers. The Committee will act as a policy organ which will draw up and recommend the necessary political, economic and technical measures for the government on efficient implementation of the national programme.

112. The proposed terms of reference of the ICC of the NCFP include the following:

~~(a)~~ The drawing up of a strategy for introducing composite bread into the national market;

~~(b)~~ The drawing up of a strategy for regular supply of good quality composite flour to bakeries;

~~(c)~~ The proposing of extensive measures for stimulating production of composite flour-based bread;

~~(d)~~ The design of a wheat import quota system (including aid) and a local wheat, cereal and tuber pricing policy in order to promote their production and consumption;

~~(e)~~ The establishment of the level of substitution, at the initial stage, of imported wheat flour with local flours in break-making, taking into account both acceptability of the composite bread and the economic needs of the country;

~~(f)~~ The co-ordination and control of sensitization and information activities undertaken through the following three media:

(~~i~~) Mass communications;

(~~ii~~) Educational broadcasting;

(~~iii~~) Promotional activities;

~~(g)~~ The monitoring of the progress of the NCFP and secure its co-ordinated implementation;

~~(h)~~ The proposing of executing agency for the programme; such an agency should be experienced in the field of composite flours.

113. The executing agency could be a food technology research institute or a business concern having the requisite expertise for implementing the following terms of reference:

~~(a)~~ To master the techniques for the production of non-wheat flour and its mixing with wheat flour;

~~(b)~~ To intensify and adapt experimentation on bread-making with non-wheat and composite flours;

~~(c)~~ To conduct acceptability and marketing tests in sample localities and increase the points of sale;

~~(d)~~ To develop optimum storage conditions for composite flour and/or non-wheat flour;

~~(e)~~ To select throughout the country a number of commercial bakeries for extensive brad-making experiments;

~~(f)~~ To calculate the cost price elements of composite flour-based bread and prepare an economic paper on composite flours;

~~(g)~~ To prepare a project paper with a detailed check-list of activities for industrial and commercial production of composite flours and their use in brad-making;

~~(h)~~ To draw up and implement, after the take-off of the commercial phase of the NCFP, a research programme involving a wide range of new composite flour-and non-wheat flour-based food items, such as biscuits, pasta, couscous and baby food;

~~(i)~~ To initiate and carry out sensitization and information activities on composite flours;

~~(j)~~ To organize training seminars for millers and bakers before the take-off of the industrial and commercial phase.

G. CONSTRAINTS TO THE DEVELOPMENT OF COMPOSITE FLOURS

114. The constraints to the development of composite flours in bread-making are at various levels:

~~(a)~~ At the attitudinal level: In many countries, composite flour-based bread in the past appeared in difficult times such as times of war and famine. Hence, these products are often regarded by consumers as low-quality products. This attitude is the reason

why bakers are reluctant and often opposed to making bread with composite flour, as they risked rejection by their customers;

(b) At the technical level: Here, 100 per cent wheat bread, being generally more developed than composite flour - based bread of equal weight, has a slightly greater volume. Since bread is sold by weight, the consumer, on buying composite bread, feels that it costs more, in a situation of controlled prices: (i) in developing countries bakeries are often underequipped and the material rarely replaced. In many cases, bakery workers, mostly illiterate, are trained on the job and show little enthusiasm for innovations which imply a great effort to readapt; (ii) in many countries, local cereals, tubers and pulses are mostly processed traditionally, hence their non-existence on the non-wheat industrial composite-flour market. Often, the launching of composite flour in these countries also requires the installation of local flour production plants. This constitutes a major handicap in that the new plants require not only substantial financing but also considerable time before achieving mastery of the production of quality finished products and are often faced with problems of securing quality raw-material supplies;

(c) The low price of imported cereals:

115. Developing countries experience the shocks created by rapid technological advancement among farmers in developed countries as well as by subsidization policies. International competition, therefore, renders local agriculture increasingly less competitive in providing products to cities and national industries. In fact, the proposed prices for composite flour-based products do not always meet the expectations of consumers and there is often the need to impose an appropriate tax on wheat imports in order to promote the viability of the NCFP.

CHAPTER IV

FOOD PRODUCTION (Cereals, tubers and pulses)

A. Production systems and potential

116. The priority long accorded cash crops in the agricultural sector of the economies of African States reflects a considerable slow-down in the production of such food products as cereals, tubers and pulses. At the economic level, the chosen varieties with sufficient mineral manures; farming equipment is used preferentially for export crops.

117. It is often observed that in Africa, the production of food crops has stagnated or grown only marginally in spite of the agricultural potential. Special attention should be given to production systems within the framework of the NCFP.

118. In Senegal, for example, millet and sorghum hold potential for mass production that can be harvested very quickly if marketing is organized and the problem of processing solved. This explains why the work done on the use of composite flour in bread-making has been based on these two cereals.

119. With a view to intensifying rain-fed farming of millet and sorghum, the improvements recommended by research are based mainly on mechanization of some operations, tilling, mineral manuring and the use of selected plant varieties.

120. All the above themes constitute a technological package recommended for simultaneous application: for instance, the

selected plant varieties, in particular, can only be grown with a sufficient quantity of manure and appropriate farming techniques.

121. The studies on the potentials of each country are based on the various climatic zones and for each of them, the necessary factors for improving yield should be identified; for instance:

~~(a)~~ Choice of varieties;

~~(b)~~ Use of quality and treated seeds;

~~(c)~~ Improvement of farming techniques by disseminating efficient methods;

~~(d)~~ Adoption of such good farming practices, as soil preparation, planting and harrowing;

~~(e)~~ Dissemination of suitable agricultural materials.

122. Studies on these subjects should be reviewed and competent technicians from institutions such as research centres, the directorate of agricultural production and FAO consulted before any action is taken.

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B. PRODUCTION PATTERNS AND TREND AND NORMATIVE PROJECTIONS

123. The major determinants of production are cultivated area and yield. The pattern of cereal, tuber and pulse production should be assessed on the basis of statistics collected over the past 10 years, in order to make trend projections that will reflect the laissez-faire scenarios of the past.

124. The theoretical possibilities for increasing production which will allow new development potentials to be defined, will be subsequently analyzed on the basis of existing studies in this field. Finally, new ambitious objectives will be proposed within the limits of what is feasible, in order to identify surpluses for the NCFD.

125. Senegal, for example, has opted for a more voluntaristic policy in the field of food production, including cereals. Not content with mere projection of demand trends whereby no additional measures are taken in terms of pricing or subsidization with a view to selectively promoting or curbing consumption of some products, the Plan Alimentaire Senegalaise has deliberately set new objectives within the limits of a desired and defined consumption pattern, taking into account genuine potential rather than acquired habits.

126. Thus, in 1986, realistic projections were made of what the millet/sorghum/maize situation will be by the year 2000 (see table 2). From those projections, it is possible to determine and

quantify the share of production which can be allocated to the NCFP.

Table 2: Millet/sorghum/maize situation by the year 2000

SCENARIOS	MILLET/SORGHUM		MAIZE	
	Historical trends	Normative trends	Historical trends	Normative trends
Available National Production (in tones)	415 000	612 000	198 000	378 000
Projected demand by the year (2000: Individual kg/person)	69	73	11	11
Total (in tones)*	716 000	761 000	125 000	125 000
Surplus/short-fall (in tones)	-301 000	-149 000	+ 73 000	+253 000
Possible adjustment of demand (in tones)	- 73 000	-149 000	+ 73 000	+149 000
Surplus/short-fall after adjustment (in tones)	-228 000	0	0	+104 000

Source: Etude de l'approvisionnement en mil et mais au Senegal
Conducted by Louis BERGER International Inc. on behalf of the ITA/USAID Millet Processing Project.

* For a population estimated at 10,425,000 by the year 2000.

C. FOOD PRODUCTION AND SELF-SUFFICIENCY

127. The issue addressed here is the estimation of domestic supply and demand. By combining the growth scenarios of national demand for and production of cereals, tubers and pulses, it should be possible to determine the overall prospects for adjusting supply and demand. These are the historic, normative and maximal trend scenarios.

128. In order to limit the comparisons to potential, realistic and meaningful situations, three combinations of the various growth assumptions of supply and demand should be used, namely: the historical, normative and maximal trend scenarios.

129. The trend scenarios for the chosen time-frame (up to the year 2000 for example) combines growth trend scenarios of production and demand. The assumptions are that:

~~(a)~~ No fresh effort is made to develop production;

~~(b)~~ Consumer prices of imported cereals remain unchanged in real terms, when compared to their current levels (which means that

they follow inflation), whereas local products are supposedly to follow the same pattern by adjustment to market prices;

~~(c)~~ No measure is taken to promote urban consumption of such local products as cereals, tubers and pulses. This is reflected by the stability of the consumption pattern, given stable price relations.

130. The normative trends scenario over the chosen time-frame (by the year 2000 for example) combines what are termed normative growth scenarios for production and demand. The assumptions are that:

~~(a)~~ Maximum effort will be made to improve, within feasible limits, productivity : cereal, tuber and pulse cultivation;

~~(b)~~ Urban consumption of these local products will be encouraged by developing a processing sector (such as the NCFP) and by increasing the price of imported wheat-based products. The level of such price increases in any country will depend on that country's specific situation;

~~(c)~~ Prices of local products will increase, as in the historical trends scenario, at a rate close to that of inflation;

~~(d)~~ Producer prices also follow the same historical trend.

131. The maximal trends scenario for the chosen time-frame (up to the year 2000 for example) combines the normative demand scenario and the maximal production growth scenario. The assumptions are similar to those of the preceding scenario - with the difference being that by means of a policy on the pricing of such local staples as cereals, tubers and pulses an increase of the sizes of land area under them is secured from other crops, such as export crops.

132. Through the data on the various scenarios, it should be possible to develop a production strategy in order to achieve food self-sufficiency. In Senegal, millet having been chosen for the CFP, a study was conducted on the various scenarios based on this cereal (cf. table 3)

Table 3

133. Tables 2 and 3 show that maize has better chances than millet of meeting the raw material requirements of the NCFP in Senegal.

