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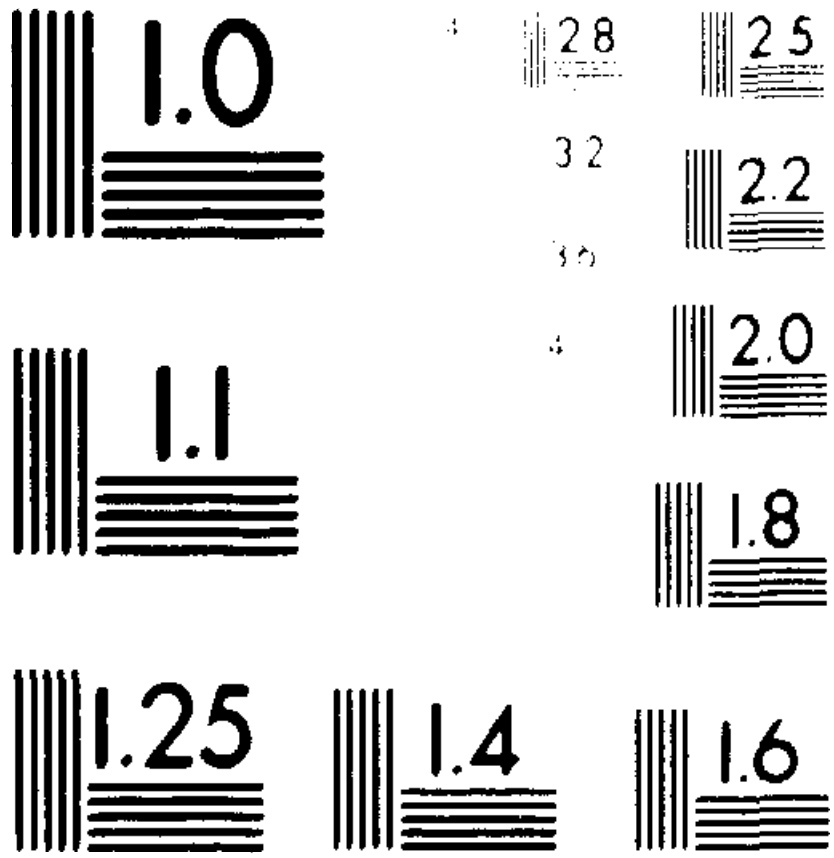

Dipl.-Volkswirt Peter Töpfer
Planung + Beratung GmbH

TPB

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Feasibility Study
on
Three Industrial Pilot Mills
for Millet and Sorghum
in Niger and Nigeria

1984

TPB

Dipl.-Volkswirt Peter Töpfer
Planung + Beratung GmbH

Feasibility-Study
on
Three Industrial Pilot Mills for
Millet and Sorghum in Niger and Nigeria

Final Report
prepared on Behalf of United Nations
Industrial Development Organization (UNIDO)

for the

Niger-Nigeria Joint Commission for Co-operation
within the Framework of the Technical Assistance
Project DP/RAF/77/020

by
Diplom-Volkswirt Peter Töpfer
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Aschaffenburg, F.R.G.

April 1984

GS/st/

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I. EXECUTIVE SUMMARY

1. Project sponsoring and financing

The project should be sponsored and financed completely by the Ministry of Economic Cooperation, Federal Republic of Germany. It's executing agency is the German Agency for Technical Cooperation, Ltd., P.O. Box 5180, D-6236 Eschborn 1

It is the Agroindustries and Food Technology Division Department 153, of the German Agency for Technical Cooperation, which will deal with the project.

Officer-in-charge is Dipl.Ing.agr.Rudolf Kiessling.

As the project should be financed completely by the F.R.G. according the german rules of technical cooperation, all investment capital needed could be regarded as equity. Therefore a distinction between "equity" and "loan financing" ist not necessary in this case.

We recommend strongly to adress to the Ministry of Economic Cooperation, F.R.G., via German Embassies in Niamey and Lagos. To improve the chances of project assessment by the proposed institutions, all calculations have been carried out in German Marks. The rate of exchange into FCFA and US-$ is indicated in chapter X.

2. Project promoting and implementing

Project promotor is the Nigeria-Niger-Joint Commission for Cooperation, assisted by the United Nations Industrial Development Organization (UNIDO).
We suggest the "Office des Produits Vivriers du Niger"(OPVN) for project implementation in Niger, and the "Northern Nigerian Flour Mills ltd." for project implementation in Nigeria.

3. Facts and figures

We consider the FAO-system for millet- and sorghum-milling (as successfully operating f.e.in the Sudan) as an appropriate technology. The three pilot mills to be established in

- Niamey/Tillabéry
- Zinder and
- Kano

should have an input-capcity of 6000 t per year each. A smaller type of 3000 t/y- capacity is considered in this study, too. But as the costs of installment and operating of both types are almost the same, we recommend the 6000 t/y-type to be established finally.

Investment costs for the pilot mills amount to

2.530.000,-- DM in Niamey/Tillabéry
2.294.000,-- DM in Zinder and
2.477.000,-- DM in Kano

We consider these costs as adequate to the proposed technology.

The break-even-point will be reached, if capacity is used to

41 % by the Niamey-mill,
52 % by the Zinder-mill and
61 % by the Kano -mill.

The feasibility of the project is given to a sufficient degree.

4. "Critical factors of success"

However the pilot mills will be operating successfully in the long run only, if

- a very intensive marketing policy of all involved institutions, combined with
- intensive product development activities, combined with
- strong governmental support

will take place.

We consider the realization of these pre-conditions i.e. the strengthening of demand as "core of sucess" of the whole project.

II. PROJECT BACKGROUND AND HISTORY

The project idea is a result of the political and socio-economic strategies persued both in the Republic of Niger and the Fereral Republic of Nigeria.

1. Political and socio-economic objectives of the Niger

Food self-sufficiency is the priority objective of the Government of the Niger (c.f.UNDP, Third Country Programme for the Niger 1983 - 1986). With regard to an increasing urban population and a permanent deficit of foreign currency, it is of essential importance to reduce expansive wheat imports. Foreign currency-paid wheat has to be substituted by indigenous cereals, i.e. millet and sorghum. Industrial mills which produce a millet- resp. sorghum-based flour, accepted by the consuming population, would be able to make a substantial contribution to the realization of the priority objective of food self-sufficiency and would thus diminish the dependence of foreign currency-paid wheat imports into the Niger.

2. Political and socio-economic objectives of Nigeria

Nigeria's Fourth National Development Plan (1981 - 1985) attaches priority importance to diversification of the national economy away from the current dependence on the petroleum sector and places emphasis on self-sufficiency and self-reliance, particularly in agriculture and manufacturing. Agricultural production, esp. food production and processing, receives particular attention as the Government whishes to drastically reduce the present high imports of essential food products and also to provide the basic raw materials which are required for the country's agro-based industries (c.f. UNDP, Second Country Programme for Nigeria 1983 - 1986).

The industrial milling and processing of basic raw materials such as millet and sorghum would contribute essentially to achieve the objectives of Nigeria's Development Plan.

3. Project initiator,financial and technical possibilities

The project was initiated by the Nigeria-Niger Joint Commission for Cooperation, P.O.Box No.867 Niamey, Republic of Niger. Technical assistance was given by the United Nations Industrial Development Organization (UNIDO), Vienna.

The financial and technical possibilities for the establishment of industrial pilot mills should be provided by the German Agency for Technical Cooperation, P.O.Box 5180, D-6236 Eschborn 1, Dept. 153 : Agro-industries and food-technology, officer in charge :
Dipl.-Ing. agr. Rudolf Kiessling

4. Project history

4.1 In 1980, Marplan Töpfer Institute (MTI) conducted on behalf of UNIDO, Vienna, a pre-feasibility-study on millet and sorghum flour milling in Niger and Nigeria (Project SI/RAF/77801)

Based on

- a market and consumption survey for millet and sorgho in these countries,

- and based on a survey of the existing flour milling situation (also including wheat) in these countries,

it should be found out in this survey,

- whether there is a demand for further milling capacities for millet and sorgho in these countries or not,

- If yes: How this demand is structured (quantitatively and qualitatively),

- and how this demand could probably be covered

  . both from the qualitative
  . and the social
  . and the economical

  point of view.

As main results of this study were formulated:

- There is a demand for industrially milled millet/sorgho-flour in Niger/Northern Nigeria, mainly if this flour would be sold to a price inferior to the wheat-flour

price, and if this industrially milled flour tastes in the same way as the traditional prepared flour.

- Therefore, the installation of 8 millet/sorgho milling plants was recommended by MTI,

  . each of them with a capacity of 1,75 tons/hour (= 5.500 to 6.000 tons/year),

  . and preferably being located in the towns Niamey, Maradi, Zinder, Dosso, Tahoua, Diffa, Agadez and Tillabery,

  . 30 % of the capacity should be used for the WFP (PAM) - the food-for-work-programme, the remaining 70 % mainly should be used for producing flour for industrial use (bakeries, pastry-industry).

4.2 On the basis of the favourable results of this survey, UNIDO decided in late 1982/early 1983 to go ahead with this project. As first step on this way, a feasibility-study for the installation of

"3 pilot mills for millet- and sorgho-flour

- one combined with an already existing rice-mill,

- the second with a millet-and sorgho-seed-research-center,

- and the third with an already existing wheat mill"

was decided to be carried out,again (as the pre-feasibility-study, too), as assistance and under the guidance of the Niger/Nigeria-Joint-Commission of Cooperation.

4.3 In January 1983, TPB was charged informally, in April 1983 also formally to realize this feasibility-study. As a first step, TPB did some preparatory work in Europe, mainly

- to study and evaluate basic milling structures and layout both from the economical and the technical point of view,
- to study and evaluate basic product patterns possibly to be realized by using millet and/or sorgho flour,
- and to study and evaluate the basic layout and functioning of seed research centers.

These studies were realized mostly in Germany, but to a limited extent in other European countries, too.

4.4 In April/May 1983, a study-team of TPB travelled to Niamey, consisting out of

- Diplom-Volkswirt Peter Töpfer (as project leader financial analyst, and marketing expert)
- Engineer Stefan Kastenmüller (as technical expert)
- Diplom-Soziologe Gerhard Schäfer (as market analyst organizational expert, and accounting specialist)

This team first did in-depth-research on this project in Niger (mainly in Niamey and Zinder). Later on, this research was done, too, in Northern Nigeria (mainly in Kano and Zaria).

4.5 During our stay in Niger and Nigeria, a very close and fruitful cooperation was realized with the Nigeria/Niger-Joint-Commission of Cooperation. We want to thank very much for all help and assistance, given by the experts of Commission. We mainly want to thank to

- Mr. Gabriel S. Akunwafor, leaving Secretary General of the Joint Commission,

- Mr. Al Hadj Umuru Bashia Wali,
  Secretary General of the Joint Commission

- Mr. Boureima Magagi, Assistant Secretary General of the Joint Commission,

- Mr. Boureima Gado, Economic Director of the Joint Commission,

- and Dr. Zdenek Svejnar, UNDP-expert joining the staff of the Joint Commission.

All these gentlemen gave us very valuable help and assistance in performing this study.

4.6 After returning from Africa, the evaluation of all data compiled was started by us. Besides that, we did further in-depth-investigations,

- in milling industry
- in seed-research centers
- and in food-research and development centers

to come to best possible conclusions, both as far as the mills to be installed and the products to be manufactured out of this flour are concerned. These further investigat-

ions were not only done in Europe, but in some countries of special interest, too, mainly in Sudan.

4.7 We hope, however, that now our report will meet the requiremtns both of UNIDO and the Niger/Nigeria Joint Commission.

5. Feasibility Study

Title	:	Feasibility Study on Three Industrial Pilot Mills for Millet and Sorghum in Niger and Northern Nigeria
Authors	:	Töpfer, Peter Schäfer, Gerhard Kastenmüller, Stefan
Ordering party	:	Niger-Nigeria Joint Commission for Co-operation within the framework of the UNIDO-project DP/RAF/77/020

We thank very much Mr. Walter Behrens and Mr.Marek Kulczycki, Feasibility Studies Section, UNIDO, for all help and assistance given to us.

6. Costs of pre-investment studies

No.	Quantity	Unit	Item description	Local	Foreign	Unit cost DM 1000	Foreign cost DM 1000	Local cost DM 1000	Total cost DM 1000
1.	1	1	Pre-Feasibility Study Flour Milling in Niger and Nigeria SI/RAF/77 801	-	x	62	62	-	62
2.	1	1	Feasibility Study on Three Industrial Pilot Mills for Millet and Sorghum in Niger and Nigeria DP/RAF/77/020	-	x	112	112	-	112
						174	174	-	174

Preparatory investigations, such as land surveys, quantity surveys, quality tests, other investigations and tests are not necessary in this case.

III. MARKET AND PLANT CAPACITY

1. Some preliminary remarks

In some other studies being ccncerned with the consumption and the milling of millet and sorgho, much in-depth-research is realized to find out

- to which share millet and sorgho is auto-consumed by the farmers and their families,
- to which extent millet and sorgho are marketed,
- which is the per-day-provision of the population with calories at all, and with cereals or millet and sorgho in special.

According to our in-depth-research done in Niger and Nigeria, we have come, however, to the conviction that all these aspects are only of minor, in any way not of main or even decisive importance for finding out the present or potential market size for industrially manufactured millet and/or sorgho-flour in these countries.

For

- whether the millet and sorgho is auto-consumed
- or it is marketed

it may alternatively be

- pounded
- or milled in small non-industrial village mills
- or milled in industrial mills.

And whether or not the population is sufficiently provided with millet or sorgho or not, the quantities available may alternatively be consumed in one of the three ways indicated above; the long discussions in many reports, whether a per-head-consumption of 190 kg per year or of 200 kg per year or even 220 kg per year is to be estimated or being regarded as sufficient or not, all these discussions are from our point of view as useless for finding out the market size for industrially manufactured flour as the calculation of surplus or deficit situation in the provision of the population with millet and sorgho. To our conviction, the only decisive factor for defining market size and potential for industrially manufactured millet and/or sorgho-flour is

- the way how millet and sorgho is actually consumed in private households

- and the size and the cereal-consumption-pattern of the production of products, in which millet and sorgho potentially may be used = bread production in bakeries and production of pastries (macaroni, spaghetti, noodles, chips, etc.)

We, therefore, have tried our best to find out as exactly as any possible how millet and sorgho is at present consumed in Niger and Nigeria

- both in private households (for daily meals)
- and in the industrial areas (bakeries plus pastry plants).

2. Present consumption-patterns for millet and sorgho in private households

a) As we were told, millet and sorgho formerly was exclusively consumed in private households in a pounded way: Women had to pound millet and sorgho day for day by hand, needing 2 hours and more per day for this heavy, tiring work, which resulted, however, in a millet/sorgho-meal for the family, delighting this family most, as tasting something sour and smooth (as being prepared in a fermented way).

b) This pounding was in the past time - perhaps up to about 15 - 20 years from now - the definitely only way of preparing millet/sorgho meals. In the course of the last 15 - 20 years (as a rough estimate only), another procedure was gradually introduced: The milling of millet/sorgho in small, primitive village mills. These mills have

- the advantage that they take away a considerable part of the heavy work women have otherwise to do daily in pounding hours and hours,

- have furtheron the advantage that the fermenting of the millet/sorgho flour is possible further on, so that the traditional, much loved taste remains unchanged,

- have, however, the disadvantage that people have to pay cash-money for getting the millet/sorgho milled (about 6 CFA/kg),

- and have the psychologically-based disadvantage to have basic, important functions of preparing the by far most important food for the family not done by the own wife, in the own house, but in an outside facility being operated by some non-family-, but at least well-known people.

Due to this advantage-/disadvantage-situation, the small village mills

- succeeded during the last years in gaining some significant share in total millet/sorgho-preparation,

- but this success was going on not too quickly and meeting much resistance, with the consequence that even today pounding is not at all to be said to be definitely substituted by the small village mills: pounding is up to now in a very strong position.

c) In having this development in mind, it cannot astonish at all that the next possible step of development - to mill millet/sorgho in industrial mills, being normally located

outside villages in urban centers to use their capacities sufficiently - that this step meets a lot of difficulties and resistance. This the more, as out of the point of view of population (mainly of the rural population) industrially milled millet/sorgho shows some significant disadvantages, but no advantages at all:

- Industrial flour is said to be not fermented, therefore, without the so much loved sour taste,

- from some former attempts (initiated by government e.g. in Niger) it is quite known that millet/sorgho-flour does not look white (as e.g. wheat), but grey, a difference being not accepted at all;

- based on some former experiences with sorgho-flour manufactured by Sotramil in Zinder and some small industrial mills in Northern Nigeria, industrial millet/sorgho-flour is said to be very expensive

  . significantly more expensive than the millet/sorgho-flour manufactured in small non-industrial village mills,

  . and even of the same price as wheat-flour (tasting and looking much better).

  These former experiences are quite wide-spread in both countries and deeply believed, although the quantities manufactured were quite low.

- Further on many potential consumers of industrial millet/sorgho-flour mistrust this product as being something artificial, manufactured by unknown persons in unknown process under unknown conditions: The initial image of this industrial flour is, therefore, considerably burdened with these prejudices, certainly hindering considerably a quick success of this flour.

d) Conclusion:

- Although there is undoubtedly quite a big potential demand for industrial millet/sorgho-flour, the acceptance of this product will be quite low and limited for quite a long starting time in private households in both countries concerned;

- This definitely comes true at all in rural households, where the previous development-step (from pounding to small, non-industrial village mills) is up to now only realized to a limited extent, so that this next step has no major chance for being realized quite for a long time.

- So that chances for industrial flour only can be seen presently in urban regions,

- but even there only to quite a limited extent up to now

  . due to the psychological
  . due to the financial
  . due to the qualitative (taste, colour, etc.)
  . due to the wheat-competitive

  reasons which were mentioned above.

3. Presentconsumption pattern for millet/sorgho-flour in bakeries and pastry-industry

There is quite a different situation in the 2 potential consumption-areas for millet/sorgho-flour just mentioned:

a) The situation in bakeries is characterized by the two following opposite items:

- On one hand, bread-production is quite expanding, in Nigeria still more than in Niger; the demand for bread is growing permanently, production is only limited by the imported wheat being available; as due to foreign exchange problems the imports of wheat were shortened during the last years in Nigeria, production of bread had to be reduced, too; without this shortage of wheat, the production of bread would increase in Nigeria for at least 15 - 20 %/year. In Niger, where such shortage problems in the imports of wheat were not to be faced up to 1982, the bread-production increased 1981/1982 for more than 22 %, the number of bakeries, too; and it may be forecasted with only little probability of error that the demand for bread will increase permanently and significantly in both countries. From this point of view, the consumption-potential for industrial millet/sorgho-flour looks favourable; this the more as this potential is so big that it only can be covered by flour manufactured in industrial mills of some major size: Little village mills certainly are not able to cover this demand.

- On the other hand, however, it will be very difficult for millet/sorgho-flour to get definitely a share at all, and even a 10 %-share in the flour-consumption for bread. From the technical point of view, it shall not be - as experts told us - impossible to have a share of 10 % or even more of millet/sorgho-flour in bread. But as already indicated above,

  . there is a substantial resistance of the consumers to accept such mixed bread: They only accept pure wheat-bread, as due

- to the said better taste

- to the colour-point-of aspect

- and due to some psychological attitudes: Consumers like "French-style" of bread, and this is wheat-bread, and not a millet-wheat mixed bread.

. And there is consequently a substantial resistance of the (privately owned) bakeries, fearing to loose their business if selling mixed bread. The experience out of past time, where mixed bread had to be manufactured due to government's intervention in Niger, and where this bread proved not to be sold, this bad experience is still very fresh in the minds of all owners of bakeries.

Therefore, it may be very difficult to get millet/sorgho-flour to be sold to bakeries: Probably,

. only interventions of governmen
. and/or shortage of wheat over some longer periods

may give a good chance to millet/sorgho-flour in bread-production: In Nigeria, this flour will face still more difficulties and resistance than in Niger.

b) The situation in pastry-industry is quite an opposite one, with the same limited chances for millet/sorgho-flour as consequence, however, too:

- The acceptance of this type of flour is quite good: Neither from the point of view of taste, nor of the colour of the flour, there are major objections against using this flour in pastry-production; and there are a lot of successful examples, how to produce pastries like

macaroni, spaghetti, cookies, biscuits, etc. in using millet/sorgho-flour to quite a substantial share.

- The problem is, however, that pastry-production is quite limited up to now in both countries:

  . In total Nigeria, about 50.000 tons of pastries are produced, out of which only about some 20 - 30 % are manufactured in Northern Nigeria.

  . In Niger, there is rather no pastry-production up to now at all, only some imports of finished pastry-products; just now, it was, however, decided to establish a plant for pastry-production in former Sotramil-complex. Therefore, situation may change to some extent in future; but up to now, the sales-potential for millet/sorgho-flour in pastry-production has to be said rather not existing in Niger.

In total, the sales-chances for millet/sorgho-flour in pastry-industry should for today and for the near future be estimated as being quite limited, with, however, some significant chance to be much improved in further future.

4. Conclusions

To sum up: The chances for selling industrially manufactured millet/sorgho-flour has to be said to be quite limited up to now in both countries concerned:

- In private households, such flour is not consumed at all up to now, and some major objections and prejudices are deeply enrooted; only in urban households, some potentials seem to be existent for this flour for the next decade at least.

- Same situation has to be stated in bread-production, where however, government could quickly initiate a substantial change in ordering the production of mixed bread.

- In pastry-industry, the acceptance of this flour is quite good, but up to now, this industry is not existing at all in Niger, and not much developed in Northern Nigeria. But this may change in near future.

As both countries, however, are harvesting millet and sorgho in very substantial quantities per year, only limited chances for industrially manufactured millet/sorgho-flour as found out above for the present, may be sufficient for implementing some milling-capacities in near future: Even little shares of such flour in total consumption of millet and sorgho should be enough to use the capacities of some mills sufficiently. Therefore, some statistical view of millet and sorgho production and consumption shall be realized now.

5. Statistical view on the present production-and consumption-situation of millet and sorgho, substitutional products (wheat) and on major industrial user-areas (bakeries, pastry-industry) in Niger and Nigeria :
Forecast of further development

a) The production and consumption situation and forecast in Niger

This situation and forecast is shown in the following table:

The production and consumption of millet/sorgho in Niger

	1978	1979	1980	1981	1982	Forecast 1985
1. Production (1000 t)						
1.1. Millet	1222,6	1255,2	1363,6	1313,8	1295,4	1415,0
1.2. Sorgho	371,2	350,8	367,9	321,6	356,5	370,0
Total production	1593,8	1606,0	1731,4	1635,4	1651,9	1785,0
2. ./. Waste, Seed 15 %	239,1	240,9	259,7	245,3	247,8	267,8
For consumption	1354,7	1365,1	1471,8	1390,1	1404,1	1517,2
3. Out of this: traditionally prepared (pounding)	1019,7	1010,1	1016,8	880,1	829,1	737,2
To be milled	335,0	355,0	455,0	510,0	575,0	780,0
4. Out of this: milled in small village-mills	170,0	180,0	255,0	310,0	365,0	535,0
Remaining	165,0	175,0	200,0	200,0	210,0	245,0
5. Out of this: milled in small urban mills	55	75	110,0	140,0	160,0	215,0
or prep.trad.in urban areas	110	100	90,0	60,0	50,0	30,0
Remaining: millet/sorgho being milled industrially:	-	-	-	-	-	-

Source of information :
Ministère du Développement Rural, Direction de l'Agriculture, Niamey/Niger; Estimation, based on our experience.

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6. Some further information:

		1978	1979	1980	1981	1982	Forecast 1985
a)	Rural consumption	1189,7	1190,1	1271,8	1190,1	1194,1	1272,2
	=	87,8 %	87,2 %	86,5 %	85,6 %	85,1 %	83,9 %
	Urban consumption	165,0	175,0	200,0	200,0	210,0	245,0
	=	12,2 %	12,8 %	13,5 %	14,4 %	14,9 %	16,1 %
	For comparison:						
	Urban share in total population	12,3 %	12,9 %	13,4 %	13,9 %	14,4 %	15,9 %
b)	Number of small mills to be installed						
	- rural	800	1000	1200	1450	1700	2500
	- urban	250	350	500	650	850	1150
c)	Industrial consumption of wheat:						
	1. Sales of wheat (t)				21.100	26.150	
	2. Out of this: for bread				18.600	22.800	
	for pastries				400	750	
	others				2.100	2.600	
	Total				21.100	26.150	
	Imported pastries				1.900	3.650	
	Industrial consumption potential				23.000	29.800	

Source of information :
Ministère du Développement Rural, Direction de l'Agriculture, Niamey

b) The production and consumption situation and forecast in Nigeria / Northern Nigeria

The production and consumption of millet and sorgho in Nigeria/Nothern Nigeria

	1978	1979	1980	1981	1982	Forecast 1985
1. Production (1000 t)						
1.1. Millet	2579	2386	2440[1)]	2460[1)]	2460[1)]	2400
1.2. Sorgho	3286	2409	2600[1)]	2650[1)]	2650[1)]	2600
Total production	5865	4795	5040	5110	5110	5000
2. ./. Waste, seed 15 %	880	719	756	767	767	750
For consumption	4985	4076	4284	4343	4343	4250
3. Out of this: trad. prep.(pounding)	1877	1111	1213	1184	1068	570
To be milled	3108	2965	3071	3159	3275	3680
4. Out of this: milled in small village-m.	1812	1897	1940	2004	2111	2515
Remaining (= urban)	1296	1068	1131	1155	1164	1165
5. Out of this:						
- milled in small urban mills	724	895	959	1066	1108	1165
- or prep. trad. in urban areas	572	173	172	89	56	-
Remaining: millet/sorgho being milled industrially	-	-	-	-	-	-
6. Some further information:						
a) Present ind. milling	very limited quantities of sorgho					
b) Rural consumption	3689	3008	3153	3188	3179	3085
=	74,0 %	73,8 %	73,6 %	73,4 %	73,2 %	72,6 %
Urban consumption	1296	1068	1131	1155	1164	1165
=	26,0 %	26,2 %	26,4 %	26,6 %	26,8 %	27,4 %
c) Number of small mills to be installed						
- rural	8500	8900	9100	9400	9900	11800
- urban	3400	4200	4500	5000	5200	7000
d) Ind. consumpt.of wheat:						
1. Sales of wheat (t)		900.000	1000.000	500.000	300.000	500.000
2. Out of this: for bread				380.000	240.000	400.000
for pastries				70.000	30.000	50.000
others		90.000	100.000	50.000	30.000	50.000

1) estimate

c) Some figures of main importance

ca) Share of pounding in total consumption of millet/ sorgho:

	Niger		Northern Nigeria	
1978	75,3 %	+ 8,0 %[1)]	37,6 %	+ 11,5 %[1)]
1979	74,0 %	+ 7,3 %[1)]	27,3 %	+ 4,2 %[1)]
1980	69,1 %	+ 6,1 %[1)]	28,3 %	+ 4,0 %[1)]
1981	63,3 %	+ 4,3 %[1)]	27,2 %	+ 2,1 %[1)]
1982	59,0 %	+ 3,6 %[1)]	24,6 %	+ 1,3 %[1)]
1985	48,6 %	+ 2,0 %[1)]	13,0 %	+ 0,0 %[1)]
1990	30,0 %	+ 1,0 %[1)]	8,0 %	+ 0,0 %[1)]

cb) Share of small village mills in total consumption of millet/sorgho

	Niger	Northern Nigeria
1978	12,6 %	36,3 %
1979	13,2 %	46,5 %
1980	17,3 %	45,3 %
1981	22,3 %	46,1 %
1982	26,0 %	48,6 %
1985	35,3 %	59,2 %
1990	50,0 %	61,0 %

1) = pounding in urban areas

cc) Share of small urban mills

	Niger	Northern Nigeria
1978	4,1 %	14,6 %
1979	5,5 %	22,0 %
1980	7,5 %	22,4 %
1981	10,1 %	24,6 %
1982	11,4 %	25,5 %
1985	14,1 %	27,4 %
1990	19,0 %	31,0 %

cd) Volume and share of urban consumption

	Niger		Nigeria/Northern Nigeria	
	urban cons. (1000 tons)	share in total consumption	urban cons. (1000 tons)	share in total consumption
1978	165,0	12,2 %	1296,0	26,0 %
1979	175,0	12,8 %	1068	26,2 %
1980	200,0	13,5 %	1131	26,4 %
1981	200,0	14,4 %	1155	26,6 %
1982	210,0	14,9 %	1164	26,8 %
1985	245,0	16,1 %	1165	27,4 %
1990	390,0	21,0 %	1361	29,0 %

6. From these tables : The substitutional potential for industrially produced millet/sorgho-flour in the two countries: present situation

The figures just given point out very clearly the main characteristics for the consumption of industrial millet/sorgho-flour in Niger and Nigeria:

(1) There is no present production or consumption of such flour at all, and no signs are to be seen that this situation will change in near future.