D CONSTRAINTS TO FOOD PRODUCTION

134. It was emphasized earlier that the major production determinants are crop area and yield. What is needed is to identify the major constraints to these two determinants, by taking into account the various interregional differences in terms of soil and yield. Such constraints may be grouped under four major categories for cereals, tubers and pulses, namely:

Table 3: Scenario for the adjustment of millet supply and demand in Senegal (000 tons)

Scenario	Production		Rural Demand	Available to urban consumption	Urban demand	Shortfall
	Gross Output	Consumable Output				
Historical trend using 1985 as reference	558.6	402	458	0	56	-112
Historical trend projected up to the year 2000	575.7	415	612	0	104	-301
Normative trend projected up to the year 2000	849.6	612	612	0	149	-149
Maximal trend projected up to the year 2000	1087	783	612	171	149	+22

Source: Etude de l'approvisionnement en mil au Sénégal Conducted by Louis BERGER International Inc. on behalf of the ITA/USAID Millet Processing Project

OR

~~(a)~~ Environmental/Agricultural: drought, reliability of rainfall, degree of soil fertility or impoverishment and use of inputs;

OR

~~(b)~~ Economic: relative prices of harvested grains/tubers and of seeds, fertilizers or other inputs.

(c) Social/manpower: availability of seasonal manpower, social structure, migration pattern, and cultivation technique;

(d) Physical and institutional infrastructures: transport for sales, extension service, marketing co-operatives, marketing channels and financing.

135. Taking Senegal as an example, an analysis of obstacles to the development of the main cereal crop (millet), choosen within the framework of NCEP led to the implementation of the following recommendations:

(a) Widespread use of quality seeds;

(b) Systematic use, at optimum measured doses, of chemical fertilizers in areas where rainfall exceeds 800 mm;

(c) Availability of agricultural equipment;

(d) Securing producer incomes by creating such markets for produce as processing plants.

136. In Senegal, though prospects for the development of maize production are brighter than those millet, NCFP chose the latter crop. This is due to the fact that, as a general rule, the taste preference of Senegalese is for millet rather than sorghum, or maize; they moreover consume many millet flour-based traditional foods including doughnuts and biscuts. Should the historical trend scenario up to the year 2000 result in a millet deficit of say 300,000 tons the choice would still be justified since adjustments can be made through the gradual introduction of maize into the food habits.

CHAPTER V

ROLE OF WHEAT IN AFRICAN FOOD HABITS

A. IMPORT GROWTH PATTERNS

137. For each country, the situation of wheat supply (commercial imports and food aid) can be traced over periods spanning two to three decades. Import growth over the period chosen, should be critically analyzed and the observed trend interpreted in terms of socio-economic conditions and such facts as the:

(a) Decline or increase in revenue;
(b) Decline or increase in expatriate population;
(c) Urban population growth rate;
(d) Population growth;
(e) Price of wheat on the world market;
(f) Price of wheat on the domestic market;
(g) Effort to promote local cereals;
(h) Change in food habits;
(i) Price of bread on the domestic market compared to that of other countries;
(j) Occurence of drought.

138. Table 4, shows in the case of Senegal, the commercial imports and food aid growth pattern of the country's wheat supply from 1974 to 1985.

Table 4: Growth pattern of domestic wheat demand in Senegal

Year	Commercial imports (in tons)	Total Food aid (in tons)	Total (in tons)
1974	86,700	4,425	91,125
1975	101,900	6,277	108,177
1976	119,900	5,627	125,527
1977	96,000	9,477	105,477
1978	142,400	1,145	143,545
1979	122,900	872	123,772
1980	97,200	16,782	113,982
1981	121,800	41,741	163,541
1982	99,166	32,596	131,762
1983	116,513	24,500	141,013
1984	74,142	64,000	138,142
1985	132,362	31,500	163,862
Average	119,180	21,722	140,902

Sources: - Direction de la Statistique pour les importations commerciales
- Commissariat à la Sécurite alimentaire (CSA) pour l'Aide alimentaire.

139. The considerable growth of wheat demand in Senegal from 1974 to 1985, has been the result of intensive urbanization coupled with a profound change in food habits dominated more specifically by the European pattern of bread and pasta consumption. etc...).

B. TRENDS AND NORMATIVE PROJECTIONS OF DEMAND

140. Using the analysis of factors affecting the growth of wheat demand such as: increase in per capita consumption, population growth, change in food habits, etc..., it is possible to build import growth scenarios for the year 2000: These scenarios, which fail to consider the growth of supply, do reflect a projected demand which should translate into actual consumption to the extent that a corresponding supply of wheat becomes available.

141. The historical trends scenario presupposes that the consumer price index for the various cereals remains unchanged. This situation should prevail if:

(a) The market price of imported cereals is periodically raised by the Government so as to keep pace with inflation;

(b) Shortfalls in local cereal production continue to be made good with imports.

142. According to these two conditions, consumer prices of cereals should keep pace with inflation. With regard to Senegal and considering the historical trends projection of population growth (10,300,000 inhabitants by the year 2000) and the average wheat consumption (in kg/head/year) observed during the period 1975-1989 (35.52 kg per head), total wheat needs by the year 2000 should be 365,856 tons.

143. The wheat import pattern observed (commercial imports and food aid) from 1974 to 1985 shows that will not be possible to import such a volume of wheat or to exceed it under the historical trends scenario.

144. In Senegal as in most African countries, should the historical trends scenario be left to evolve, relatively substantial imports growing at a rate of about 5.5 per cent from 1974 to the year 2000 in the case of Senegal would be required. With the introduction of NCEP, it should be possible to gradually reduce these imports as in a normative trends scenario. In such a scenario, special import quotas and as supported by an NCEP, should be instituted to reduce imports. In Senegal, for instance, wheat imports could be reduced to 20 kg/head/year by the year 2000 instead of the 35.52 kg of the historical trends scenario suggested in table 5. The difference should be made up by local cereals, tuber and pulse staples.

Table 5: Projection of wheat imports in Senegal

(in tons)

Year	Trend scenario	Normative scenario
1985	163,862	163,862
1988		
1989	203,002	
1990	204,168	
1991	225,949	179,570
1992	238,378	182,330
1993	251,491	185,134
1994	265,324	187,980
1995	279,919	190,870
1996	295,317	193,804
1997	311,561	196,784
1998	328,699	199,809
1999	346,780	202,881
2000	365,856	206,000

Historical trend: Annual growth of 5.5 per cent

Normative trend: Annual growth of 1.54 per cent

C. IMPACT OF WHEAT IMPORTS ON THE NATIONAL ECONOMY

145. In African countries, towns are where Western food consumption patterns are transferred or where a highly-westernized intermediate pattern takes shape. The privileged social categories (senior staff trained in Western countries, intermediate staff, etc...) bring in these models and are therefore at the root of the importation of products such as wheat. This is inimical to the economy of these countries owing, above all, to the massive transfer of foreign exchange that it entails.

146. This situation is worsened by advertisements exclusively focused on imported products such as CERELAC and pasta. Since mass communication (radio, television) is developing fast in African countries, these advertisements reach the vast majority of the population (particularly the rural population) and end up denigrating local staples in favour of imported foods.

147. This penetration by the Western pattern is further enhanced by the westernization of mass consumption: menus in school canteens, boarding schools, the army, hospitals, etc. are established on the basis of Western standards. Food aid wheat, despite its usefulness in adjusting cereal demand and supply, goes to accentuate this phenomenon.

148. This change in traditional consumption patterns is greatly enhanced by urbanization due to the high population growth in the major cities and the mass exodus of the working population attracted by the city centres. This reduces growth in local agricultural production and increases dependency on the outside world for such strategic foodstuffs as wheat. That is why wheat imports in Africa increased at an annual rate of 11 per cent. Concretely speaking, it increased from 4.5 million in 1970 to 16 million tons in 1982, corresponding to an annual rate of 21.7 per cent in value, from $US 319 million in 1970 to $US 3,364 million in 1982.

149. The trade balance of a country like Niger, which recorded a shortfall of CFAF 6,300 million francs ($US 18 million) in 1986, would have shown a surplus of CFAF 1,700 million ($US 4.8 million) had the country not imported foreign cereals, particularly wheat, for CFAF 8,000 million ($US 22.8 million).1/

D. FLOUR MILLING AND BAKING INDUSTRIES IN AFRICA

150. The increasing proportion of wheat-based products (bread, pasta, semolina, etc...) in household consumption in Africa, contributed to the development of the milling and baking sectors which offer genuine profit opportunity for private promoters and public authorities alike.

151. In most African countries, there exist flour milling plants which essentially process wheat. Countries in which these wheat processing industrial plants do not exist, content themselves with supplies of finished and semi-finished products from external markets and generally from neighbouring countries.

152. Senegal has two big wheat milling plants: Grands Moulins de Dakar with a wheat capacity of 4,500 quintals/day and the Moulins SENTENAC whose capacity is 1,000 quintals/day.

153. The installed capacity of the Grands Moulins de Dakar alone exceeds the needs of Senegal. In carrying out such an investment, officials of this milling plant speculated upon the constant increase in wheat consumption in Senegal and in the neighbouring countries to which they already export part of their production.

1// Jeune Afrique Economie, No. 97, May 1987, p.29

154. In Senegal, it is in milling and dairy farming that we find the most externally oriented agro-based sector. Wheat-based products such as bread and pasta, symbolize the change in food habits noted in African cities. Their consumption by the urban population is increasing tremendously, especially bread which is being consumed even in the rural area where an interesting market is developing for unsold stale bread from the cities.

155. The development of bread consumption in Senegal, has increased the number of bakeries almost twofold from 145 in 1974 to 273 in 1979 within a space of five years.

E. MINIMIZATION OF WHEAT NEEDS

156. The effort to reduce wheat needs in African countries must start with upgrading local cereals, tubers and pulses and restoring their consumption especially in the urban area.

157. The rapid increase in wheat production in Africa is due partly to the shortage of local resources (cereals, tubers, pulses and other staples) and partly to the change in the quite discernible food habits in cities where the population is influenced by Western consumption patterns.

158. The availability on most markets in African countries of ready-to-eat (RTE) wheat-based products at quite often subsidized prices, contributes to intensify this phenomenon which is gradually gaining ground among the rural folk.

159. One of the main causes of the decline in the consumption of local cereals, tubers and pulses in Africa, is that they do not come RTE. To check both this decline and the increasing dependency on external wheat, co-ordinated action should be taken in terms of their production, marketing and processing.