(2) There are some areas of consumption, which are still so much back in the development of their patterns and attitudes of consumption that they seem to be quite unlikely to be converted to accept industrial flour in near future:

- This mainly comes true for those consumers, and those areas of consumption, where up to now pounding is used exclusively or predominantly: The next step of development of this sector will be to substitute pounding more and more by using small village mills; after this step is done, there may - perhaps, but not sure and definitely - be a further substitutional development towards accepting (at least to some degree) industrially manufactured flour, too.

- And this comes true for those consumers, living in rural areas and accepting at least to some degree millet/sorgho to be milled in small village mills. It is, certainly, something more likely that this group would in some future be ready to accept to a limited extent industrially manufactured flour, too; but

. their resistance to do so

. and the difficulties to get this flour transported and distributed to these little villages far away

would be so big that no real sales-chances should be seen for industrial flour in this sector for quite a long time (at least).

(3) Some better chances should be assumed for industrial flour in those urban consumer-areas, in which today millet/sorgho is consumed being presently milled in small non-industrial urban mills. As

- urban population will grow continuously and significantly in future,

- and this population is more ready to change traditional attitudes, it may be necessary (= the small urban mills should perhaps be not sufficient in their capacity in future to meet the fast growing urban demand) and possible to move a permanently increasing share of all urban population to accept industrial flour. But in any way, this process will step forward only slowly, with little increase per year.

(4) Some potential chances have to be seen for industrially manufactured millet/sorgho-flour in bakeries. Inspite of all the resistance to accept this flour today in this sector, it may be called a potential user-sector for this type of flour, too.

(5) The best chances to be accepted, industrially manufactured millet/sorgho-flour definitely will find in pastry-industry. If this industry will develop in future (and we are sure that this definitely will happen), the sales volume for this type of flour will go up permanently.

In total, the sectoral chances for industrially manufactured millet/sorgho-flour may be summed up in this way:

- Best chances: pastry-industry
- Second-best chances: bakeries
- Third-best chances: urban population, presently consuming millet/sorgho being milled in small, non-industrial urban mills
- Very limited chances: rural population, consuming flour manufactured in small, non-industrial village-mills
- No chances for any reasonable time: rural population, consuming even today millet/sorgho in a pounded way

7. The "should-situation" in future

The overall view just given on the chances of selling industrially manufactured millet/sorgho-flour looks not much promising or positive: The sales chances should be said to be quite limited, if no substantial change would be realized in the market-conditions,

- being initiated by the consumers themselves (private or industrial)
- and/or being initiated by some external institutions, mainly by government.

Up to now, we cannot see any major change in consumers' behaviour on behalf of an increasing acceptance of industrially manufactured millet/sorgho-flour. But we can see - and were definitely confirmed about this by governmental authorities in both countries - some very important hints that mainly the 2 governments will create more favourable conditions to increase acceptance and consumption of this flour in future, may it be by legislative means or in some other way. For there are some very important reasons asking the two governments urgently to do all to promote the consumption of industrially manufactured millet/sorgho-flour in their countries. The most important of these reasons are:

a) the urgent necessity to substitute wheat to save foreign exchange, mainly in bread-production; the only way to reach this aim (by domestic means) is, however, to develop the production and consumption of industrially manufactured millet/sorgho-flour to be in a position to produce mixed bread.

b) the urgent necessity to establish a domestic pastry-industry, again due to the same reason = to save foreign exchange spent up to now for importing pastry-products.

c) the urgent necessity to improve more and more the working and living conditions of women. To reach this aim, the pounding of millet/sorgho should be much more than up to now replaced by other procedures = by milling.

d) and finally, the necessity of stabilizing the flour provision of fast-growing urban population. The aim may no longer be reached in future by using small urban mills: Only by installing some industrial mills, this aim will be reached in future.

8. Conclusions and forecast of the development of demand for industrially manufactured millet/sorgho-flour in Niger and Nigeria under optimal assumptions

These 4 factors just mentioned will force government in future (partly even today)

- to do all efforts to increase the consumption of industrially manufactured millet/sorgho-flour in their countries, both in the private and the industrial segment,

- and to give in this way substantial additional impulses to the consumption of this product,

- additionally to the development in the consumption of this product , which certainly would go up even without these impulses, but in a quite moderate and slow extent only.

In adding

- the normal development of the consumption of such flour (coming out of the normal development-process of consumers' attitudes and behaviour towards industrially manufactured flour as indicated before)

- and the additional development being initiated and caused by governments' activities to increase the consumption of industrially manufactured millet/sorgho-flour out of the reasons mentioned above,

in adding these 2 developments, the consumption of industrially manufactured millet/sorgho-flour in Niger and Northern Nigeria may be forecasted as follows (in 1000 tons of flour, in using the factor: 1 t of millet/sorgho-flour = 1,3 tons of millet/sorgho-grain):

Forecasting the future development of the consumption of industrially manufactured millet/sorgho-flour in Niger:
Definition of milling-capacity needed

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
A. The demand-potential f.ind. millet/ sorgho-flour										
1. Pastry-industry:										
1.1. Consumpt.of flour at all(wheat,etc.)t	400	750	850	1000	1400	1800	2200	2500	2800	3100
1.2. Potential share of ind.millet/sorgho-f.										
- without government-actions				10 %	15 %	20 %	25 %	25 %	25 %	25 %
- incl. government-actions				10 %	20 %	30 %	40 %	50 %	50 %	50 %
- = consumption in to*)	-	-	-	100	280	540	880	1250	1400	1550
2. Bakeries / bread production:										
2.1. Consumpt.of flour at all(wheat,etc.)t	18600	22800	28000	34000	39000	44000	49000	53700	58000	61000
2.2. Potential share of ind.millet/sorgho-f.										
- without government-actions	-	-	-	-	-	1 %	2 %	3 %	4 %	4 %
- incl. government-actions	-	-	-	-	-	5 %	7 %	9 %	11 %	14 %
- = consumption in to*)	-	-	-	-	-	2200	3400	4800	6400	8500
3. Private households in urban regions:										
3.1. Consumpt.of millet/sorgho milled in small,non-ind. urban mills (t)	140000	160000	178000	196000	215000	235000	260000	295000	335000	380000
3.2. Potential share of ind. millet/ sorgho-flour:										
- without government-actions	-	-	-	-	-	1 %	2 %	3 %	3 %	3 %
- incl. government-actions	-	-	-	-	1 %	3 %	4 %	5 %	6 %	7 %
- = consumption in to grain					2150	7050	10400	14700	20100	26600
- = equivalent in flour (t)*)					1650	5400	8000	11300	15500	20500
4. Consumpt.of ind. manuf.millet/sorgho-flour in other household-segments (rural-households, etc.) Assumpt. 8 - 10 % of consumption in item 3. = (t)	-	-	-	-	130	430	720	1020	1550	2050
5. Total consumpt. of ind. millet/ sorgho-flour:										
a) based on governm.-actions (t)	-	-	-	100	2060	8750	13000	18370	24850	32600
b) without government-actions (t)	-	-	-	100	210	2750	5890	9650	11520	12860

*) assumed government-actions are intensively realized

table continued next page

Table of page 31, continued:

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
3. Industrial milling capacity needed (degree of using capacity: max. 80 %)										
1. Minimum (t /year) ((= without government-actions)					-	6000	8000	12000	15000	17000
2. Maximum (t /year) (= inclusive government-actions)					3000	10000	17000	24000	32000	42000

Forecasting the future development of the consumption of industrially manufactured millet/sorgho-flour in Nigeria / Northern Nigeria: Definition of milling-capacity needed

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
A. The demand-potential for industrially millet/sorgho-flour:										
1. Pastry-industry:										
1.1. Consumpt.of flour at all(wheat, etc.) (t)[1]	70000	30000	35000	45000	50000	57000	64000	72000	81000	90000
1.2. Pot.share of ind. millet/sorgho-f.										
- without government-actions				2 %	2,5 %	3 %	3,5 %	4 %	4 %	4 %
- incl. government-actions				2 %	3 %	4 %	5 %	5 %	5 %	5 %
- = consumption (in t)[2]	-	-	-	900	1500	2300	3200	3600	4000	4500
2. Bakeries/bread-production:										
2.1. Consumpt.of flour at all (wheat, etc.) (t)[1]	380000	240000	400000	440000	484000	532000	586000	644000	708000	779000
2.2. Pot.share of ind.millet/sorgho-f.										
- without government-actions	-	-	-	-	-	0,3 %	0,5 %	0,7 %	0,9 %	1,0 %
- incl. government-actions	-	-	-	-	-	0,6 %	1,0 %	1,5 %	2,0 %	2,0 %
- = consumption in t [2]						3190	5860	9660	14160	15580
3. Private househ. in urban regions:										
3.1. Consumpt. of millet/sorgho milled in small, non-ind.urban mills(t)[1]	1066000	1108000	1127000	1146000	1165000	1205000	1245000	1283000	1321000	1361000
3.2. Pot.share of ind.millet/sorgho-f.										
- without government-actions	-	-	-	-	-	0,6 %	1,2 %	1,8 %	1,8 %	1,9 %
- incl. government-actions					0,6 %	1,8 %	2,3 %	2,8 %	3,5 %	4,3 %
- = consumption (in t)[2]	-	-	-	-	7000	21700	28600	35900	46200	58500
- = equivalent in flour	-	-	-	-	5380	16700	22000	27600	35500	45000
4. Consumpt. of ind.millet/sorgho-f. in other househ.(rural househ., etc.):Assumpt. 5% of consumption in item 3. = t [2]					670	840	1100	1380	1780	2250

1) all Nigeria

2) assumed government-actions are intensively realized

table continued next page

Table page 34, continued:

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
5. Total consumption of industrial millet/sorgho-flour:										
a) based on government-actions (t)				900	7550	23030	32160	42240	55440	67330
b) without government actions (t)				900	1250	9145	17230	26028	28827	32275
8. Industrial milling-capacity needed (degree of using capacity: 80 %)										
1. Minimum (to/year) (= without government-actions)				-	2000	16000	22000	32000	38000	42000
2. Maximum (to/year) (= incl. government-actions)					10000	29000	40000	53000	69000	84000

The milling capacities needed are forecasted as follows (in tons of flour)

	Niger		Nigeria	
	min.	max.	min.	max.
1984	-		-	-
1985	-	3.000	2.000	10.000
1986	6.000	10.000	6.000	29.000
1987	8.000	17.000	22.000	40.000
1988	12.000	24.000	32.000	53.000
1989	15-000	32.000	38.000	69.000
1990	17.000	42.000	42.000	84.000

Assumptions made for calculation of these figures :

a) the capacities would be used to maximally 80 %
b) some small capacity-reserve is included.

This quite favourable development, however, only definitely will take place, if some very important "critical factors of success" are realized.

9. The "critical factors of success" for the 3 pilot-mills

In total, we just came to the conclusion that

- there should be sufficient acceptance and demand in the 2 markets to justify the installation

  . first of 3 pilot-mills each of quite limited capacity,

  . followed later on (after further development of the markets) by further mills,then certainly of bigger capacities (to manufacture in the cost-optimum)

- but it was pointed out, too, that this acceptance of industrially manufactured millet/sorgho-flour is not indoubtedly, unconditionally given, but bound on some very important conditions to become definitely effective.

These conditions constitute the "critical factors of success" for the 3 pilot-mills, and for further mills in future, too: Only if these factors (all of them) are given

- optimally to an utmost,
- but at least to a significant extent

only then the installation of the 3 pilot-mills promises to become - from the market-/demand-point of view - a good success.

There are the following "critical factors of success" to be met best:

1st factor: Both governments should agree to regulations to give industrially manufactured millet/sorgho-flour a better, substantial chance in the markets. The most important of these regulations should be:

- to restrict wheat-imports at all

- to ask bakeries obligatorily to produce mixed bread, with a share of first only a few percent, later up to 10 or even 15 % (if technically possible) of millet/sorgho-flour,

- to restrict imports of pastries, encouraging and supporting the domestic production of pastries, with major shares of industrially manufactured millet/sorgho-flour included,

- to undertake promotion campaigns

  . both to reduce pounding to the better welfare of the women
  . and to better the image of industrially manufactured flour,

- to install some warehouse-system in urban areas for industrially manufactured flour to ensure a permanent sufficient provision of population.

As a matter of fact the above mentioned restriction of wheat-imports agrees to the main objectives of both the National Development Plans of the Niger and Nigeria, but certainly such a measure has to be initiated very carefully and in the long run only.

2nd factor: In-depth-research should be done on a cooperative basis in the two countries to

- develop new products on the basis of industrially manufactured millet/sorgho-flour, both

  . in private household fresh consumption (daily meals, prepared in the households)
  . in pastries

    - to substitute wheat in present product compositions
    - and to create new products (pastries, snacks, sweeties, etc.) based on millet/sorgho-flour

  . in bakeries, again in a (wheat-)substitutional and new-product-creating way

- and to try to diminish the main disadvantage of industrial flour (= not to be fermented, therefore without sour taste), but the colour problems, too,

- and to solve the technical problems to use this flour in bakeries and industry.

A research-organization of it's own should be founded, cooperating with practice as closely as any possible.

3rd factor: Inspite of all these efforts both of government and of research and product-development, the capacities of the 3 pilot-mills should be as limited as it economically is feasible. We think that this comes true for mills with a capacity of 6000 tons grain/year; but if any possible from the cost-point of view, even 3000 tons - mills should be realized; we shall do our calculations later on for both types.

4th factor: As a further potential problem for industrially manufactured flour we pointed out formerly that industrially manufactured flour may be significantly more expensive as if millet/sorgho is consumed in one of the 2 other possible ways. This would limit the chances of this flour substantially. Therefore, it should be of key importance of high priority to manufacture this flour in the cost-optimum, what is synonym to cost-minimum: as cheaply as any possible.

5th factor: To reach this aim, and to keep investments and their (not only financial) risks as low as any possible, existing mills and other installations should be used wher - ever possible and wherever resulting in some cost- or other advantages: If in an existing mill (producing today rice or wheat-flour), it would be possible, to use (additionally or at least alternatively)

- a part of the existing manpower (in top-or middle-management, or on the skilled- and unskilled worker-level)

- a part of the existing machinery (what should in principle be possible for rather all operations outside the definite milling process)

- a part of the existing civil-works-potentials (offices, plant-buildings, warehouses, etc.)

- and a part of the existing infrastructure (trucks, roads, power-provision, etc.)

- and a part of the existing working-systems (grain-collecting systems, flour-supplying systems, etc.)

this definitely should be done to

- lower investments and current operating costs
- and to lower risks of failure.

6th factor: Due to the same reasons, but also to create a consumer-confidence-potential for industrial flour as high as any possible, we further think it a "critical factor of success" to install these pilot-mills near (or better: inmidst of) to the potential consumption areas as any possible. The stands of these mills, therefore, should be in urban areas at all, but near to the centers of industrial use of this flour, too.

7th factor: To minimize the possible negative reactions to industrially manufactured millet/sorgho-flour, this flour should be manufactured out of that grain, which consumers up to now know best. As indicated before,

- consumers in Niger are much more familiar with millet than with sorgho

- and the same comes true in principle, only to some reduced extent, to the consumers in Nigeria, too.

Therefore, we recommend to manufacture in the pilot-mills millet, and not sorgho, although the level of experience in industrial milling is to some extent higher concerning sorgho.

8th factor: Finally, intensive marketing efforts have to be realized in both countries to implement industrially manufactured millet-flour to best possible conditions and intensity in the 2 markets. The most important components of this marketing concept should be

- a good product policy (see above)
- a good distribution policy
- a good pricing policy
- and a good sales promotion policy, convincing potential consumers best.

10. The development model for industrial millet-mills in Niger and Nigeria

To meet these "critical factors of success" best, the following model or concept of implementing pilot-mills for industrial millet-flour-production in the 2 countries concerned should be realized:

(1) A millet-mill should be installed in Niamey on the site of, and in very close combination with the existing rice-mill. The starting capacity should be 3000 t /year with immediate planning from beginning to increase this capacity to 6000 t /year. If this 2-step-development originates additional costs of significant importance, a starting capacity of 6000 t /year should be accepted, too, with no further extension in future, however.

(2) A further millet-mill should be established in combination with the existing old and new (being soon under construction) Sotramil-plant in Zinder; the capacity should be the same as just indicated for Niamey, with the same alternatives, too.

(3) A third millet-mill finally should be installed in Kano, in very close combination with the existing wheat-mill of NNFM. Here, the capacity should definitely be 6000 t year from the beginning.

(4) As necessary supplements to the installation of the 3 mills just mentioned, we recommend strongly:

a) the existing seed-research-center at the university of Zaria should be equipped with

- all manpower (experts)
- and all equipment

needed to work effectively as "product-development-center" for products based on industrially manufactured millet-flour. Main emphasis should be laid in this center on the development of mixed-bread-products and of meals for private households, being in a position to make the disadvantage of this flour to be not fermented and tasting, therefore, not in a sour way forgotten.

b) the experimental bakery in Kano (being in quite poor conditions today, if still existing at all) should be organized as an outside satellite of the development-center of Zaria. Some additional equipment and manpower should be transferred to this bakery enabling it to assist Zaria effectively in the field of developing millet-based bakery-products.

c) Sotramil finally should be equipped with some additional manpower and equipment to act as development-center for millet-based pastry-products.

d) Finally, a millet-flour-marketing-board should be established in Niamey (perhaps in close connection to the Niger-Nigeria-Joint-Commission), with a subsidiary office in Kano to

- first promote the consumption of industrially manufactured millet-flour
- and to care for the physical distribution of this product.

A 3-experts-team in Niamey (plus secretarial services) and a 2-experts-team in Kano should be sufficient at all.

This is the model of implementing industrial milling of millet in the 2 countries, which we recommend most. It fits the requirements of the 8 "critical factors of success" as they were pointed out before, best, as proven in the following table:

(table, see next page)

Products proposed / Crit.factors of success	(1)mill combined with rice-mill in Niamey	(2)mill combined with Sotramil in Zinder	(3)mill combined with wheat-mill in Kano	(4)product-development center in Zaria*)	(5)product-development-center (pastries) in Zinder	(6)marketing-board in Niamey and Kano
1. Government regulations agreed	should be agreed to each projected stand					
2. New product-developm. realized intensively	applying (households): yes	applying (pastr.): yes	applying (households + baker.): yes	yes	yes	accompanying market-research
3. Limited capacities	yes:3000 t /y max. 6000 t/y	yes: 3000 t /y max. 6000 t /y	yes: 6000 t /y	not relevant	not relevant	not relevant
4. Manufacturing in a cost-optimum	yes, possible at all	yes, possible at all	yes, possible at all	yes, possible at all	yes, possible at all	yes, possible at all
5. Minimizing investments and operating costs by combining with existing manpower and installations	yes, by closely combining with existing rice-mill	yes, by closely combining with old Sotramil-plant + new pastry- installat.	yes, by closely combining with existing NNFM-wheat-mill	yes, by using partly already existing research manpower and facilities	yes, by using existing pastry-plant-manpower and installations	no investment necessary manpower: partly using Joint Commission staff
6. Stands near to consumer centers	yes	yes	yes	yes	yes	yes
7. Millet available and accepted by consumers	yes	yes	sufficiently yes	sufficiently yes	yes	sufficiently yes
8. Marketing-efforts to be realized	yes	yes	yes	yes	yes	yes

*) incl. the experimental bakery in Kano

Conclusions: All the stands proposed meet the "critical factors of success"

- in most cases fully,
- or at least very sufficiently,
- or these critical factors of success do not depend in their realization on a given or proposed stand, what means that they may be met by each stand.

This check gives us full justification to recommend our model of installing

- 3 pilot-mills for industrially manufactured millet-flour
- and some supporting, supplementary installations and facilities

to be realized, if the economical feasibility is checked carefully, and comes to positive results. This may be checked now.

IV. MATERIAL AND INPUT REQUIREMENTS

1. Raw Material

1.1. Definition of millet- and sorgho-qualities appropriate for industrial processing

For the industrial processing we recommend, an "average level" of common millet and sorgho quality is requested and sufficient, too.

1.1.1. Quality of millet

The average percentage of the various parts of common millet-grain are

- hulls	16 %
- fruit and seed coats	3 %
- aleuron layer	6 %
- endosperm	70 %
- embryo or germ	5 %
Total	100 %

The chemical composition of common millet as whole grain contains 13.2 % protein, 4 % fat, 12,2 % cellulose and 4.1 % ash.

This average quality of common millet is available very well in all areas of Niger and Northern Nigeria our mission visited.

1.1.2. Quality of sorgho

For industrial processing an average quality of common sorgho resp. guinea corn is requested. From the industrial point of view differences between "sorgho"and "guinea corn" (red colour resp. golden colour, etc.) can be neglected.

The average sorgho / guinea corn grain contains

- starch	80 %
- protein	12 %
- minerals	2 %
- fat	3 %
- cellulose	3 %
Total	100 %

The structure of the sorgho grain is similar to that of all other cereals. The endosperm may be mealy or flinty; the embryo or germ is rather well developed (6 % of the grain weight).

Sorgho/guinea corn of this common quality can be obtained very well in the areas we visited, esp. in Northern Nigeria.

1.2 Areas bringing up requested qualities and quantities

According to our recommendation to establish industrial pilot mills in

- Niamey-Kirkissoye
- Zinder and
- Kano

the environmental areas of these cities have to be analyzed in regard to their production quantities of millet and sorgho.

Therefore, we have to answer the question, whether sufficient quantities of common millet and sorgho are available in the Niamay-, Zinder- and Kano-areas.

1.2.1. Niamey and Zinder

The millet- and sorgho-production-statistics of the Republic of Niger contain subsequent figures:

a) for areas bringing up millet 1977 - 1982,
b) for areas bringing up sorgho 1977 - 1982,
c) for areas bringing up millet and sorgho 1977 - 1982.

(see following pages)

a) Niger: Areas bringing up millet 1977 - 1982

Area	Production per year (1000 tons)					
	1977	1978	1979	1980	1981	1982
Niamey	272	297	328	325	322	319
Dosso	197	211	219	247	256	254
Tahoua	173	158	162	183	170	151
Maradi	214	224	241	289	265	268
Zinder	259	226	293	303	285	284
Diffa	16	7	13	16	17	20
Agadez	-	-	-	-	-	-
Total	1131	1123	1256	1363	1315	1296

Source of information :
Ministère du Developpement Rural, Direction de l'Agriculture, Niamey/Niger

b) Niger: Areas bringing up sorgho 1977 - 1982

Areas	Production per year (1000 tons)					
	1977	1978	1979	1980	1981	1982
Niamey	27	52	44	42	32	27
Dosso	12	21	19	20	18	24
Tahoua	105	96	101	112	115	121
Maradi	81	91	82	70	82	89
Zinder	90	92	84	91	62	80
Diffa	20	20	22	32	13	13
Agadez	-	-	-	-	-	1
Total	335	372	352	367	322	355

Source of information :
Ministère du Développement Rural, Direction de l'Agriculture, Niamey/Niger

c) Niger: Areas bringing up millet and sorgho 1977 - 1982

Area	Production per year (1000 tons)					
	1977	1978	1979	1980	1981	1982
Niamey	299	349	372	367	354	346
Dosso	209	232	238	267	274	278
Tahoua	278	254	263	295	285	272
Maradi	295	315	323	359	347	357
Zinder	349	318	377	394	347	364
Diffa	36	27	35	48	30	33
Agadez	-	-	-	-	-	1
Total	1466	1495	1608	1730	1637	1651

Source of information :
Ministère du Développement Rural, Direction de l'Agriculture, Niamey/Niger

On the basis of these figures we can draw the following conclusions concerning the establishment of industrial pilot mills in Niamey and Zinder.

1.2.1.1. Area of Niamey

From 1977 to 1982 the area of Niamey produced an average annual millet quantity of 311.000 tons, i.e. 25 % of the total average Niger-production (app. 1.247.000 tons).

From 1977 to 1982 the area of Niamey produced an average annual sorgho quantity of 37.000 tons, i.e. 11 % of the total average Niger-production (app. 351.000 tons).

From 1977 to 1982 the area of Niamey produced an average annual millet and sorgho quantity of 348.000 tons, i.e. 22 % of the total average Niger-production (app. 1.598.000 tons).

An industrial pilot mill of a milling capacity of 3.000 tons per year requests 0.9 percent of the total millet and sorgho production of the Niamey area.

An industrial pilot mill of a milling capacity of 6.000 tons per year requests 1.8 percent of the total millet and sorgho production of the Niamey area.

As 89 % (= 311.000 tons) of the total production of the Niamey-area are millet, the industrial pilot mill to be established in Niamey-Kirkissoye should concentrate on processing of millet only.

In this case a pilot mill of 3000 tons' capacity requests 1.0 percent, and a pilot mill of 6000 tons' capacity requests 2.0 percent of the total average millet production of the Niamey-area.

Conclusion: If an industrial pilot mill will be established in Niamey-Kirkissoye, its requested millet-inputs are completely available in the Niamey-area, too.

Notes on calculation :

The area of Niamey is bringing up an average millet-production of 311.000 tons. This figure is the yearly average 1977-1982, derived from production figures page 48, first line.

The Area of Niamey is bringing up an average sorghum-production of 37.000 tons. This figure is the yearly average 1977-1982, derived from production figures, page 49, first line.

The addition of 311.000 tons/millet and 37.000 tons/sorghum amounts to 348.000 tons total average production of millet and sorghum in the Niamey area. We assume that this figure represents a valid and reliable indicator of the production of millet and sorghum in the Niamey area over a longer period.

We suggest two types of industrial pilot mills : Type A requests 3000 tons of cereals a year, Type B requests 6000 tons a year. This means that Type A requests a quantity of 0.9 percent (i.e. 3000 tons: 348.000 tons) and Type B requests a quantity of 1.8 percent (i.e. 6000 tons : 348.000 tons) of the total average annual production in the Niamey area.

This leads to the conclusion, that there is enough production quantity available in the Niamey area. 0.9 resp. 1.8 percent of a whole area-production should be purchased without any difficulties by the pilot mill to be established in this region.

The areas of Zinder and Kano are analysed according to this scheme, too.

1.2.1.2. Area of Zinder

From 1977 to 1982 the area of Zinder produced an average annual millet quantity of 275.000 tons, i.e. 22 % of the total average Niger-production (app. 1.247.000 tons).

From 1977 to 1982 the area of Zinder produced an average annual sorgho quantity of 83.000 tons, i.e. 24 % of the total average Niger-production (app. 351.000 tons).

From 1977 to 1982 the area of Zinder produced an average annual millet and sorgho quantity of 358.000 tons, i.e. 22 % of the total average Niger-production (app. 1.598.000 tons).

An industrial pilot mill of a milling capacity of 3.000 tons per year requests 0.9 percent of the total millet and sorgho production of the Zinder-area.

An industrial pilot mill of a milling capacity of 6.000 tons per year requests 1.8 percent of the total millet and sorgho production of the Zinder-area.

77 % (= 275.000 tons) of the total production of the Zinder-area are millet; therefore, an industrial pilot mill to be established in Zinder should concentrate on processing of millet.

In this case a pilot mill of 3.000 tons' capacity requests 1.1 percent and a pilot mill of 6.000 tons' capacity requests 2.2 percent of the total average millet production of the Zinder-area.

Conclusion: If an industrial pilot mill will be established in Zinder, its requested millet-inputs are completely available in the department of Zinder, too.