160. As regards processing, Senegal has encouraged research on the industrialization of traditional cooking, making of new foods from cereals and pulses and the development of composite flours. In these areas, the research findings currently being used by the private sector.

161. This stage of applied research is necessary to obtain RTE products which satisfy the tastes of consumers and to make the processing of local cereals, tubers and pulses profitable, as is already the case with wheat.

162. In Senegal, such research work is entrusted to the Institut de Technologies alimentaire (ITA) which has many results to its credit, particularly in the area of composite flour.

CHAPTER VI

VI. EXPERIMENTAL COMPOSITE FLOUR PLANT

A. TECHNOLOGY FOR MILLING, BLENDING AND BAKING COMPOSITE AND NON-WHEAT FLOURS

163. Milling technologies deal with all operations carried out from the reception of raw materials to packaging, indeed, to the storage of finished products as well as techniques and equipment needed in these operations. (See list and stated prices of equipment in annex III).

164. Blending consists in preparing composite flour with products derived from raw materials that are different in given optimum proportions. Bread-making also applies to both common and refined bread-making (milk bread, sandwich bread, croissants, etc...). After the going into operation of the industrial and commercial phase of bread making, pastry and biscuit-making will be considered so as to diversify.

1. Milling of cereals

165. This essentially includes precleaning, dehulling and reduction to flour.

(a) Precleaning

166. The objective is to remove from the raw material all impurities likely to infest the flour and/or to have a negative effect on its quality and stability.

167. Precleaning consists in scaling to eliminate impurities larger than the grain considered, on the one hand, and in carrying out densimetric separation on the other hand. Densimetric separation makes it possible to eliminate impurities of the same dimension but heavier such as

stones. The lighter impurities can be eliminated through air-separation (suction or air-extrusion). In certain cases, precleaning could include grain humidification.

168. In all precleaning operations there exist accessible technologies as well as possibilities to adapt and even innovate.

(b) Dehulling

169. The objective is to separate, partially or completely, the grain bran from the endosperm. The dehulling degree or rate must be such that the final product obtained is acceptable from the organoleptic viewpoint while efforts are made to preserve as much as possible its nutritive value. Dry dehulling is the most recommended method because it has more advantages than wet dehulling.

170. The designing and functioning of the various dehulling machines are based on the principle of rubbing the grains against rough and abrasive surfaces and against each other. Generally, rough surfaces are either carborundum wheels or resinoid discs or emery wheels. Abrasive cone dehullers are increasingly being discarded in favour of disc or wheel dehullers. Some notes on such machines are provided in the annex.

173. The dehulling operation is of vital importance in the non-wheat flour-making process. The separation of bran from grain must be well done and when necessary, brushing and/or densimetric separation must be carried out. The quality of the dehulling process determines the quality of the finished products. In this respect, the granulometric homogeneity of grains enhances balanced dehulling.

(c) Milling

174. The objective of milling is to produce flour from husked grains. It is necessary to state that flour means any product resulting from crushing whose fineness is determined by its users. Indeed, though particles which make up wheat flour known as baker's flour range from 2 and 150 microns, flour meant for the making of traditional couscous can comprise within it particles equal to or exceeding 500 microns. Milling may or may not be followed by sifting and scaling whose objective is to obtain one or several products of a given granulometric composition or profile.

175. While variable humidification is used in the traditional milling of tropical cereals, on one hand and, in the conventional milling of wheat and maize, on the other hand, it is highly recommended that dampness be avoided in the mechanized milling of tropical cereals. Reasons belying this recommendation are related not only to the nature of the bran of these cereals but also to the stability of finished or semi-finished products.

176. At the moment, there is a wide range of mills and grinding machines that are perfectly suited to the making of flour from cereals, pulses, roots and tubers produced in Africa in particular and in tropical countries in general. Depending on their design and functioning principles, there exist the following mills: hammer mills,wheel mills, pin or spindle mills, attrition mills and cylinder mills.

177. For each type of these mills, there exist varied models and their capacity could go up to from a few kilogrammes to several tons per hour. Each type of mill has advantages and

disadvantages depending on the raw material used and the expected characteristics of the desired finished product.

178. Selection of the most appropriate technology must be guided by technical and economic factors. The industrial fabric and the technical skills of people must be taken into account in order to avoid the errors of the past. Also worth considering are problems relating to maintenance, spare parts and renovation.

2. Other specific and special operations

179. These are operations whose ultimate objective is to introduce changes designed to improve organoleptic quality, nutritive value and/or digestibility. That is why regarding pulses, use can be made of steeping (hot or cold), fermentation, germination, toasting and defattening. As concerns roots and tubers, there are specific pre-milling operations such as peeling, grating, pressing, steeping and fermentation.

180. All these specific or special operations need drying generally and require relatively simple techniques. The objective would be to simply provide the appropriate equipment so that the experimental plant can conduct tests in a good number of areas.

3. Blending

181. It is generally carried out on flour but in certain cases it is possible to effect it on ains before or during milling. Above all, it is necessary to ensure the homogeneity, consistency and stability of the composite flour obtained. At the present stage of research, the characteristics and properties of local flour are not yet sufficiently known, especially their behaviour when blended and the effects which that could have on the stability of composite flour.

182. The means of controlled blending determine the quality of composite flour, and in this respect, the blending techniques are chosen in terms of the nature of the basic components (grains, flour or pasta). Local and foreign constructors have the appropriate machines and equipment available (Archimedean screw, kneading troughs, beaters etc...)

4. Bread-making

183. The objective pursued here is to make French bread (baguette francaise) in a certain number of African countries. However, as stated in Chapter III paragraph E, it is advisable, indeed, recommended, that the notion of bread should be extended to cover new products and all types of possible presentations including English bread.

184. In fact, the current state of the bread-making art has yet to reach the stage of obtaining from composite flour French bread whose specific volume would be equal to that of 100 per cent wheat-based bread, all things being equal. In order to attain an equivalent specific volume, it would be necessary to incorporate additional ingredients. This would entail an increase in production cost. Such a situation would greatly reduce the competitive edge of composite bread over wheat bread. The use of coarse wheat would have mitigated the loss in volume. A cost-benefit analysis should be conducted before any decision is taken in this area.

185. Limiting the notion of bread to the "baguette française" in French-speaking countries is one of the errors of the past which had handicapped many NCFPs. The establishment of the Pamiblé programme in Senegal surely suffered from this. The conventional bread-making techniques are easily more adaptable to the use of composite flour in making millet or English bread.

186. Formulas and methods for making bread from composite and non-wheat flour are available at: I.T.A., B.P. 2765, Dakar, Senegal for millet-wheat and maize-wheat composite flour; FIIRO, P.M.B. 21023, Ikeja, Lagos, Nigeria for composite flours of maize-wheat, sorghum-wheat, cassava-wheat, millet-wheat, and recently non-wheat flour; FRC, P.O. Box 213,

Shambat, Khartoum-north, Khartoum, Sudan for sorghum-wheat composite flour. This information can also be obtained from the ECA (Industry Division), P. O. Box 3001, Addis Ababa, Ethiopia, and from the FAO (Agricultural Industry Service) Via delle Terme di Caracalla. 00100 Rome, Italy, for pre-gelatinization techniques. Many formulas and methods can also be consulted from the Technical Compendium on Composite Flour published by the ECA in 1985.

5. Other applications of composite flour

187. The experimental plant will, above all, concentrate its activities on bread-making. Later on, it must adapt the existing technologies to such areas as the making of pastry, biscuits, pastes and weaning foods. This diversification is highly advisable, indeed, recommendable, because many current or completed experiments in countries of the North and South have achieved encouraging results.

B. PHYSICAL COMPONENTS OF THE EXPERIMENTAL PLANT

1. Buildings

188. The experimental plant will be established over a land area of 80m x 60m that is 48 ares. It shall comprise two main buildings: one for flour milling and the other for the bakery, laboratory, meeting room and offices (see the projection Plan in annex V).

(a) Non-wheat flour manufacturing unit

189. The building will comprise the following:

- Stores for raw materials and finished products. Such stores will allow for phytosanitary treatment, particularly fumigation;

- A machine room for equipment for cleaning, specific and special dehulling operations, milling and blending, bagging and packaging of finished products;

- Staff cloakroom and common office; and

- The mill official's office.

190. Whenever it is necessary, the premises could be extended on the available free space.

(b) Bakery-laboratory

191. The building will comprise the following:

- Premises for storage of flour and other non-perishable foodstuffs;

- Spacious and well ventilated bake-house for equipment and furniture;

- Cloakroom and general office;

- Meeting room for classes and conferences for about 30 people;

- Sufficiently large room for the laboratory, with an office for the head of the special local laboratory, providing space for measuring appliances such as precision scales;

- Office for the head of the experimental plant; and

- Office for the secretariat and other services such as accounting.

- Toilets.

(c) Annex buildings

192. These buildings will provide space for the maintenance service, selling point (shop) and a tasting room.

2. Infrastructural facilities

(a) Shared facilities

193. The plant should be established on land located in an area of easy access but out of residential quarters, preferably on the same premises as the executing agency or in its vicinity. It should be connected to various networks (water, electricity, telephone, etc.). and be equipped with a transformer designed to supply current at 220 and 380 volts. The electrical installations should provide power for external lighting and an alarm system. A stand-by generator should be installed to supply current to the whole experimental plant in the event of a power cut.

194. Connection to the water network should regulate water pressure and flow in order to avoid any drop in pressure that can affect the laboratory and especially the bakery. It will provide for a fire-plug.

195. Provision should be made for a fence and the construction of roadways, the main ones of which will be tarred or cemented. An enclosed parking lot should be constructed for visitors and staff cars.

(b) Specific infrastructures

196. In the flour mill, these infrastructures should essentially comprise:

- Individual control rooms for machines, sockets for immediate connection of machines and equipment for flour milling activities and maintenance services;

- Internal circuits for compressed air, potable and used water, and gas to provide heat during processing.

197. In the bakery and laboratory, provisions should be made for:

- A good system of waste water drainage;

- A ventilation system of wide glass openings for proper lighting and good circulation of air; and

- Easily washable surface preferably with tiles on floors and walls up to a height of 1.5m.

3. Equipment (see annex IV for an indicative list of specific equipment)

(a) Flour milling

198. The cleaning equipment should comprise: a grading machine with air and magnetic separation device, a destoner, a moisture stopper, steeping, fermentation and drying equipment for the processing of pulses, and a scale.

199. The dehulling equipment will comprise: a small disc-dehuller for minor tests, a production PRL/RIIC or NUHUL dehuller, a sifter for supplementary cleaning or measuring of grains before or after dehulling.

200. Equipment for milling, blending and packaging should include: a conventional testing mill for five wheat with an hourly capacity of 10 to 15kg (CHOPIN model), a cylinder grinder with two holes (one grooved and the other smooth) with an hourly capacity of 200 kg or more (BUHLER or OMAS), a single-box plansichter (BHULER), a laboratory sifter (TRIPETTE and RENAUD), a densimetric table for further degerming whenever necessary, a mobile hammer mill with an hourly capacity of 400 to 600 kg, a pin-mill (ALPIN), a flour blender with a ponderal mixing system, a measuring scale and balance, a sack hemmer, portable sewing machine, adjusting and measuring tools and instruments.

(b) Bakery

201. This should comprise: an oven for trial bread-making (CHOPIN), a production oven with pastry furnace and a baking rack with a capacity of 150 to 200 loaves of bread per day, two trial kneading troughs with a capacity of 2 to 10 kg, a kneading trough of 60 litres (100 kg of flour), a 10 x 20 hydraulic divider, a moulder, two cupboards with adjustable locks and accessories, a water cooler with a capacity of 100 to 200 litres, baking moulds and plates, bread racks, scoops and trolleys a measuring scale and balance, a bread volumeter, measuring appliances, crockery trolley, various light equipment and a refrigerator-freezer.

(c) Laboratory

202. This should be designed to meet milling and baking needs in the control and analysis of raw materials, finished and semi-finished products on the one hand, and to satisfy the demands of professionals (industrialists, traders and other users) and administrative bodies operating in the agro-based food sector. In this respect, it will conduct routine and specific analyses on flour from cereals, pulses and tubers with special emphasis on humidity, ash or mineral substances, proteins, lipids, acidity, pH, colour, granulometry, phytosanitary quality.

203. The following equipment should be provided: three laboratory sample grinders (KT, ALPINE, CHOPIN), two laboratory sifters (TRIPETTE and RENAUD, ALPINE), one

nilometer to determine the specific weight of grains, three precision scales, one microscope, one light magnifying glass, one muffle furnace, two precision scales, one ash oven, one multicellular drying oven, two dryers, two-litre blenders, one multipurpose dosage measures, one viscometer, one water filter, one refrigerator-freezer, various light equipment (plates, glasses, light measuring apparatuses (hygrometers, thermometers, chronometers), one hood and one air conditioner.

C. INVESTMENTS

204. Investments must cover the following elements whose details are provided in annex III (in CFAF at the rate of $US 1 = 270 CFAF in July 1990).

(i) Infrastructured facilities (estimates for Senegal)

	Cost	Life span
Land	1,500,000	(PM)
Development	2,500,000	(PM)
Roadways	3,000,000	(30 years)
Fence and parking lot	1,500,000	(30 years)
Water connection	3,000,000	(20 years)
Electrical equipment and installations	10,000,000	(20 years)
Total (infrastructures)	29,000,000	

(ii) Buildings (estimates of Senegal)

Flour mill (312 m^2)	23,400,000
Bakery-laboratory and administrative services (572 m^2)	42,900,000
Maintenance workshops (32 m^2)	4,800,000
Total (buildings)	71,100,000

(iii) Equipment

Flour mill	28,700,000
Bakery	31,930,000
Pastry	7,600,000
Laboratory	24,730,000
Maintenance	3,000,000
Vehicles (2)	14,000,000
Total	109,960,000

(iv) Studies and sundries

5% of (i + ii + iii)	10,503,000

(v) Working capital 37,120,000

205. The working capital was calculated for a three-month operation period. It includes staff salaries broken down as follows:

	Senior Staff	Technicians	Workers	Labourers
Flour mill	1	2	1	0
Bakery	0	2	1	0
Laboratory	0	2	0	0
Maintenance	1	1	1	0
Management/ co-ordination	1	2	3	1
Total	3	9	6	1

D. ECONOMIC PROFITABILITY AND JUSTIFICATION OF NCFP

206. The above breakdown of investments shows a total amount of about CFAF 275 million i.e. about US $1,018,000 needed to implement the NCFP.

	(in CFAF million)
Infrastructures	29.00
Buildings	71.00
Equipment	110.00
Studies and sundries	10.50
Working capital	37.10
Contingencies	17.30
Total	275.00

207. Not all benefits accounting from the industrial and commercial use of flour can be measured. For instance, reduced food dependency constitutes a far-reaching policy achievement difficult to quantify; the increased food security that the programme achieves for the country has a basically social objective namely: to provide a high nutritional level and hence ensure the health of the population. This will indirectly make the population more productive for the country. However, composite flour development entails the reduction or abolition of wheat

imports, and boosts the production of local foodstuffs whose economic and financial impact can be quantified.

208. Quite apart from the immeasurable socio-economic benefits, the immediate macro-economic benefit from the NCFP will be substantial foreign exchange savings estimates of which are given in table 6 for some countries. The initial investment for the implementation of a NCFP of about $US 1,018,000, financed by the State or by a donor, will be more than compensated for by the foreign exchange savings made right from the first year of marketing of composite flour bread. This first year would correspond to the second or third year of implementation of the programme.

Table 6: Foreign exchange savings for composite flour bread comprising 30 per cent non-wheat flour and 70 per cent wheat flour
(US dollars)

Country	Value of wheat imports in 1988 1	Foreign exchange savings 2
Angola	15,500	4,650
Cameroon	25,900	7,770
Côte d'Ivoire	39,000	11,700
Kenya	11,200	3,360
Mozambique	23,400	7,020
Niger (The)	13,300	3,990
Senegal	22,420	6,726
Somalia	32,200	9,660
Sudan (The)	104,000	31,200
Tanzania	21,500	6,450
Togo	12,070	3,621
Zaire	39,500	11,850
Zimbabwe	13,000	3,900

(1) Source: FAO Trade Yearbook, 1988.

(2) The volume of wheat imported is supposed to be used entirely for composite flours.

209. The cereal and pulse requirements for gradually replacing and eventually phasing out wheat imports under a normative scenario can be determined from table 5 (see table 7) .

Table 7: Estimates of maize and soya for the NCFP in a normative scenario (proposals for Senegal)

		Maize		Soyabeans		Wheat 2	
Year	Wheat 1	Tonnage	Rate %	Tonnage	Rate %	Tonnage	Rate %
1989							
1990	176,581					100	
1991	179,570					100	
1992	182,330					100	129,594
1993	195,134	30	59,507			70	131,536
1994	187,980	30	60,422			70	131,586
1995	190,870	40	81,801	20	38,174	40	76,348
1996	193,804	40	83,059	20	36,761	40	77,522
1997	196,784	50	105,420	20	39,357	30	59,943
1998	199,809	50	107,041	20	39,962	30	59,943
1999	202,881	60	130,424	20	40,576	20	40,576
2000	206,000	70	132,429	20	41,200	20	41,200
2001	209,172	70	156,879	20	41,833	10	20,917
2002	212,393	70	159,295	20	42,479	10	21,239
2003	215,664	80	184,855	0	43,133	0	0

Wheat 1: Volume of wheat to be imported in a normative scenario.

Wheat 2: Volume of wheat to be imported in a normative scenario within the context of a NCFP.

Maize: (Wheat 1 x 75 per cent/70 per cent) x rate of incorporation 75 per cent = extraction rate for wheat flour and 70 per cent = extraction rate for maize flour.

Soya: Wheat 1 x rate of incorporation (extraction rate for wheat flour = extraction rate for soya flour based on the weight of the beans.

210. The cereals, tubers and pulses produced locally to replace imported wheat (see the example for Senegal in table 7), will generate additional revenue in the farming areas. An approximate calculation of such additional revenue can be made from table 7 on the basis of the following assumptions. The producer price for maize is fixed at CFAF 50 per kilo during the entire period and the cost of intermediate operations (collection, storage and transportation up to the mill) estimated at CFA 25 per kilo. For soya beans, the producer price and the cost of intermediate processes are estimated at CFAF 100 and CFAF 25 per kilo respectively. Table 8 presents the level of additional revenue that can be injected in to the national economy on the basis of these assumptions.

Table 8: Additional revenue for the national economy
(in millions of CFA francs)

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Agricultural sector											
- Maize	2,975	3,021	4,090	4,153	5,271	5,352	6,521	6,621	7,844	7,965	9,243
- Groundnut			3,817	3,876	3,936	3,996	4,057	4,120	4,183	4,248	4,313
Intermediary operations											
- Maize	1,487	1,510	2,045	2,076	2,635	2,676	3,260	3,310	3,822	3,982	4,621
- Groundnut			954	969	984	999	1,014	1,030	1,046	1,062	1,078
Total for the national economy											
- Maize	4,462	4,531	6,135	6,229	7,906	8,028	9,781	9,931	11,766	11,947	13,864
- Groundnut	0	0	4,771	4,845	4,920	4,995	5,071	5,150	5,229	5,310	5,391
Total	4,462	4,531	10,906	11,074	12,826	13,023	14,852	15,081	16,995	17,257	19,255

211. The processing of local raw materials (maize and soya beans and/or groundnuts in the case of Senegal) can be started at the production areas with the cleaning, decortication and grinding into grits of the grains in order to facilitate the in transportation to the mills to be blended with wheat. These operations would also promote the establishment of small rural industries, curb rural-urban drift and strengthen the rural economy. At the micro-economic level, the fixing of the price of imported wheat and that of local raw materials in such a way that all-wheat bread is more expensive than the composite flour bread would give bakers a higher profit margin on composite flour bread. Consumers on their part, would gain financially by buying the composite flour bread or the 100 per cent non-wheat bread. At the macro- and micro-economic levels taken together, the foreign exchange savings and additional revenue for rural folk and bakers would be an incentive for them to aim at increasingly higher rates of substitution of imported wheat by local cereals, tubers and pulses.

212. The experimental unit is itself designed to be economically viable (profitable) from the third year of operation when the main mill with a capacity of 500 kg/hour, would have attained the normal working speed of 400 kg/hour of flour production for both bread and traditional uses.