1.2.2. Kano

On the basis of available millet- and sorgho-production statistics of the Republic of Nigeria we estimate subsequent figures:

a) for areas bringing up millet 1977 - 1982
b) for areas bringing up sorgho 1977 - 1982
c) for areas bringing up millet and sorgho 1977 - 1982

in Northern Nigeria

(see following pages)

a) Northern Nigeria: Areas bringing up millet 1977 - 1982

Area	Production per year (1000 tons)					
	1977	1978	1979	1980	1981	1982
Bauchi	231	207	191	195	197	197
Benue	32	28	26	27	27	27
Bornu	373	333	308	315	317	317
Gongola	20	19	17	18	18	18
Kaduna	489	435	403	412	416	416
Kano	555	495	458	468	472	472
Kwara	41	37	33	34	34	34
Niger	38	33	31	32	32	32
Plateau	81	71	67	68	69	69
Sokoto	1033	921	852	871	878	878
Total	2893	2579	2386	2440	2460	2460

Source of information :
Federal Office of Statistics, Rural Economy Survey, Lagos/Nigeria

b) Northern Nigeria: Areas bringing up sorgho 1977 - 1982

Area	Production per year (1000 tons)					
	1977	1978	1979	1980	1981	1982
Bauchi	316	353	258	278	284	284
Benue	83	91	67	73	74	74
Bornu	124	137	101	109	111	111
Gongola	301	335	246	265	270	270
Kaduna	404	451	330	356	363	363
Kano	454	507	371	401	408	408
Kwara	91	101	75	81	82	82
Niger	183	204	149	161	164	164
Plateau	230	256	188	203	207	207
Sokoto	764	851	624	673	687	687
Total	2950	3286	2409	2600	2650	2650

Source of information :
Federal Office of Statistics, Rural Economy Survey, Lagos/Nigeria

c) Northern Nigeria: Areas bringing up millet and sorgho
1977 - 1982

Area	Production per year (1000 tons)					
	1977	1978	1979	1980	1981	1982
Bauchi	547	560	449	473	481	481
Benue	115	119	93	100	101	101
Bornu	497	470	409	424	428	428
Gongola	321	354	263	283	288	288
Kaduna	893	886	733	768	779	779
Kano	1009	1002	829	869	880	880
Kwara	132	138	108	115	116	116
Niger	221	237	180	193	196	196
Plateau	311	327	255	271	276	276
Sokoto	1797	1772	1476	1544	1565	1565
Total	5843	5865	4795	5040	5110	5110

Source of information :
Federal Office of Statistics, Rural Economy Survey, Lagos/Nigeria

From these figures we can derive the following statements concerning the establishment of an industrial pilot mill in Kano.

From 1977 to 1982 the Kano State produced an estimated average millet quantity of 487.000 tons, i.e. 19 % of the estimated total average production of Northern Nigeria/Nigeria (app. 2.526.000 tons).

From 1977 to 1982 the Kano State produced an estimated average annual sorgho quantity of 425.000 tons, i.e. 15 % of the estimated total average annual production of Northern Nigeria/ Nigeria (app. 2.758.000 tons).

From 1977 to 1982 the Kano State produced an estimated average annual millet and sorgho quantity of 912.000 tons, i.e. 17 % of the total average annual production (app. 5.284.000 tons).

An industrial pilot mill of a milling capacity of 3.000 tons per year requests 0.3 percent of the total average annual millet and sorgho production of Kano State.

An industrial pilot mill of a milling capacity of 6.000 tons per year requests 0.6 percent of the total average annual millet and sorgho production of the Kano State.

If millet only or sorgho/guinea corn only are to be processed, a pilot mill of 3000 tons' capacity requests 0.6 percent of the total average

millet production resp. 0.7 percent of the total average sorgho production of the Kano State. A pilot mill of 6000 tons' capacity requests 1.2 percent of the total average millet production resp. 1.4 percent of the total average sorgho production of the Kano State.

Conclusion: The requested millet- and sorgho inputs of an industrial pilot mill to be established in Kano are completely available in the Kano State, too.

1.3 Definition of an adequate production programme

The production programme of the three pilot mills should be based on millet inputs. These inputs should be processed into

- flour (80 % of all millet inputs) and
- semolina (20 % of all millet inputs).

We suppose a yield of 80 % for both alternatives of pilot mills (3.000 tons resp. 6.000 tons p.a.) recommended. Thus subsequent quantities of flour and semolina can be obtained.

a) Industrial pilot mill of 3.000 tons per year

millet input		3000 t
yield, thereof		2400 t
- flour	1920 t	
- semolina	480 t	

b) Industrial pilot mill of 6.000 tons per year

millet input		6000 t
yield, thereof		4800 t
- flour	3840 t	
- semolina	960 t	

Millet flour should be admixed to wheat flour to a substantial degree or finished to pastries. Semolina should also be finished to pastries and products like couscous, etc.

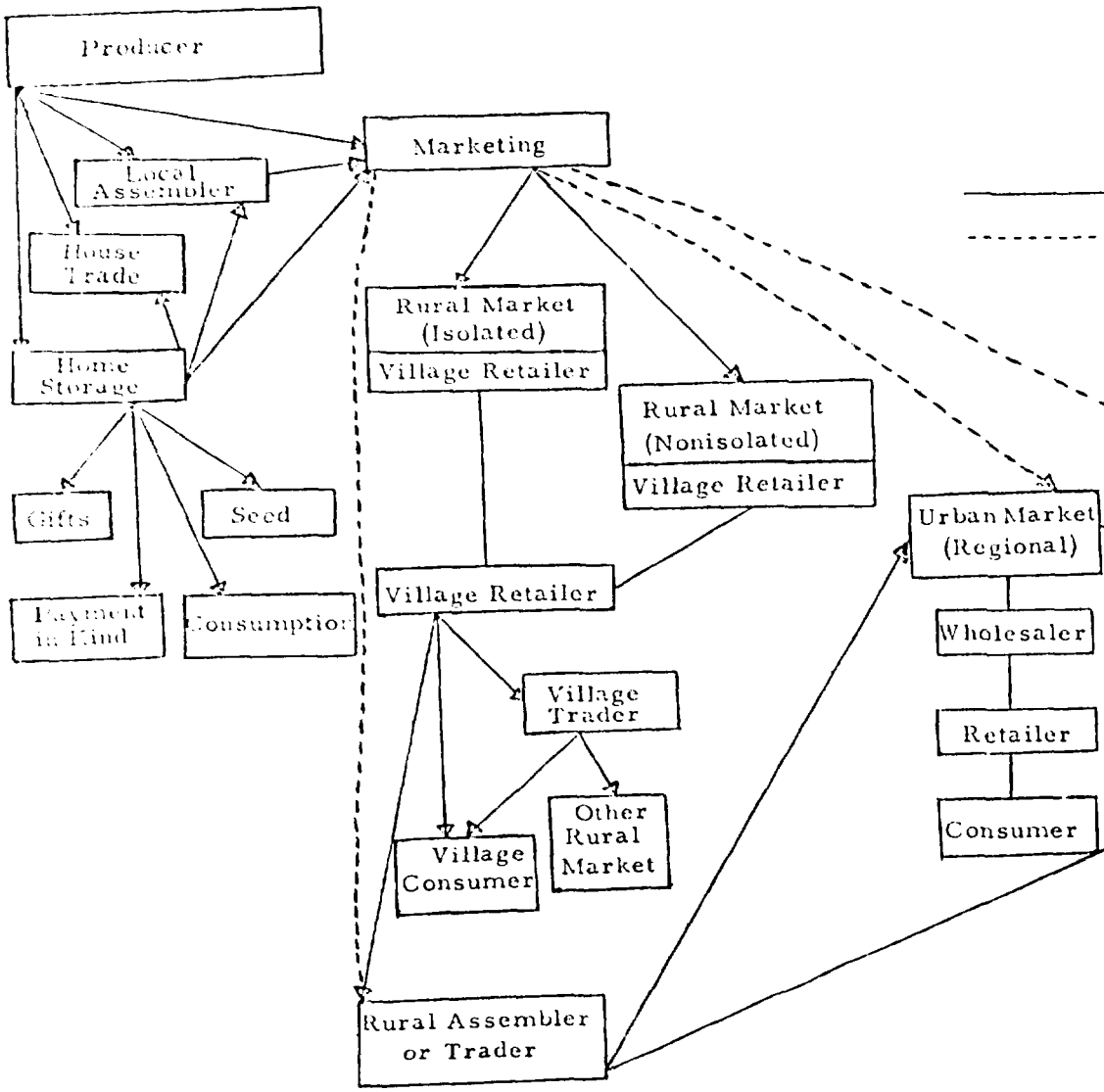
2. Supplies and utilities

The supply sector of Niger and Northern Nigeria is subdivided into

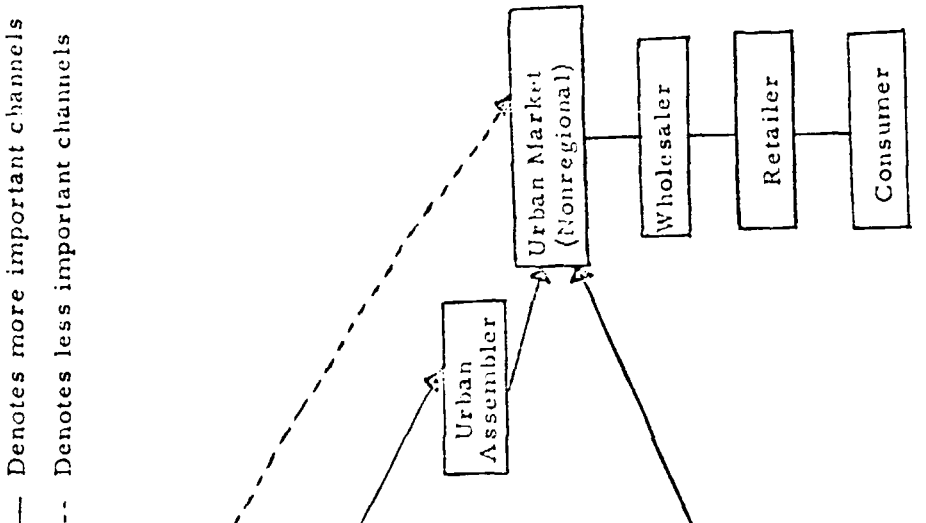
a) the private sector and
b) the public sector.

The private sector both in Niger and Northern Nigeria presents very similar structures. The following scheme of the private grain marketing in Nigeria can also be applied to the prevailing conditions of Niger .

(see next page)


Producer
Marketing
Local Assembler
House Trade
Home Storage
Gifts
Seed
Payment in Kind
Consumption
Rural Market (Isolated)
Village Retailer
Rural Market (Nonisolated)
Village Retailer
Village Retailer
Village Trader
Other Rural Market
Village Consumer
Rural Assembler or Trader
Urban Market (Regional)
Wholesaler
Retailer
Consumer

Traditional channels of millet and sorgho supplies



The main characteristics of grain marketing in both countries are:

a) A very high percentage of sales effected by the producers either directly to consumers in the neigbourhood (49 % of total sales in Nigeria) or directly by producers on periodical rural markets (75 - 80 % in Niger).

b) A great number of local assemblers who are often part-time traders (farmer-traders) and who at the same time will provide the farmers and the local communities with consumer goods (tea, sugar). They are often assisted by a local intermediary (Rabatteur).

c) Wholesalers may be lorry-owners at the same time. Many wholesalers use local agents who are often members of their family. Especially the trade between Niger and Northern Nigeria is based on family links on both sides of the border.

d) The retailers buy either directly from the producers or from the wholesalers. They generally rent a stand on the urban markets. They have to compete with the farmers and their wives who usually sell their products in the neighbouring streets of the official market, where they have to pay no market fees.

e) The importance of retail trade conducted by women either as house-trade (especially in the case of strict muslim seclusion) or as street trade by children and younger women. In Northern Nigeria it was estimated that 40 % of the women were involved in preparing food for immediate sale. The processed food often has millet and sorgho as ingredients (fura, marmari, tuwo). These women are also important buyers of grains, each purchasing an average quantity of 3 - 8 kg grain per day.

To guarantee continuous and effective supplies of the industrial pilot mills to be established in Niamey, Zinder and Kano, we recommend to rely on the public collection systems of Niger and Northern Nigeria.

2.1 Public collection systems of Niger

Within the public collection systems for millet and sorgho the "Office des Produits des Vivriers du Niger" (OPVN) holds a central position.

Cooperatives being organized and advised by the "Union Nigérienne de Crédit et de Cooperation" (UNCC) and also the traditional chiefs use to sell to OPVN.

Transport for the local assembling and the transfer to the regional OPVN warehouses are mainly provided by OPVN, but also military and private vehicles are used.

2.1.1. OPVN - Storage Niamey

The OPVN-Storage Niamey has a capacity of 9.000 tons. This warehouse should take over the function of an intermediate stock for the industrial pilot mill to be established in Niamey-Kirkissoye.

The road- and transportation infrastructure between the OPVN-Storage and Kirkissoye is well developed. We do not expect any transportation problems.

2.1.2. OPVN - Storage Zinder

The OPVN-Storage Zinder has a capacity of 5.500 tons. This warehouse should take over the function of an intermediate stock for the industrial pilot mill to be established in Zinder/Sotramil.

The road- and transportation infrastructure between the OPVN-Storage and Sotramil is well developed. We do not expect any transportation difficulties.

2.2 Public collection systems of Northern Nigeria

Within the public collection systems for millet and sorgho in Northern Nigeria

- the Nigerian Grains Board (NGB).
- the National Grains Production Company (NGPC) and
- various state government storage facilities

play the most important role.

Although the influence of this system ist still weak (compared with the great influence of the large private sector), it will be sufficient for the supply of the industrial pilot mill to be established in Kano.

2.2.1. NGB - Storage Kano

As a part of its storage programme, NGPC has constructted storage facilities in 9 States of the Nigerian Federation capable of storing 80.000 tons of grains. These facilities have since been made available to Nigerian Grains Board (NGB).

The NGB-Storage Kano has an estimated stock capacity of 10.000 tons. This storage should take over the function of an intermediate stock for the industrial pilot mill to be established on the area of the Northern Nigerian Flour Mills Ltd., Kano.

The road- and transportation infrastructure between the NGB-Storage Kano and the Northern Nigerian Flour Mills is well developed. Therefore, transportation difficulties are not to be expected.

2.3 Energy

Energy is available in all three locations to a sufficient degree.

A special advantage of energy supply will be given in Niamey-Tillabéry. As the German Agency for Technical Corporation intends to install an incinerator system for rice-mill-waste products on the site of the "Riz du Niger" according to the COMPLANT-Model (develloped by the People's Republic of China and the German Agency for Technical Cooperation and already being tested in Mali), energy from this incinerator could be available free of charge until an extend of 140 KW for the millet-mill to be established.

V. LOCATION AND SITE OF THE THREE PILOT MILLS

1. Choice and description of optimum location of the three pilot mills

In Chapter III. we came to the conclusion and recommendation that the three pilot-mills should be located

- one in Niamey, in combination with the existing rice-mill
- one in Zinder, in combination with the existing Sotramil-plant
- and one in Kano, in combination with the existing NNFM-wheat-mill.

In this chapter we have pointed out that all three locations meet the "critical factors of success" to an utmost; therefore, each of these three locations was definitely recommended by us.

It, now, should be further on checked, whether or not these three locations meet further requirements, such as sufficient provision with raw-materials, water, energy, etc., manpower sufficiently available, transport-infrastructure, etc. This check is done in the following table. To give a clear overall idea to the reader, whether or not a given location meets some requirements or not, each requirement is noted with notes from 1 - 5, where means

- 1 = location meets this requirement very well
- 2 = ... well
- 3 = ... fairly well
- 4 = ... sufficiently
- 5 = ... unsufficiently

How far meet the three proposed locations the requirements?

Requirements to the locations of the 3 pilot-mills	Niamey-mill, combined with existing rice-mill	Zinder-mill, combined with Sotramil -plant	Kano-mill, combined with existing NNFM-wheat-mill
1. Meeting the 8"critical factors of success" (= chapter B) best	yes	yes	yes
Notes	1,0	1,5	1,0
2. Using existing plant-facilities as much as any possible:			
2.1. which plant-facilities can be used:			
2.1.1. buildings, etc.:	- offices - to some extent: raw-material-storage-facilities - repair-shop - workers' homes - linking roads	- offices - complete raw-material - ... and finished-products-storage facilities - parts of production-buildings - repair-shops - workers' homes - linking roads	- offices - to some lower extent: raw-material- - .... and finished products-storage-facilities - major part of the production-buildings - repair-shop - workers' homes - linking roads
2.1.2. manufacturing installations: machinery, etc.	- to some limited extent: cleaners - to some limited extent: bagging and closing mach. - to the same extent: weighing machines	- major parts of manufacturing machinery already installed in the old plant may be renovated - this comes true for handling equipment, too	- to some limited extent: bagging and closing machines - to the same extent: weighing machines - handling/conveying systems

How far meet the three proposed locations the requirements?

Requirements to the locations of the 3 pilot-mills	Niamey-mill, combined with existing rice-mill	Zinder-mill, combined with Sotramil -plant	Kano-mill, combined with existing NNFM-wheat-mill
2.1.3. Auxiliary equipment	- transportation facilities (trucks) - loading/unloading installations - spare-part-stocks for electrical and general mechanical equipment - maintenance-tools and -materials	the same as in Niamey	the same as in Niamey + laboratory
2.2. Which existing manpower-facilities can be used?	- top-management - executive management - administration personn. - sales-personnel - unskilled workers for auxiliary services - truck-drivers - repair- and maintenance personnel (limited)	- top-management - administration-personnel - partly: sales personnel - unskilled workers for auxiliary services - truck-drivers	top-management - executive management - administration personn. - sales-personnel - unskilled workers for auxiliary services - truck-drivers - repair- and maintenance personnel
2.3. Which existing manpower-facilities can be used?	- grain collecting and supplying-system - finished-product-distribution-system - 2-shifts-operation-syst. - customer-infrastructure	- finished products-distribution-system - customer-infrastructure (limited) - administration and accounting-system	- laboratory-personnel - grain collecting (partly) and supplying-syst. - finished products-distribution-system - 2-shifts-operation-syst.

How far meet the three proposed locations the requirements?

Requirements to the locations of the 3 pilot-mills	Niamey-mill, combined with existing rice-mill	Zinder-mill, combined with Sotramil -plant	Kano-mill, combined with existing NNFM-wheat-mill
	- administration- and accounting system - quality-control-system - comprehensive overall-management-system		- customer-infrastructure - production control- and steering-system - effective maintenance-system - administration and accounting-system - quality-control-system - comprehensive overall-management-system - profit-center-system
Notes	2,5	3,5	1,8
3. Transportation-costs-situation:			
a) Concerning raw-material-supplying	see Chapter C: - OPVN-stocks - and millet-production-areas in close neighbourhood	see Chapter C: - some smaller OPVN-stocks - and millet-production-areas in close neighbourhood	see Chapter C: - no stocks - but sufficient production-areas in sufficient neighbourhood
Notes	1,0	2,0	3,0
b) concerning finished products-transport	a few km away from Niamey = the consumption-area	- close to Zinder = consumpt. center for the major part of the flour produced - further share used directly in Sotramil for pastr.	located in midst of the consumption-area = Kano
Notes	1,0	1,0	1,0

How far meet the three proposed locations the requirements?

Requirements to the locations of the 3 pilot-mills	Niamey-mill, combined with existing rice-mill	Zinder-mill, combined with Sotramil -plant	Kano-mill, combined with existing NNFM-wheat-mill
4. Organization of collection:	no problem, as already existing for rice + OPVN	- mainly to be handled by OPVN, - with, however, some remaining problems in the beginning	- has to be enforced - some problems perhaps in the beginning
Notes	1,5	3,0	3,5
5. Stockage organization	mostly to be established	partly to be established	mostly to be established
Notes	3,5	2,8	3,8
6. Manpower-availability			
a) out of existing mill/ plant	yes, no problem:sufficiently given	yes, no problem: sufficiently given	yes, no problem: sufficiently given
b) additional manpower needed (domestic)			
- skilled	no major problem	no major problem	no major problem
- unskilled	no problem	no problem	no problem
Notes	1,5	1,5	1,5
7. Sites of sufficient size available?	yes	yes	yes
Notes	1,0	1,0	1,0

How far meet the three proposed locations the requirements?

Requirements to the locations of the 3 pilot-mills	Niamey-mill, combined with existing rice-mill	Zinder-mill, combined with Sotramil -plant	Kano-mill, combined with existing NNFM-wheat-mill
8. Infrastructure (roads, water, waste, energy, sanitary-services, etc.) available?	yes	yes	yes
Notes	1,0	1,0	1,0
9. Utilities available:			
a) Water	yes	yes	yes
b) Electricity	yes	yes	yes
c) Fuel, etc.	yes	yes	yes
Notes	1,5	1,5	1,5
10. Outside-services and facilities available (for repairs, maintenance of trucks, civil works, plumbing, electrical fitting, etc.)	yes	sufficiently, yes	yes
Notes	2,0	3,0	1,8
11. Personal security, etc.	fairly good	fairly good	some restrictions
Notes	2,5	2,8	3,9

How far meet the three proposed locations the requirements?

Requirements to the locations of the 3 pilot-mills	Niamey-mill, combined with existing rice-mill	Zinder-mill, combined with Sotramil -plant	Kano-mill, combined with existing NNFM-wheat-mill
12. Supporting fiscal and legal regulations, major interest of local authorities in the project	no problems at all	no problems at all	no problems at all
Notes	1,0	1,0	1,0
13. Living-conditions satisfying (housing, food, recreation, schools, medical welfare, etc.)	fairly good	fairly good	fairly good
Notes	2,5	2,8	3,2
14. Enrivonmental protection problems?	no problems	no problems	no problems
Notes	1,4	1,4	1,4
Total noting:	1,66	1,99	2,03

2. Conclusions

- All three locations proposed meet the requirements in a quite satisfying way and extent.

- There is not any requirement in a location, which is met only in a very limited way.

- Therefore, it may be recommended one more time to install the three pilot-mills in the three locations Niamey, Zinder and Kano.

- As far as the locations of the food-research- and development-center in Zaria, of the experimental bakery in Kano, and of the marketing-board in Niamey, with a branch-office in Kano, are concerned, we think the reasons and arguments pointed out in chapter III. for quite sufficient to justify this recommendation. No further comment should, therefore, be made on this subject.

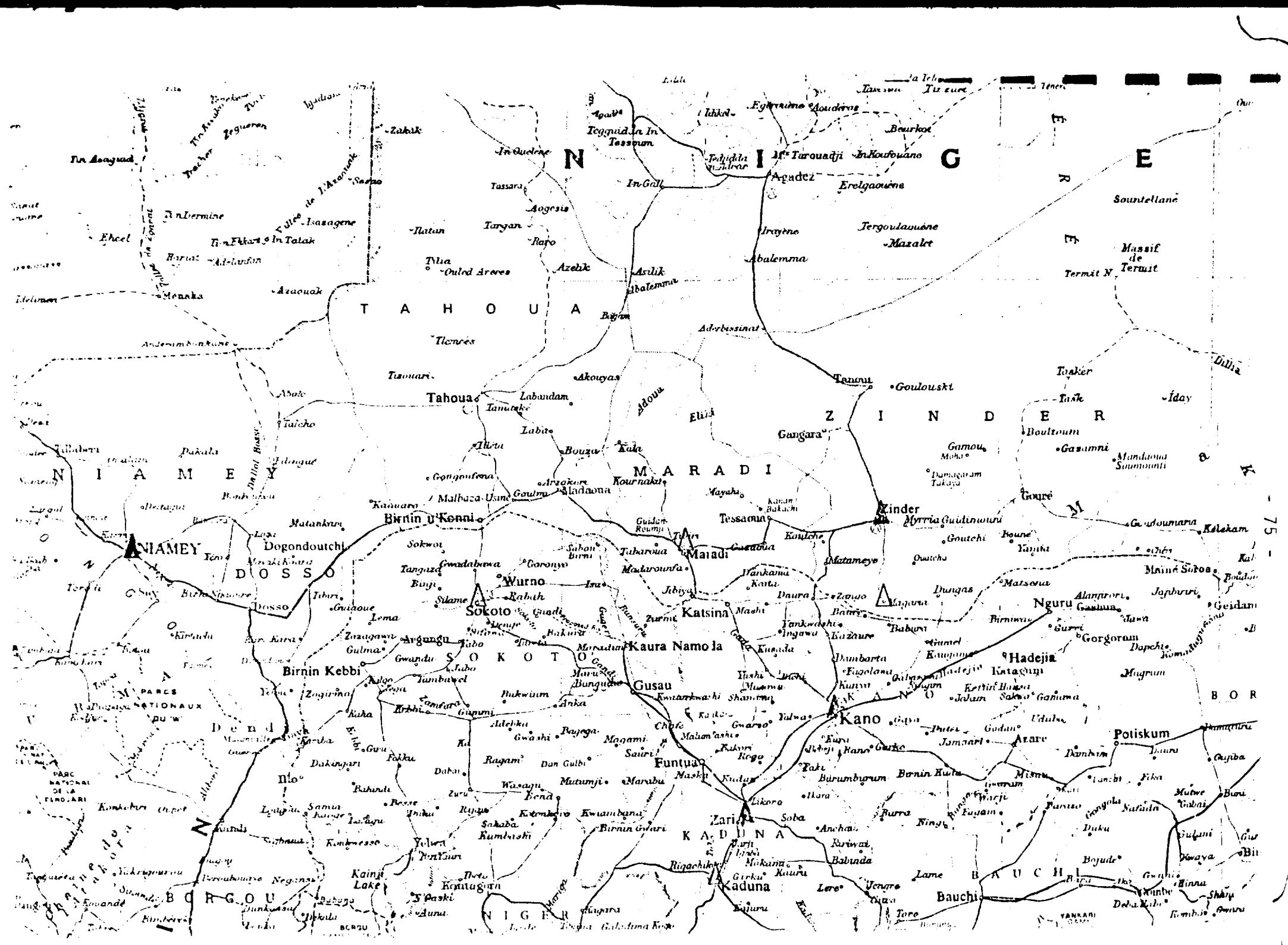
3. Adresses

In all three cases already existing mills should be combined with an industrial pilot mill for millet and sorghum. Their addresses are the following :

a) Niamey - Le Riz du Niger S.A. Tillabéry
b) Zinder - SOTRAMIL, Zinder
c) Kano - Northern Nigeria Flour Mills Ltd. Kano

4. Regional Distribution

The regional Distribution of the proposed pilot mills is shown on the following map.


N I G E R
T A H O U A
Tahoua
Agadez
Tessaoua
Zinder
Maradi
Gouré
N I A M E Y
NIAMEY
Dogondoutchi
D O S S O
Dosso
Birnin Konni
Wurno
Sokoto
Katsina
Nguru
Argungu
S O K O T O
Kaura Namoda
Hadejia
Birnin Kebbi
Gusau
Kano
Potiskum
Funtua
Zaria
K A D U N A
Kaduna
Bauchi
B A U C H I
B O R G O U
Kainji Lake
Konuagora
Tessaoua
Mayahi
Tanout
Goulouski
Gangara
Goure
Nguru
Gorgoram
Hadejia
Potiskum
Bauchi
Kaduna
Zaria
Kano
Funtua
Gusau
Katsina
Maradi
Zinder
Tahoua
Agadez

VI. PROJECT ENGINEERING, INVESTMENT- AND COST-PATTERNS

1. Project layout in general: its critical items

From the engineering point of view, the project-layout should be designed in a way that it covers the following "critical items" in the best possible way:

(1) Mills of completely the same technical layout should be installed in all three locations to ensure an intensive exchange of experiences, spareparts, maintenance-works, packaging-materials, etc.

(2) To use this potential advantage as much as possible, some at least centrally planned, or even centrally located spare-parts- and maintenance-activities should be installed.

(3) To have all three mills of the same technical layout, they should have the same capacity from the beginning, although we have formulated some objections against this policy formerly. We think, however, the advantages of such a solution significantly more important than its disadvantages. Therefore, we recommend to install in all three locations mills with a starting capacity of 6000 tons/year.

(4) The technical layout of these three mills should allow a further increase of capacity in future without major problems. On the other hand, however, it should be possible to run the starting capacity for ever to reasonable costs.

(5) The technical layout of the mills should be structured in a way that the requirements of the consumers towards taste and colour are met as fas as any possible. Some fermenting process should, however, at least for the beginning, not be implemented, due to the very bad experiences of some former attempts of this type. If in future some better approaches to solve this fermenting problem in a satisfying way should be developed, this process should be implemented to this time.