213. With regard to the financial autonomy and profitability of the NCFP, the example of Senegal is illustrated by tables 9 and 10 with detailed calculations of costs in annex 4. The unit can function autonomously, generate its own resources and, to a degree, finance itself if neecessary. The only government expenditure will be the initial outlay which, in any case, will be quickly recovered through foreign exchange savings.

Table 9: Estimate of income for Senegal
(in CFA francs 1,000)

	First year	Second year	Third year
B.F. (bread flour)	8,000	16,000	32,000
FTU (flour for traditional use	15,488	19,494	20,133
Semolina	15,655	21,200	21,500
By-products	3,090	4,635	6,180
Sub-total for flour mills	42,233	61,329	79,813
Composite flour bread	12,792	21,320	31,980
Milk bread	3,465	8,328	8,328
Cakes	4,164	8,328	8,328
Sub-total for bakeries	20,421	36,578	47,238
Laboratory analysis	14,625	14,625	14,625
Grand total	78,279	112,832	141,676

Table 10: Determination of the profitability of the experimental unit
(in CFA francs 1,000)

	First year	Second year	Third year & following
Raw materials	34,572	51,358	69,144
Other materials	6,000	9,000	12,000
Chemicals	100	150	150
Workshop & laboratory supplies	250	250	300
Wages	22,464	24,710	28,080
Manufacturing costs	7,567	9,227	11,965
Electricity	1,800	2,250	2,700
Gas	700	1,050	1,400
Fuel and maintenances	2,015	2,150	2,300
Water	450	525	600
Repair and maintenance	2,602	3,252	4,065
General management costs	17,224	16,972	21,330
Wages	10,224	11,247	12,730
Representational costs	300	300	300
Office supplies		600	
Mail & telecommunications	1,200	1,200	700
Insurance	1,500	1,500	1,200
Taxes	1,000	1,500	2,000
Travel	500	1,575	1,650
Training	500	500	550
Documents & Information		500	600
Works & services	500	550	600
Selling & distribution costs	800	1,125	1,450
Production cost	89,475	115,792	114,069
Earnings	78,279	112,832	141,676
Gross production margin	(11,195)	(2,960)	27,607

See annex 4 for calculation method.

CHAPTER VII

STUDY ON THE LAUNCHING OF THE NCFP ON AN INDUSTRIAL AND COMMERCIAL SCALE

A. PRICING MECHANISM

214. The experience of Senegal shows that consumers expect composite flour or non-wheat bread to be inferior to all-wheat bread. Yet, the price of imported wheat is so low in most African countries that mixing it with local flours automatically increases the price of the bread.

215. Considering the economic advantages of composite flour bread, including foreign exchange savings, revitalization of local production and increased revenue for peasants, it is important to apply a pricing mechanism that could promote composite flour bread.

216. Where the two types of bread are to be marketed together (as in the case of the second "pain riche" operation in Senegal), it is important to consider a pricing mechanism that establishes a price differential wide enough to stimulate the consumption of composite flour bread. This would also help to offset the specific volume advantage of all-wheat bread.

217. Where only composite flour bread is marketed, (as in the case of Pamiblé - millet-wheat composite flour bread), a pricing mechanism should be found that prevents any possibility of cheating by bakers who could be tempted not to adhere to the recommended mixing levels. To avoid this happening, the mixing should be done at the mill.

218. Judging from the the Senegalese experience, it would be advisable to initially sell the two types of bread together and levy an appropriate tax on wheat flour so as to generate the necessary financial resources to support the production of local flours cheaply. Generally, the institution of a high tax on wheat imports (see table 11 on proposals for Senegal) and of its by-products could stimulate the consumption of local products including composite flour and non-wheat bread. The monies thus collected could be paid into a Fund for the promotion of

composite flours to be managed by the Inter-ministerial Committee for the Co-ordination of the NCFP.

219. Such a fund could be channelled through an appropriate mechanism for the following purposes.

- Supporting the price of composite flour bread and the raw materials for non-wheat bread for as long as necessary;
- Supporting advertisement at selling and other rantage points throughout the country;
- Introducing annual awards for bakers who distinguish themselves by their innovations in the manufacture and sale of composite flour bread; etc.

220. According to the projections made for Senegal (see table 5) the country would be importing 365,856 tonnes of wheat by the year 2000 if the present trend continues. To avoid such dependence, the adoption of a combination of measures comprising wheat import quotas and taxation could help bring down the level of imports to 20,600 tonnes, based on a voluntarist and normative scenario. The aim of the quotas and taxation is to encourage the people to reduce their overall consumption of all-wheat bread by increasing the price of such bread. Proposed prices are indicated in table 11. The current price of CFAF 65 should be maintained for composite flour bread while the price of all-wheat bread sold along with composite flour bread is increased significantly (see alternative 1, 2, 3 in table 11) to achieve the desired deterrence.

Table 11: Price of wheat bread, taxes and budget revenue
(proposals for Senegal)

	Situation	Alternative 1	Alternative 2	Alternative 3
1. Price per kg of 75% extract wheat flour sold at the baking	160 F	585 F	716 F	1,010 F
2. Weight of flour per 200 g bread	153 g	154 g	153 g	153 g
3. Price of 153 g of wheat flour	24.5 F	89.5 F	109.5 F	154.5 F
4. Production cost + profit for 200 g bread	40.5 F	40.5 F	40.5 F	40.5 F
5. Selling price of 200 g all-wheat bread	65 F	130 F	150 F	195 F
6. Additional tax per kg of wheat flour (price A 1, 2 and 3 = 160	actual	425 F	556 F	850 F
7. Corresponding tax per kg of imported wheat	actual	319 F	417 F	564 F
8. Net annual budget revenue (millions CFA francs for imports				
in 1993 - 129,594 tonnes	actual	41,340	54,050	73,091
in 1998 - 59,943 tonnes	"	19,122	24,996	33,808
in 2002 - 21,239 tonnes	"	4,651	8,857	11,979
in 2003 - 0	"	0	0	0

1. The price per kilo of flour in alternatives 1, 2 and 3 are deduced from the current selling price of 200 g bread.
2. Calculated on the basis of a bread/flour ratio of 1.312.
3. Calculated from 1 and 2.
4. Deduced from 3 and 5 (on the basis of fixed selling price).
5. Price fixed by the Government and/or proposed by the International NCFP co-ordinating committee.
6. Tax calculated from 1 or alternative 1, 2, 3 - 160.
7. Price culculated by extrapolation on the basis of 6, the flour represents 75 per cent of the grains.
8. Calculated by multiplying the unit tax (7) by imported wheat quantities (see wheat 2, table 7).

B. SUPPLY OF NON-WHEAT RAW MATERIALS

220bis. The supply of local raw materials (cereals tubers and pulses) is one of the major constraints in the smooth running to the NCFP. Although the farming system, in most countries, is capable of quickly responding to new demands, such arrangements as would best secure the supplies should be made in each country.

221. Considering the conditions for the marketing of millet in Senegal, the following steps could be recommended for supplying mills:

- The traditional commercial channels should be used and the exclusive dependence on official marketing structures which only collect raw materials during bumper years avoided;

- With the seasonal price changes, it is recommended to stock-up all the supplies that will be required throughout the year as soon as harvesting begins this entails having adequate storage facilities;

- Using of regional price differentials, supplies should be bought from the structurally surplus regions;

- Primary wholesalers and collectors who are already experienced and who are best able to provide supplies at reasonable cost should be used;

- Recourse to such wholesalers requires purchases, deliveries and primary storage to be made at urban centres in the collection areas. The mills should therefore send purchasing agents to such centres to receive, weigh, check the quality of grains and pay the local wholesalers. Primary storage could be undertaken locally mainly by hiring existing storage infrastructure. This would make it possible to spread out the transfer of needed supplies to the mills as and when transport facilities become available;

- Production contracts should be established. This entails identifying, selecting and supervising a small number of individual producers or groups of producers within a given structure and to sign contracts with them. This system would enable the NCFP to directly control and promote production (variety, quantity, quality, basic processing, etc.) that it requires independently of the efforts of national rural development departments. The supervision could include the provision of agricultural inputs to farmers in exchange for their commitment to deliver all or part of their production to NCFP mills;

(g) Marketing co-operatives have been formed in certain countries and are very active. Such groups could constitute a reliable alternative for the supply to the NCFP of local cereals, tubers and pulses. For instance in the Niger, the Union nationale des coopératives strives to deliver a given volume of sorghum-millet to the NCFP, during good years and bad, under annual fixed purchasing contracts.

C. PRODUCTION AND BLENDING OF FLOURS

222. Flour production and blends techniques are described in chapter VI.A. It should be noted, however, that the blending can be done at the mill. Experience has shown that it is in fact possible to grind wheat together with other cereals so long as such cereals are suitably prepared (dehulled, degermed and broken down into grits in the case of maize [1] and dehulled in the case of millet-sorghum). When necessary, the flour can be dried by current techniques used in traditional mills.

223. In the industrial and commercial use of composite flours, it is important that the quality of the non-wheat flour should be constant and conform to technical specifications for obtaining a good secondery processed product, namely a good composite flour bread. For the production of such flour, it is recommended to use existing mills as much as possible before thinking about the establishment of new units by private promoters. In any case, account should be taken of available research findings.

224. Within the context of the Pamiblé operation in Senegal, the public authorities had granted tax relief to two mills in order to encourage them to acquire additional equipment for the production of millet flour.

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[1] The milling together of wheat and maize at the Grand Moulins de Banfora in Burkina Faso does not require any special prior preparation of the maize.

D. TRAINING OF FLOUR MILLERS AND BAKERS

225. This phase is decisive for the industrial and commercial success of the NCFP. Training should be financed by the NCFP and participation of the operators concerned should be mandatory. Depending on the country and region, the training could be carried out in two stages. Firstly, training of trainers and secondly the training of the staff of flour mills and bakeries by trainers. These trainers should come from commercial mills and bakeries and they will be required to train their colleagues.

1. Training of flour millers

226. Such training should be provided in the form of workshops during which supervisors and trainers deal with all the technical and economic aspects of milling with explanations of specific experiences and practical cases. The training course should focus on the techniques of simultaneous milling of wheat and non-wheat materials in the existing wheat mills and the separate milling followed by blending after milling, problems of conservation and storage of the flours.

227. The courses should be geared towards production and marketing officials at the industrial and semi-industrial mills as well as cereal importers. Special attention should be paid to the quality of the imported wheat, given that its dilution with non-wheat flours reduces its rheological qualities. During the launching period, the NCFP should provide assistance and advise in the form of periodic visits and monitoring of the quality of basic and composite flours produced by the mills.

2. Training of bakers

228. This should be done at two levels and should be mandatory. The first level of training should be aimed at the proprietors, directors and managers of bakeries. Their training should consist of impressing upon them the need to stop importing wheat and the various aspects of the use of composite and non-wheat flours in bread making.

229. The training should be carried out in the form of seminars in each regional or provincial capital and should address the following issues, without getting into too much detail: objectives and importance of the NCFP, the role of bakery proprietors and managers in the success of the NCFP, advantages of composite flour bread (yield).

230. The second level of training should be aimed at production officials. Their training should be carried out in the form of seven to 10-day workshops with the assistance of a selected bakery, and should be based on the Trainer's Manual on the Production and Utilization of Composite Flours.

231. If necessary, the training should be provided in the appropriate national languages and should include practical sessions with an examination at the end of each seminar. The NCFP should follow-up the people trained through visits and respond to the requests of bakeries during the launching phase.

232. The seminars should be organized in the provincial capitals for about a dozen or so participants per session. Each bakery will transport its participants to the seminar. Participants should continue receiving their salaries in the form of paid leave for the duration of the seminar.

E. MARKETING AND DISTRIBUTION STRATEGY

233. Bakeries will be directly supplied with composite flour through the usual distribution channels. The bread will also be sold to the public through the existing channels such as at counters in bakeries, bread kiosks, neighbourhood shops, supermarkets, traditional markets, railway and lorry stations, eating houses, restaurants, cafeterias, canteens, hotels, etc.

234. During the acceptability and pre-marketing trial period, it is important to carefully study the motivations of consumers, identify the pshychological bases for their behaviour and use the appropriate distribution channels accordingly.

235. The Pain-riche experiment in Senegal began by targetting the distribution channels frequented by the affluent classes of society (neighbourhoods of the intellectuals and the rich, big hotels, supermarkets, restaurants, grocery shops, etc.). The acceptance of composite flours or non-wheat flour breads by such people could enhance the value of the product and hence its popularization among the other classes of the society. This kind of marketing strategy requires the gradual introduction of the composite flour bread on the market.

236. Besides, the types and forms of composite bread to be offered to consumers, be it baguette, small loaves, soft bread, fancy bread, 200-, 100- or 50 gms bread, should also be studied in detail.

237. Following the two experiences in Senegal of the marketing of composite bread, namely Pamiblé and Pain-riche, the following recommendations could be made:

(a) Instead of selling the composite bread alone, it would be preferable to strat selling the two types of bread, composite flour and all wheat bread together right from the outset;

(b) New forms of composite bread should be introduced including small sugar loaves which are well liked by children. The innovations should be made mostly in accordance with the segments of the markets being targeted;

(c) A price differential in favour of composite flour bread should be applied right at the beginning to enable consumers to quickly discover the benefits of this bread and to get accustomed to it;

(d) Distribution channels should be carefully selected so as to satisfy consumer demands as fully as possible (for some channels hot bread will be preferred at certain hours of the day);

(e) The appropriate promotion-publicity strategy should be applied to each segment of the market.

F. CHECKLIST OF ACTIVITIES FOR LAUNCHING THE NCFP

238. The following is an unexhaustive list of activities to be undertaken by the various agents from the beginning to the end of the experimental phase.

239. The Government should:

(a) Appoint members of the Inter-ministerial Co-ordinating Committee of the NCFP (ICC/NCFP). The Chairman of the ICC should be a senior official at the Office of the President of the Republic while the Secretary of the Committee should be the Director of the Executing Agency;

(b) Officially inaugurate the work of the ICC and the NCFP. During the inaugural session, the Government should give directives to the ICC to replace current bread with composite bread containing increasing quantities of local flours and eventually with 100 per cent local flour within the quickest possible time;

(c) Set new prices for imported wheat and local raw materials on the proposal of the executing agency of the NCFP through the ICC. The new prices for imported wheat should be higher for imported wheat than for local raw materials and thus make the latter more competitive;

(d) Enact and disseminate a new law on food giving a new definition of bread which makes the manufacture of non-wheat breads official;

(e) Allocate the necessary resources for the execution of the NCFP;

(f) Facilitate and ensure application of the policies and strategies for implementing the NCFP.

240. The ICC/NCFP should:

(a) Identify an executing agency and make a proposal to the Government;

(b) Prepare the terms of reference of the ICC and of the executing agency;

(c) Prepare and propose to the Government for enactment and dissemination a new food law defining bread;

(d) Prepare and submit to the Government for adoption a study comprising a new pricing policy on imported wheat and local raw materials;

(e) Revise and adopt the study prepared by the executing agency on modalities and strategies for providing non-wheat raw materials for the NCFP;

(f) Supervise the implementation of the NCFP by finding solutions to problems encountered.

241. The executing agency of the NCFP should:

(a) Prepare an implementation plan for the NCFP;

(b) Draft a food law defining bread;

(c) Prepare a detailed study proposing a new pricing mechanism for imported wheat and local cereals, tubers and pulses;

(d) Develop a training programme for flour millers and bakers on the basis of the available training manual (when, how, where, number of participants in each training session, etc.);

(e) Prepare and invite for the supply of the flour milling, bakery and laboratory equipment necessary for the experimental unit;

(f) Prepare and invite bids for the construction of the buildings (if the executing agency does not have the required facilities) and supervise their construction as well as the establishment of the physical infrastructure (water, electricity, gas, etc.);

(g) Prepare a plan for the installation of the equipment and supervise the installation work;

(h) Prepare a plan for the supply of raw materials;

(i) Carry out control tests on the materials and make an appropriate report to the ICC;

(j) Receive equipment after the establishment and commissioning exercise;

(k) Produce composite flours incorporating increasing volumes of local flours and use them for baking bread; try various methods and procedures already used by institutions such as ITA, FIIRO, FRC, TNO and FAO (See Annex 2);

(l) Carry out acceptability and premarketing tests;

(m) Select a number of commercial bakeries and carry out expanded premarketing tests;

(n) Develop a strategy for co-opting more bakeries into the NCFP.

Annex 1

Wheat imports to Africa (wheat and wheat flour in wheat equivalent

(quantity in 1,000 tonnes and value in $US 1,000)

Country		1960	1965	1970	1975	1980	1985	1988
Africa	Quantity	1,729	4,089	4,673	9,224	15,470	19,717	19,797
	Value	119,730	299,000	327,000	1,874,000	3,272,732	3,721,320	3,499,110
Algeria	Quantity	557	274	340	1,576	3,001	4,038	4,392
	Value	44,310	21,700	26,300	385,000	690,119	751,610	666,000
Angola	Quantity	10	48	94	97	164	126	146
	Value	800	3,300	7,000	20,000	31,000	18,200	15,500
Benin	Quantity	-	6	10	7	43	24	76
	Value	-	500	700	500	9,900	3,850	11,200
Botswana	Quantity	-	-	-	-	29	38	45
	Value	-	-	-	-	8,216	7,790	8,000
Burkina Faso	Quantity	-	11	26	13	27	30	34
	Value	-	2,000	3,600	9,700	6,955	4,700	5,000
Burundi	Quantity	-	3	12	7	18	20	15
	Value	-	400	1,000	2,400	6,494	7,360	3,520
Cameroon	Quantity	-	31	53	66	117	81	219
	Value	-	2,500	4,000	15,000	27,665	12,410	25,900
Cape Verde	Quantity	-	3	4	5	13	15	14
	Value	-	400	400	1,600	1,352	1,500	1,520
Central African Republic (The)	Quantity	-	6	9	10	11	16	36
	Value	-	600	1,000	2,700	3,619	3,480	7,500
Chad	Quantity	-	2	9	9	5	36	39
	Value	-	500	1,500	2,700	1,560	7,100	7,600
Comoros	Quantity	-	2	2	2	1	3	3
	Value	-	200	100	400	383	520	1,330
Congo (The)	Quantity	-	16	23	39	84	86	104
	Value	-	1,600	1,600	8,200	19,345	16,160	13,400
Egypt	Quantity	631	2,078	1,232	3,404	5,423	6,996	7,239
	Value	38,650	142,000	65,600	66,300	1,035,000	1,393,000	1,580,000
Equatorial Guinea	Quantity	-	2	-	-	-	4	3
	Value	-	100	-	-	-	730	800
Ethiopia	Quantity	na	26	71	-	396	659	107
	Value	-	1,500	5,100	-	64,400	142,970	192,000
Djibouti	Quantity	-	5	7	7	14	21	23
	Value	-	400	700	1,200	3,426	3,700	4,100
Gabon	Quantity	-	6	-	57	25	45	45
	Value	-	600	-	6,000	5,760	7,600	7,900
Gambia (The)	Quantity	-	2	4	2	11	9	26
	Value	-	200	300	400	2,800	2,000	4,800
Ghana	Quantity	-	51	85	84	131	77	141
	Value	-	5,500	7,200	19,800	31,000	13,550	21,800
Guinea	Quantity	-	22	17	23	39	67	93
	Value	-	600	1,000	3,400	6,400	11,000	11,000
Guinea Bissau	Quantity	-	-	6	1	3	8	6
Côte d'Ivoire	Quantity	-	64	100	79	197	211	249
	Value	-	5,300	7,500	12,600	45,977	36,520	39,000
Kenya	Quantity	1	10	3	82	49	150	76
	Value	110	800	300	11,400	13,579	24,310	11,200

Annex 1 (contd.

Country		1960	1965	1970	1975	1980	1985	1988
Lesotho	Quantity	-	14	35	35	68	52	45
	Value	-	4,000	10,000	4,700	12,795	8,400	6,400
Liberia	Quantity	-	5	8	10	11	17	22
	Value	-	600	1,000	2,700	3,689	3,760	4,100
Libyan Arab	Quantity	9	136	238	501	745	559	675
Jamahiriya	Value	660	8,000	15,000	-	180,449	110,000	99,000
Madagascar	Quantity	-	26	34	15	37	32	49
	Value	-	3,000	2,000	3,000	10,024	3,580	7,430
Malawi	Quantity	-	13	21	19	23	22	10
	Value	-	800	2,000	4,200	6,965	5,690	2,590
Mali	Quantity	-	20	16	48	22	58	34
	Value	-	800	1,300	9,200	9,000	9,950	5,360
Mauritania	Quantity	-	12	7	14	81	158	133
	Value	-	1,000	400	2,000	14,300	21,500	17,900
Mauritius	Quantity	-	46	63	80	80	85	83
	Value	-	3,000	4,100	16,600	22,124	15,940	16,510
Morocco	Quantity	175	312	414	1,383	1,693	1,966	1,469
	Value	11,620	20,000	29,200	254,500	329,945	266,110	183,420
Mozambique	Quantity	28	50	74	116	192	104	168
	Value	2,060	2,700	5,000	25,500	41,000	17,000	23,400
Niger (The)	Quantity	-	2	7	6	26	68	67
	Value	-	200	800	1,000	6,637	11,800	13,300
Nigeria	Quantity	na	56	267	407	1,176	1,442	25
	Value	na	9,800	22,300	89,400	240,860	369,940	4,000
Rwanda	Quantity	-	2	11	10	6	14	6
	Value	-	100	1,300	3,000	2,430	4,530	2,700
Sao Tome & Principe	Quantity	-	2	3	3	4	15	4
	Value	-	200	200	600	800	710	650
Senegal	Quantity	63	61	113	104	85	115	137
	Value	4,490	5,300	8,500	22,000	20,493	18,120	22,420
Seychelles	Quantity	-	1	2	2	2	3	3
	Value	-	100	200	500	771	800	940
Sierra Leone	Quantity	-	20	37	25	20	27	22
	Value	-	2,000	3,500	5,700	6,532	4,290	4,600
Somalia	Quantity	-	23	31	31	91	150	137
	Value	-	1,600	2,000	5,400	35,561	37,500	32,200
Sudan (The)	Quantity	na	131	229	124	224	1,073	650
	Value	na	9,000	15,000	23,000	64,703	180,000	104,000
Swaziland	Quantity	-	-	-	-	-	17	28
	Value	-	-	-	-	-	2,290	3,740
Tanzania	Quantity	2	48	32	159	45	66	88
	Value	180	4,000	2,600	34,700	11,851	13,360	21,500
Togo	Quantity	-	7	15	na	19	24	67
	Value	-	700	100	na	6,581	5,030	12,070
Tunisia	Quantity	154	180	454	265	651	487	1,251
	Value	10,850	12,700	34,000	39,000	155,571	70,810	201,000
Uganda	Quantity	-	32	26	-	7	12	22
	Value	-	2,700	2,000	-	1,700	2,150	3,300
Zaire	Quantity	-	79	116	104	177	196	265
	Value	-	7,600	9,000	21,600	41,400	33,200	39,500
Zambia	Quantity	-	30	107	160	179	67	35
	Value	-	2,000	6,000	19,400	30,688	12,680	5,600
Zimbabwe	Quantity	98	90	57	12	3	139	75
	Value	5,980	5,000	4,000	2,000	503	20,920	13,000

Source: FAO Trade Yearbook.

Annex 2

RESEARCH INSTITUTES EXPERIENCES IN COMPOSITE FLOUR MAKING

Research institute	Raw materials used	Products developed and rate of incorporation of substitutes
1. University of the West Indies (Trinidad)	Wheat flour sweet potatoes, yam, dried fruits, cotton flour, fish protein concentrate	Bread (10 to 25 per cent) Cakes (20 per cent) Biscuits (30 per cent)
2. Tropical Products Institute (Culham, England)	Wheat flour Cassava, yam, sorhum, rice, maize, millet, cotton flour, coconut, fish protein concentrate	Bread up to 40 per cent Biscuits (cassava/sorghum mixture)
3. Instituto Centro-Americano de Investigacion Technologia Industrial (ICAITI, GUATEMALA)	Wheat flour, potatoes, cassava, maize	Bread (10, 25 and 30 per cent)
4. Institutio de Investigaciones Technologicas (Bogota, Colombia)	Wheat flour, soya, cassava	Pastries (75 per cent), Bread (20 per cent) Biscuits,
5. Universidad Nacional de Asuncion, Instituto de Ciencias, (ASUNCION, Paraguay	Wheat flour cassava flour	Bread (up to 10 per cent) Biscuits (up to 10 per cent)
6. Kansas State University, Manhattan, Kansas, USA	Wheat flour, soya, cotton flour, fish protein concentrate, sesam seeds, rice, cassava	High-protein bread (30 per cent) bread with high starch content (40 per cent)
7. Roman Catholic University of Louvain, Belgium	Cassava, potatoes, maize, rice	Bread and other baked goods
8. Bundes Forschungsandstalt für Getreideverarbeitung Detmold, Germany	Wheat flour, maize, soya and cassava flour	Bread (3 to 10 per cent), biscuits (100 per cent)
9. Food and Nutrition Research Centre, Manilla, Phillippines	Wheat flour, coconut, mung-bean (leguminous)	Pasta (50 per cent), bread and biscuits (15 per cent)
10. University of Zagreb, Laboratory of Cereal Processing, Zagreb, Yugoslavia	Wheat flour, sunflower flour, soya, maize, potatoes	Bread (15 to 33 per cent), pasta (33 per cent)

Annex 2 (contd.)

RESEARCH INSTITUTES EXPERIENCED IN COMPOSITE FLOUR MAKING (Cont'd)

11. Grain Research Laboratory (Winnipeg, Canada)	Wheat flour, cassava, soya, legumes	Bread
12. Institut de Technologie Alimentaire (Dakar, Senegal	Wheat flour, sorghum, cassava, groundnut, fish protein concentrate	Bread (30 per cent), pasta (33 per cent)
13. Instituto Nacional do Pao, Lisboa, Portugal	Wheat flour, sweet potatoes, sorghum, soya, rice, cassava	Bread (up to 35 per cent)
14. Ege Universitesi, Ziraat Fakultesi, Bornova, Izmir, Turkey	Wheat flour, soya, potatoes	Bread (10 per cent)
15. Department of Agriculture, Nadi, Fiji	Wheat flour, maize, sorghum	"ROTIS" bread (up to 50 per cent)
16. Research Institute of the Management of Flour Mills and Bakeries, Praha 4, Checoslovakia	Wheat flour, rye, soya, gluten, wheat germ	Bread for diabetics, biscuits
17. Technoloski Fakultet Yugoslovenski Institut Za Prehrambenu Industryu, Novi Sad, Yugoslavia	Wheat flour, wheat germ, soya, gluten	Biscuits for diabetics, pasta, bread
18. Universitario di Chimica Bromatologica Laboratorio Provinciale di Igiene e Profilassi di Grémona (Cremona, Italy)	Wheat flour, maize	Pasta
19. Central Food Technological Research Institute, India, Mysore 2	Tests on a number of flour mixtures, with and without wheat flour	Bread, pasta, biscuits, typical Indian products
20. Institute for Cereals, Flour and Bread TNO, Netherlands, Wageningen	Wheat flour, soya, cassava, groundnut, millet, sorghum, maize, rice	Bread (30 per cent), biscuits (100 per cent)
21. Universidad Agraria Instituto de Selva La Molina (Lima, Peru)	Wheat flour, boiled potatoes	Bread (20 per cent)
22. Federal Institute of Industrial Research Oshodi, Ikeja, Lagos, Nigeria	Wheat flour, cassava, soya, maize	Bread (30 per cent), cakes (50 per cent), biscuits (50 per cent)
23. Food Research Centre, Khartoum, Sudan	Wheat flour, sorghum	Bread (20 to 25 per cent)

Annex 3:

EQUIPMENT

A1: Equipment and approximate costs (in CFA francs)

A.	Flour mill		
1.	Cleaning		6,400,000
-	Laboratory cleaner - separator	3,000,000	
-	Destoner or lab densimetric table		3,000,000
-	200 kg weighing machine	400,000	
2.	Decortication 4,3000,000		
-	Scale	300,000	
-	SISMAR/CNRA-CRDI dehuller	1,500,000	
-	PRL/RIIC dehuller	2,500,000	
-	Rotary sifter	500,000	
3.	Milling		13,300,000
-	SISMAR Noflacy mill	1,500,000	
-	MGS hammer grinder	2,500,000	
-	PM (OMAS-Italy) cylinder mill	4,000,000	
-	Vibrating sifterr	3,000,000	
-	Round sorter	2,000,000	
-	Air compresser	250,000	
-	Calculators	50,000	
4.	Blending		2,900,000
-	MR 101 Blender		900,000
-	Swivel blender		2,000,000
5.	Packaging		1,300,000
-	Hydraulic divider	1,700,000	
-	Moulder	1,500,000	
-	Weighing machine	400,000	
-	Scale	300,000	
-	Equipped fermentation chamber	1,000,000	
-	Water cooler (100 l.)	1,500,000	
-	Baking tray and pans	500,000	
-	Bread trays	200,000	
-	Bread baskets	50,000	
-	Cooling shelves	100,000	

Annex 3 (contd)

-	Flour bin and crockery	100,000	
-	Rising gauge	50,000	
-	Bread volumeter	200,000	
-	Miscellaneous equipment	300,000	
-	Calculators	30,000	
6.	Furniture		500,000
B.	Bakery - Pastry shop		
1.	Bakery		31,930,000
-	Chopin trial oven	1,500,000	
-	Production oven	17,000,000	
-	Trial kneading troughs		2,000,000
-	Production	3,000,000	
-	Hydraulic divider	1,700,000	
-	Moulder	1,500,000	
-	Weighing machine	400,000	
-	Scale	300,000	
-	Equipped fermentation chamber	1,000,000	
-	Water cooler (100 l.)	1,500,000	
-	Refrigerator	500,000	
-	Baking trays and tins	500,000	
-	Bread trays	200,000	
-	Bread baskets	50,000	
-	Cooling shelves	100,000	
-	Flour bins and crockery	100,000	
-	Rising gauge	50,000	
-	Bread volumeter	200,000	
-	Miscellaneous equipment	300,000	
-	Calculators	30,000	
2.	Pastry shop		7,600,000
-	Complete PM beater-mixer	1,500,000	
-	Complete GM beater-mixer	2,000,000	
-	Roller	2,500,000	
-	Roller with accessories	100,000	
-	Piping bags	50,000	
-	Baking trays and tins	500,000	
-	Water heater		250,000
-	Water filter	50,000	
-	Miscellaneous appliances	300,000	
-	Electric cooker	350,000	
			39,530,000

Annex 3 (contd.)

C. Laboratory

-	Laboratory grinder (including KT30)	1,500,000
-	ROTACHOC laboratory sifter	1,500,000
-	ALPINE laboratory sifter	4,000,000
-	Precision scales (2)	1,000,000
-	Magnifying glasses	50,000
-	Ash oven	2,000,000
-	Multicellular vacuum drier	750,000
-	Dessicator	1,600,000
-	Ventilated modular drier	200,000
-	Dessicator	750,000
-	MR - 2 lt. mixer	600,000
-	Installable multi-purpose proportioner	8,000,000
-	pH-metre	500,000
-	Sterile basket	1,500,000
-	Refrigerator	400,000
-	Freezer	500,000
-	Gas cooker	300,000
-	Water filter	50,000
-	Furniture	500,000
-	Calculator	30,000
	Total laboratory	24,730,000

D. Maintenance workshop

-	Various appliances	2,500,000
-	Furniture	500,000
	Total	3,000,000
	Grand total - equipment	95,960,000

Annex 3 (contd.)

A2: Some recommended equipment for experimental and industrial purposes

1. Cleaning

(a) Experimental plant (small industry)

- Buhler MTRA-60/100AG cleaner - separator
- HELIOS TRIPETTE and RENAUD (T.R.) type H-30 (1000 kg/hr) cleaner-separator
- Vibrowest T and R Model 900 6 SWECO vibrating sifter
- Densimeter type INRA GM model - capacity of 100 to 1500 kg/h
- Destoner - BUHLER MTSB-50 model
- SCHULE model 10 (1000 kg/h)
- Siddi Vinavaka Machinery Equipment, model SV-4

(b) Industrial plant

- HELIOS T and R type H.300 cleaner - separator (13000 kg/h)
- BUHLER MTRA-60/100 or MTRA 100/100
- Planisichter monocaisse BUHLER model ROTOSTAR No.AR-8
- Destoner - BUHLER model MTSB-50
- SCHULE Model 30 (3000 kg/h)
- Siddi Vinavaka Mach. Eq. model SV-8

2. Decorticating

(a) Experimental plant

- Decorticator PRL/RIIC
- Decorticator CRDI/SISMAR/ISRA
- NUHUL/Peace Bridge Brokerage

(b) Industrial plant

- Decorticator PRL/RIIC (a set)
- NUHUL (a set)
- Decomatic decorticator
- Vertical decorticator SHULE GmbH
- " UMS type DVA
- Horizontal BUHLER DNRH
- Aspirator BUHLER MVSE
- Winnowing machine - separator BUHLER MVSB

3. Milling

(a) Experimental plant

- SISMAR - type Noflaay C hammer crusher

- ABI hammer crusher
- "HARUSHA Hammer Mills MGMS
- Pin mill ALPINE 160-UPZ or 315 model
- Cylinder crusher with sifter OMAS-Italy
- BUHLER Plansichter monocaisse
- Vibrating sifter (Tripette and Renaud or SWECO)
- Horizontal sifter Tripette and Renaud le Coq model
- HEID densimeter Tripette and Renaud model GA-100
- BUHLER densimeter MTLB model

(b) - Industrial plant

4. Mixing

(a) Experimental plant

- Blender with double alternating spirals, multi-purpose grinder of 800 to 1000 kg capacity
- Spiral convoyor blender: Tripette and Renaud, BUHLER SCHULE and all general manufacturers
- MR10L Tripette and Renaud blender (for trials)

(b) Industrial plant

- MR10L blender (for trials)
- Spiral conveyor blenders
- Blender with double alternating spirals, multi-purpose grinder of 1600 kg capacity

5. Bakery

The necessary equipment could be found from the following suppliers:

- Establishment DUCORBIER Fournitures

  49, Rue Saint-Julien
  76 100 Rouen
  FRANCE

- Société PAVAILLER Z I

  B.P. 102
  26 501 Bourg-les-Valence
  FRANCE

Annex 3 (contd.)

A3 Some addresses of equipment suppliers

1. BUHLER GmbH Company

Postfach 3396, d-3300 BRAUNSCHWEIG
Federal Republic of Germany and/or

BUHLER GmbH Company
CH 9240 UZWIL
Switzerland

2. Société TRIPETTE and RENAUD ZI du Val-de-Seine

20, Avenue Mareclin BERTHELOT
92 390 Villeneuve-la-Garenne
France

3. ALPINE AG Company

D-89 AUGSBURG 1
P.O. Box 10-1109
Federal Republic of Germany

4. Société Sahelienne Industrielle

5. Abidjan Industrie (ABI) Company

6 OMAS Company

35 010 ARSEGO-S, GIORGIO Delle Pertiche (Padova)
Italy, Fax 049/5742610

7 Rural Industries Innovation Centre

TSHOKTSA House
P.O. Box 18 Gaborone
Botswana

8. F.H. SCHULE GmbH

D-2000 Hamburg 26
P.O. Box 260 620
Federal Republic of Germany

9. SISMAR S.a

B.P. 3214 Dakar
Senegal (Telex 7781 SG)

Annex 3 (contd.)

10. S.R.I. SIDDI VINAVAKA Machinery Equipments

MYSORE, India

11. BLOUNT Agro-industrial Corp.

P.O. Box 256, 805 S. DECKER DRIVE
BLUFFTON, IN 46714 USA (Telex 232-419 MM Clipper BFTN)

12. Peace Bridge Brokerage

SASKATOON, Sash
Canada, S7K 4R4

Annex 4

Calculation method and annual production

[to be adapted to each country (in kg)]

	First year	Second year	Third year
1. Local cereals (LC)			
- Gross quantities (GQ) 200 kg/h x 6 h/j	300,000	450,000	600,000
- Impurities (2% of GQ)			
- Dehulled grains (GQ) (300,000-6,000) X GQ (80% ouput)	235,200	352,800	470,400
- Flours obtained (output 77.22% of GQ)	231,600	347,400	463,200
2. Primary processed LCs			
- Bread flour (BF) for the experimental baking 47 kg/day x 250 + 2% (flouring and losses)	11,985	27,030	37,230
- B.F. sold at CFAF 160/kg to other users (bakeries, pastry shops, etc.) 200 kg/day x 250/days = 50,000 kg or 51,250 kg of GQ	50,000	100,000	200,000
- Flour for traditional uses (FTU) (couscous, porridge, pastas ...): 96,800 kg or 84,808/0.99=85,665 kg de GQ + 14% semolina flour FTU sold at CFAF 160 per kilo	96,800	121,840	125,830

Annex 4 (contd.)

Calculation method and annual production

[to be adapted to each country (in kg)]

	First year	Second year	Third year
1. Local cereals (LC)			
- Gross quantities (GQ) 200 kg/h x 6 h/j			
- Impurities (2% of GQ)	300,000	450,000	600,000
- Dehulled grains (GQ) (300,000-6,000) X GQ (80% ouput)	235,200	352,800	470,400
- Flours obtained (output 77.22% of GQ)	231,600	347,400	463,200
2. Primary processed LCs			
- Bread flour (BF) for the experimental baking 47 kg/day x 250 + 2% (flouring and losses)	11,985	27,030	37,230
- B.F. sold at CFAF 160/kg to other users (bakeries, pastry shops, etc.) 200 kg/day x 250/days = 50,000 kg or 51,250 kg of GQ	50,000	100,000	200,000
- Flour for traditional uses (FTU) (couscous, porridge, pastas ...): 96,800 kg or 84,808/0.99=85,665 kg de GQ + 14% semolina flour FTU sold at CFAF 160 per kilo	96,800	121,840	125,830
- Semolina for porridge and other traditional recipes 77,815 kg or 85,665 kg of GQ (72,815/0.85) sold at CFAF 215 per kilo	72,815	98,530	100,140

Annex 4 (contd.)

Calculation method and annual production

[to be adopted to each country (in kg)]

	First year	Second year	Third year
3. Secondary processed products :			
• 120 kg of composite flour bread (CF) with 30% non-wheat flour (120 kg x 1.64) (yield 0.25) (weight of dough) x 250 days = 196,800	196,800		
200 g breads sold at CFAF 65 per loaf		328,000	492,000
- Composite flour milk bread 20 kg of CF with 30% non-wheat flour x 231 breads/20 kg CF x 250 days = 57,750; 140 to 150 g breads sold at CFAF 60 per loaf	57,750	115,500	115,500
- Composite flour cakes : 10 kg CF with 50% non wheat flour x 53,300 cakes/1,600 kg FC x 250 days = 83,280	83,280		
45 to 50 cakes sold at CFAF 50 per cake one		166,560	166,560
4. By-products 300,000 x 2% (including 50% of impurities) + 29,400 x 20% of bran sold at CFAF 50/kg	61,800	92,700	123,600
5. Current analyses External services			
- Moisture : 3 analyses/day x 250 days			
- Ash : 3 analyses/day x 250 days			
- Proteins : 3 analyses/day x 250 days			
- Fat : 3 analyses/days x 250 days			
Total : 3,000 analyses /year at CFAF 4,875 each	3,000	3,000	3,000

N.B.

(a) Capacity of the flour mill : 500 kg/h with a 40 per cent capacity utilization during the first year, 60 per cent during the second year and 80 per cent during subsequent years.

(b) Composite flour with 30 per cent non-wheat flour in the first year, 40 per cent in the second and third year.

(c) Composite flour made into bread at the experimental plant : 120 kg/day during the first year, 200 kg/day during the second year and 300 kg/day during the third year. For the milk bread, 20 kg/day during the first year and double that amount during subsequent years. For cakes, 50 per cent non-wheat composite flour at a rate of 10 kg/day during the first year and double that amount during subsequent years.

(d) Non-wheat flour (NWF) used in baking at the experimental plant : 47 kg/day during the first year, 106 kg/day during the second year and 146 kg/day during the third year.

(e) 47 kg broken down as follows: NWF for bread (120 kg x 0.30 = 36 kg) + NWF for milk bread (20 kg x 0.30 = 6 kg) + NWF for cakes (10 kg x 0.50 = 5 kg).