(6) The technical layout of the three mills should allow a best-possible integration into the existing mills or plants.

(7) The technical systems installed in the new mills should be of similar type as those already installed in the existing mills: A major reduction of costs and risks could be realized in this way.

(8) In any way, the technical layout of the new mills should follow to this rule as much as possible:

- As many operations done manually as any possible (to create new jobs)

- and only as many operations done automatically as unavoidable from the technical and / or economical point of view.

(9) A system should be installed, which already has been proven of high efficiency for milling millet under comparable conditions in practice.

(10) A milling-system should be preferred which easily can be cnanged from milling millet to milling sorgho and vice-versa.

(11) Main emphasis should be laid on installing a milling-system being

- as robust
- and as easily to behandled

as any possible.

(12) The milling-system installed should be in a position to produce not only one, but quite a variety of products:

- Not only flour, but semolina, too
- not only one type of flour, but several types.

(13) The layout of the three mills should be a very comprehensive one: It should consist not only out of the definite milling-process, but out of all procedure before and after milling: This layout

- should start with installations for unloading the raw-material

- continuing with storing it

- comprehending then all preparatory operations before milling (cleaning, drying, etc.)

- proceeding then to the definite milling-process

- continued by quality-control-operations

- and the packing of the finished-products

- storing of the finished products should be the next step in this chain,

- ending in loading and transporting of the finished products.

(14) The flow through this procedure should be organized in the best possible way: Intermediary stops or breaks should be avoided wherever possible.

2. Technology: evaluating a technical layout-scheme meeting the critical items just pointed out best

The critical items just pointed out are due to our investigations met best by a system of millet-mills showing the following characteristics:

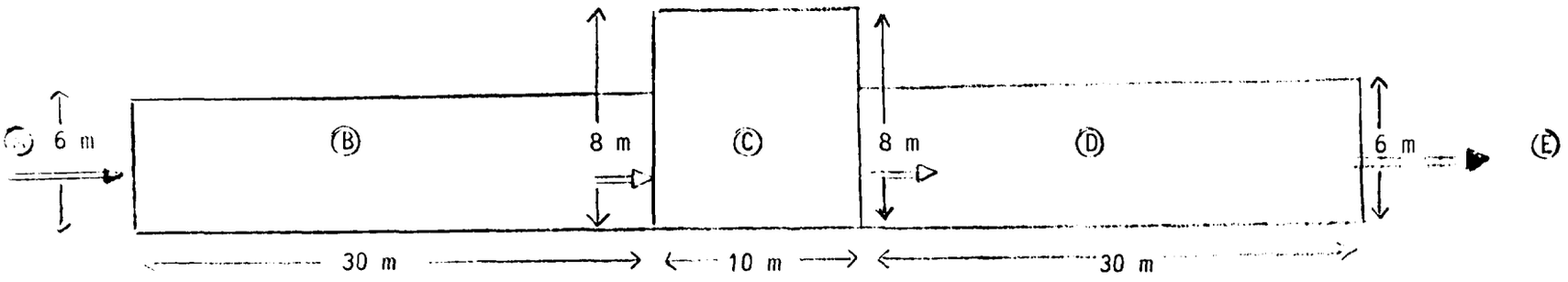
(see tables next pages)

2.1. Civil works, plant-buildings

2.1.1. Overall view

System of the three pilot-mills for millet to be installed in Niamey, Zinder and Kano

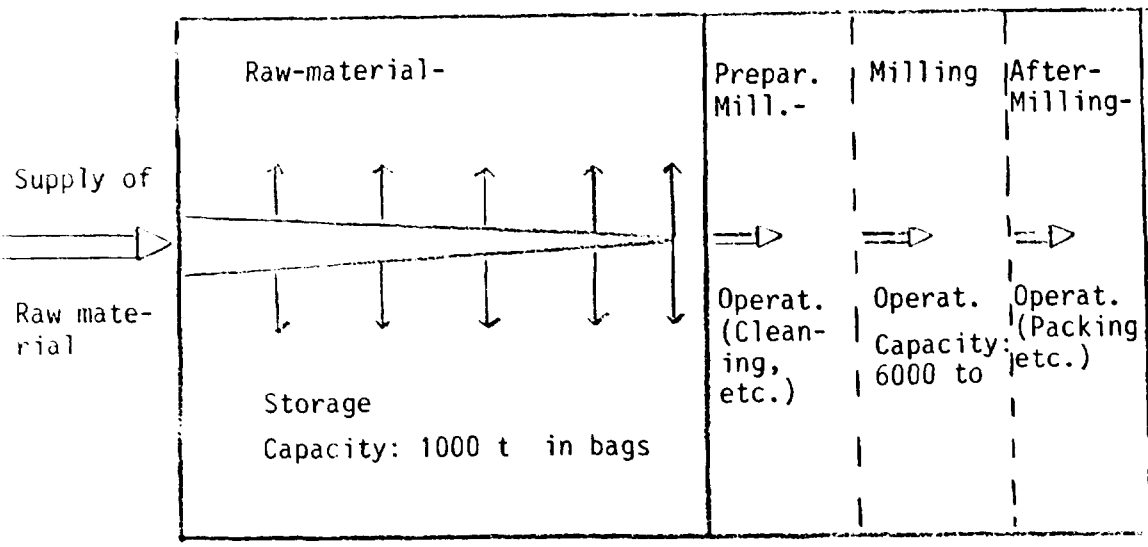
(Repair-shop and office-building separately)

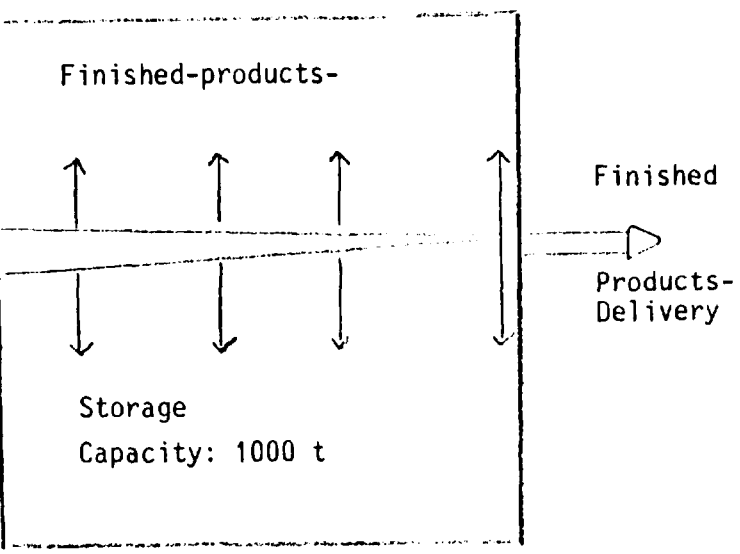


A = Supplying of millet
B = raw-material storage
C = Milling and related procedures
D = Flour-storage
E = Delivery of flour to the market

2.1.2. Flow-chart of these mills

Flow-chart of flour-production in the 3 pilot-mills in Niamey,




Finished-products-
Finished
Products-
Delivery
Storage
Capacity: 1000 t

2.1.3. Some information to these buildings:

a) Size:

aa) Storage (both raw-material and finished-products-storage of same size):

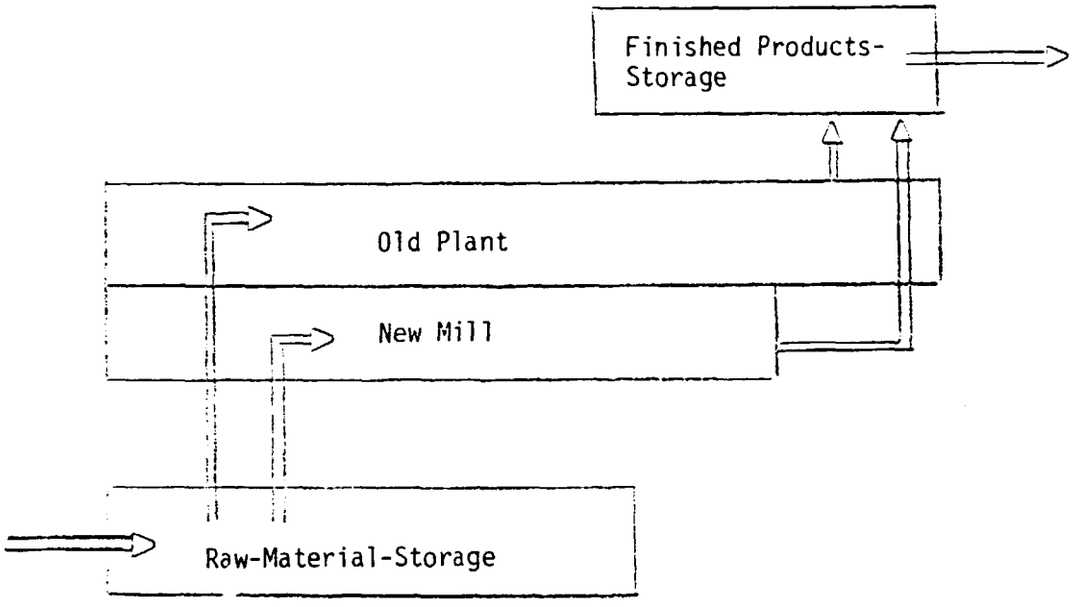
- 15 m broad
- 30 m long
- 6 m high
- = each 450 m^2

ab) Production:

- 15 m broad
- 10 m long
- 8 m high
- = 250 m^2

b) Allocation:

- Optimally as indicated above,
- with some necessary compromises due to the actual building situation in the 3 already existing mills or plant.
- In Zinder, e.g., the actual plant-layout will probably ask for a future layout of the new mill as follows:



c) Erection:
Should be done by domestic companies

d) Types of halls:

- Walls: bricks, cement blocks or similar materials
- Roof: corrigated sheets, asbestos-cement-sheets or similar

e) Types and procedures of storage:

- Raw-material-storage: in 50 kg-bags, without any further installations
- Finished-products-storage: much better equipped to keep the flour in good conditions. Flour should principally be stored in 50-kg-bags, too; shortly

before delivering-time a considerably share be filled into smaller bags (starting with 1 kg, up to about 10 kg); these smaller packages should be stored only for a limited time (= a few days) to avoid damages and losses. For storing these smaller bags, some racks should be installed.

2.2. Machinery-Equipment

After careful examination, we think the FAO-milling-system for millet and sorgho best suited for the three pilot-mills concerned. This system includes the following equipment:

(1) Capacity: 2,400 - 3,600 kg of raw millet/hour depending on desired rate of extraction during shelling and fineness of millet flour, based on processing millet of fair average quality containing not more than 3 % impurities and having a moisture content of 12 - 13 %.

(2) Electrical equipment: All machines arranged for individual electric motor drive, including the required AC motors and AC gear motors as well as power transmitting elements. Including: Switchboard and starters.

(3) Cleaning-section:

Item	Quantity	Description
01	1	Grate for Intake Hopper: Hopper to be built locally out of concrete
02	1	High-Efficiency Cleaner in all-steel construction, for cleaning the raw material in 3 different stages,incorporating vibratory sieve, vertical air separator and magnetic separator
03	1	Centrifugal Dust Collector equipped with fan on top as well as gear motor driven dust lock at the bottom
04	1	Automatic Intake Weigher discharging with every tip 10 kilos, including casing and automatic counter, in framework of structural iron, with feed and discharge box, shut-off slide, however without weights
05	1	Dry Stoner for removing stones, magnetic and non-magnetic metals, in rigid, enclosed steel construction, with crankshaft, detachable air slit screen and dust removal hood, with special feed mechanism for uniform distribution of stock, including exchangeable sieves with steel wire netting
06	1	Fan to serve Centrifugal Dust Collector
	1	Centrifugal Dust Collector to serve Dry Stoner

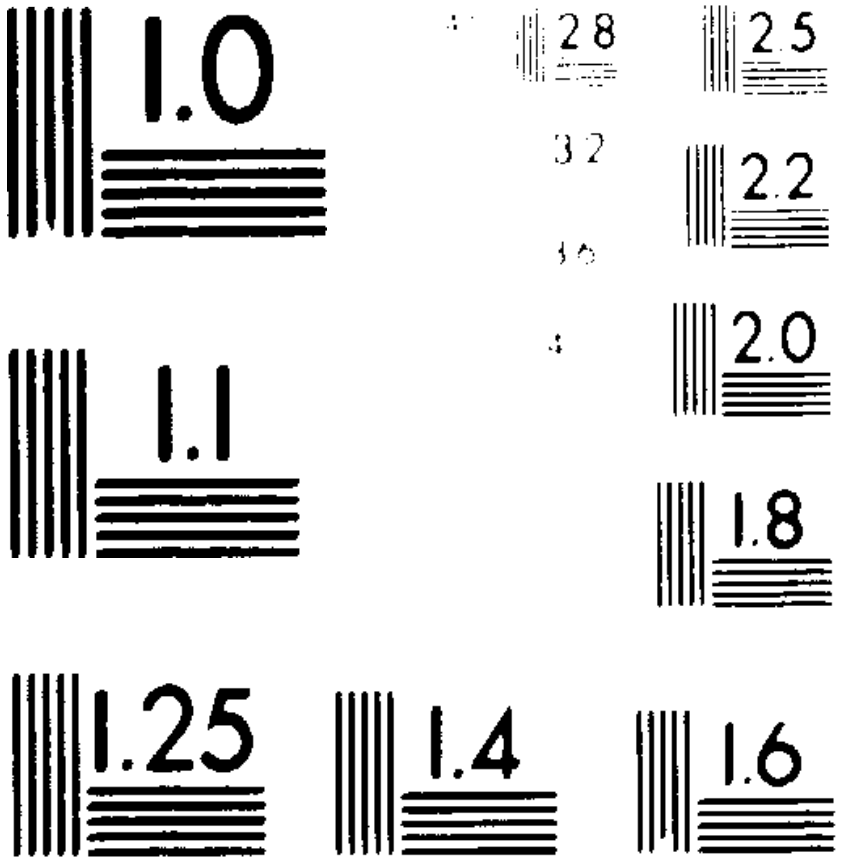
(4) Hulling/Shelling-Section:

Item	Quantity	Description
07	2	Vertical Shelling Machines in sturdy, cast-iron construction, with grinding discs mounted on a vertical shaft, with exchangeable screen cage, outlet for shelled stock with adjustment for determination of milling degree
08	1	Jet Filter comprising modules HA, HL, HB and HS, as well as gear motor driven dust lock, electro-pneumatic cleaning device for the filter sleeves and fan
09	2	Counter-Current Coarse Sifters suitable for the removal of husk particles, meal and dust, with aspiration chamber and cone with adjustable height, diameter of the cylindrical part: 300 mm
10	1	Centrifugal Sifting Machine for the separation of bran, including one set of nylon screens
11	3	Vibratory Feeders, size of trough: 500 x 200 mm, including magnet

(5) Grinding-Section:

12	3	Mills, average of rotor diameter 800 mm, adjustable grinding gap, also comprising electric control unit
13	1	Jet Filter as described under item 08, however with air compressor

Item	Quantity	Description
14	1	Centrifugal Sifting Machine as described under item 10
		(6) Conveying- and Packing-Section for the finished products, further equipment:
15		The required Conveying Elements in all-steel construction
16	1	Pneumatic conveyor for Flour, capacity: max. 2.2 T/h flour
17	1	Flour Storage Bin in stainless steel, capacity: 1 to
18	1	Flour Bagging Scale with pneumatic control
19	1	Conveyor Belt for Bags Length: 4.000 mm Width: 400 mm
20	1	Bag Closing Machine with column, ref.80 800 R
21	1	Main Framework of Structural Iron with common platform, including the required staircase and railing
22		The required Sacking-off Boards
		(7) Parts, accessories, tools
23		The required Intermediate Bins
24		The required Supports and Brackets for Elevators and Intermediate Bins



Item	Quantity	Description
25		The required Feeding Pipes, Intakes and Outlets
26		The required Aspiration Piping
27		The required Erection Material
28		Tools and Accessories, comprising: 1 Block and Tackle Mill, lifting capacity: 500 kilos 1 Tensioner for Elevator Belts 1 Paint Kut 1 Set of Standard Tools
29	1	Switchboard in dust-proof, sheet-metal construction, including the required instruments, such as voltmeters, ammeters, main switch, starters, terminals, lamps, etc.
30	1	Set of electric cable
31	1	Set of Spare Parts
32	1	Labor-Material

(8) Weight and cubage of the equipment:

Total Gross Weigth: approx. 35.000 kg
Total Cubage: approx. 155 m^3

2.3. Spare-parts

- as indicated
- covering the potential demand of 3 years
- = 10 % of the value of total machinery-equipment

2.4. Additional equipment

(1) Laboratory

- All necessary equipment for analyzing the contents of

  . water
  . ashe
  . protein
  etc.

- Some equipment for realizing some baking- and similar tests
- Laboratory-materials

(2) Repair-Shop

- Some small metal-processing-machines like drilling-machines, turning machines, welding equipment, etc.
- Some installations for electrical repair- and maintenance work
- Some installations for truck-repair and maintenance

2.5. Storage-equipment

- Raw-material storage: no special equipment needed
- Finished-products-storage: only some racks needed
- For both stores, a fork-lift should perhaps be installed later on.

2.6 Assembling

- 1 container including a set of appropriate assembling-tools and -equipment needed, which should be integrated into the equipment of the repair-shop later on.

- Some auxiliary assembling-materials, and supporting structural steel-framework-constructions will be needed, too

- As manpower, 1 foreign assembling-expert of the equipment supplier would be necessary plus 1 domestic fitter, 1 domestic electrician and 10 domestic unskilled workers.

- Civil-works should be realized by domestic companies.

3. Investments needed

3.1 Investments needed for the three pilot-mills

3.1.1. Civil works
3.1.2. Machinery-equipment
3.1.3. Storage-equipment
3.1.4. Repair-shop-equipment
3.1.5. Laboratory-equipment
3.1.6. Transportation-equipment (as far as needed)
3.1.7. Spare-parts-provision
3.1.8. Assembling-materials

3.2 Investments needed for the supplementary installations recommended

- Development-center in Zaria
- Experimental-bakery in Kano
- Development-center in Zinder
- Marketing-board in Niamey and Kano

3.1. Investments needed for the three pilot

	Niamey-mill, combined with existing rice-mill
3.1.1. Civil-works:	
(1) Storage for raw-material 450 m^2	180.000 DM
(2) Production-hall, 250 m^2, height 8 m	125.000 DM
(3) Storage for finished products, 450 m^2	180.000 DM
(4) Office-building	not necessary[1)]
(5) Repair-shop	not necessary[1)]
(6) Grate for intake Hopper	20.000 DM
(7) Roads and other infra-structure	not necessary[1)]
(8) Houses for workers (additionally to already existing houses)	40.000 DM
(9) Reserve for further civil-works and unforeseen events	15.000 DM
Total investments	560.000 DM

1) not necessary, as already sufficiently existing

mills

	Zinder-mill, combined with Sotramil -plant	Kano-mill, combined with existing NNFM-wheat-mill
	not necessary[1)]	180.000 DM
	125.000 DM	125.000 DM
	180.000 DM	180.000 DM
	not necessary[1)]	not necessary[1)]
	not necessary[1)]	not necessary[1)]
	20.000 DM	20.000 DM
	not necessary[1)]	not necessary[1)]
	40.000 DM	40.000 DM
	15.000 DM	15.000 DM
	380.000 DM	560.000 DM

3.1. Investments needed for the three pilot mills

	Niamey-mill, combined with existing rice-mill	Zinder-mill, combined with Sotramil -plant	Kano-mill, combined with existing NNFM-wheat-mill
3.1.2. Machinery equipment			
(3) Cleaning-Section:			
It. Qty Description			
02 1 Cleaner	37.100 DM	37.100 DM	37.100 DM
03 1 Dust-Collector	14.500 DM	14.500 DM	14.500 DM
04 1 Intake Weigher	15.800 DM[1)]	15.800 DM[1)]	15.800 DM[1)]
05 1 Dry-Stoner	20.100 DM	20.100 DM	20.100 DM
06 1 Fan	11.000 DM	11.000 DM	11.000 DM
Total cleaning-section	98.500 DM	98.500 DM	98.500 DM
(4) Hulling/Shelling Sect.			
07 2 Shelling Machines	152.000 DM	152.000 DM	152.000 DM
08 1 Jet Filter	48.600 DM	48.600 DM	48.600 DM
09 2 Sifters	4.900 DM	4.900 DM	4.900 DM
10 1 Sifting machine	12.000 DM	12.000 DM	12.000 DM
11 3 Feeders	8.800 DM	8.800 DM	8.800 DM
Total Shelling-section	226.300 DM	226.300 DM	226.300 DM

1) possibly not nessary

3.1. Investments needed for the three pilot mills

			Niamey-mill, combined with existing rice-mill	Zinder-mill, combined with Sotramil -plant	Kano-mill, combined with existing NNFM-wheat-mill
(5) Grinding-Section:					
12	3	Mills	390.000 DM	390.000 DM	390.000 DM
13	1	Jet Filter	60.500 DM	60.500 DM	60.500 DM
14	1	Sifting Machine	12.000 DM	12.000 DM	12.000 DM
Total Grinding section			462.500 DM	462.500 DM	462.500 DM
(6) Conveying- and Packing-Section:					
15		Conveying elements	37.100 DM	37.100 DM	37.100 DM
16	1	Pneumatic Conveyor	28.800 DM	28.800 DM	28.800 DM
17	1	Flour Storage Bin	10.700 DM	10.700 DM	10.700 DM
18	1	Flour Bagging Scale	60.100 DM[1)]	60.100 DM[1)]	60.100 DM[1)]
19	1	Conveyor Belt for Bags	19.200 DM[1)]	19.200 DM[1)]	19.200 DM[1)]
20	1	Bag Closing Machine	26.600 DM[1)]	26.600 DM[1)]	26.600 DM[1)]
21	1	Main Framework of structural steel	50.900 DM	50.900 DM	50.900 DM
22		Sacking-off-boards	5.000 DM	5.000 DM	5.000 DM
Total Conveying and packing-Section			238.400 DM	238.400 DM	238.400 DM

[1)] possibly not necessary as already existing

3.1. Investments needed for the three pilot mills

	Niamey-mill, combined with existing rice-mill	Zinder-mill, combined with Sotramil -plant	Kano-mill, combined with existing NNFM-wheat-mill
(7) Parts, accessories, tools:			
23 - Intermediate Bins	6.900 DM	6.900 DM	6.900 DM
24 - Supports,Brackets, etc.	6.400 DM	6.400 DM	6.400 DM
25 - Feeding Pipes, Intakes, Outlets,etc.	23.500 DM	23.500 DM	23.500 DM
26 - Aspiration Piping	7.100 DM	7.100 DM	7.100 DM
27 - Assembling materials	7.500 DM	7.500 DM	7.500 DM
28 - Assembling Tools	3.900 DM	3.900 DM	3.900 DM
29 1 Switchboard	87.500 DM	87.500 DM	87.500 DM
30 1 Set of electr.cables	18.800 DM	18.800 DM	18.800 DM
Parts, etc. in total	161.600 DM	161.600 DM	161.600 DM
Total Machinery Equpipment:			
- Cleaning Section	98.500 DM	98.500 DM	98.500 DM
- Shelling Section	226.300 DM	226.300 DM	226.300 DM
- Grinding Section	462.500 DM	462.500 DM	462.500 DM
- Conveying- and Packing-Section	238.400 DM	238.400 DM	238.400 DM
- Parts, etc.	161.600 DM	161.600 DM	161.600 DM
Total Machinery Equipment	1.187.300 DM	1.187.300 DM	1.187.300 DM

3.1. Investments needed for the three pilot mills

	Niamey-mill, combined with existing rice-mill	Zinder-mill, combined with Sotramil -plant	Kano-mill, combined with existing NNFM-wheat-mill
3.1.3. Storage-Equipment			
- Silos for Raw Material	-	-	-
- Racks, etc. for finished products	15.000 DM	not necessary[1)]	15.000 DM
- 1 fork-lift	not in the starting period, perhaps later		
Total Storage-equipment	15.000 DM	-	15.000 DM
3.1.4. Repair-Shop-Equipment			
- Some additional metal-processing machinery	15.000 DM	10.000 DM	not necessary[1)]
- Some welding equipment	not necessary[1)]	not necessary[1)]	not necessary[1)]
- Some electrical fitting, repair and maintenance equipment	5.000 DM	5.000 DM	not necessary[1)]
- Some truck-repair-equipment	not necessary[1)]	not necessary[1)]	not necessary[1)]
Total repair-shop-equipment	20.000 DM	15.000 DM	-

[1)] as already existing

3.1. Investments needed for the three pilot mills

	Niamey-mill, combined with existing rice-mill	Zinder-mill, combined with Sotramil -plant	Kano-mill, combined with existing NNFM-wheat-mill
3.1.5. Laboratory-equipment			
- Laboratory-test- and analysing equipment	not necessary[1)]	not necessary[1)]	not necessary[1)]
- Laboratory-material[2)]	4.300 DM	4.300 DM	4.300 DM
- Chemicals, etc. to be used during the first time	2.000 DM	2.000 DM	2.000 DM
Total laboratory equipment	6.300 DM	6.300 DM	6.300 DM
3.1.6. Transportation-equipment			
Trucks	not necessary	not necessary	not necessary
3.1.7. Spare-part-provision			
- Spare-parts for machinery equipment	120.000 DM	120.000 DM	120.000 DM
- Spare-parts, tools, etc. for repair-shop, etc.	15.000 DM	15.000 DM	15.000 DM
Total spare-parts	135.000 DM	135.000 DM	135.000 DM

1) as already existing

2) plus some additional, now lacking equipment

3.1. Investments needed for the three pilot mills

	Niamey-mill, combined with existing rice-mill	Zinder-mill, combined with Sotramil -plant	Kano-mill, combined with existing NNFM-wheat-mill
3.1.8. Assembling-operat.			
Additionally to tools and materials included in section 3.1.2.:			
- Assembling installations and facilities	64.000 DM	64.000 DM	64.000 DM
- Costs of assembling-personnel: 1 foreign expert, 2 skilled, 10 unskilled domestic workers	85.000 DM	85.000 DM	85.000 DM
Total assembling	149.000 DM	149.000 DM	149.000 DM
3.1.9. Total investments			
(1) Civil-works	560.000 DM	380.000 DM	560.000 DM
(2) Machinery equipment	1.187.300 DM	1.187.300 DM	1.187.300 DM
(3) Storage equipment	15.000 DM	-	15.000 DM
(4) Repair-shop-equipment	20.000 DM	15.000 DM	-
(5) Laboratory equipment	6.300 DM	6.300 DM	6.300 DM
(6) Transportation equipm.	-	-	-
(7) Spare-parts	135.000 DM	135.000 DM	135.000 DM
(8) Assembling-operations	149.000 DM	149.000 DM	149.000 DM
Total investments	2.072.600 DM	1.872.600 DM	2.052.600 DM
(9) + Costs of training of personnel	70.000 DM	55.000 DM	40.000 DM
Total investments	2.142.600 DM	1.927.600 DM	2.092.600 DM

3.2 Investments needed for the supplementary installations recommended

3.2.1. Investments for the product-development-center in Zaria

Quantity	Item	Costs (cif Lagos or Abidjan)
(1)	Equipment:	
1	farinograph/resistograph (for physical tests on flour)	17.000,- DM
1	mixer measuring head (for the preparation of the farinogram)	9.600,- DM
1	circulation thermostat	2.400,- DM
1	flour and dough balence	500,- DM
1	valorimeter	400,- DM
1	extensograph (for measuring the stretching properties of flour)	24.000,- DM
1	circulation thermostat	2.300,- DM
1	planimeter	500,- DM
1	anylograph (measuring the gelatinization properties of flour)	12.300,- DM
1	laboratory pilot mill (for test-flour)	14.300,- DM
1	struct-O-graph (for deformation- and fructure-tests	11.000,- DM
1	electric baking oven	19.500,- DM
1	bread-volume-analyzer	6.800,- DM
	Total equipment:	120.600,- DM

Quantity	Item	Cost (cif Lagos or Abidjan)
(2)	Accessories (not obligatory):	
	- Accessories for anylograph (bowl, measuring bowl, special measuring probe, 1 set of gear wheels	1.900,- DM
	- Accessories for struct-O-graph (sensitivity spring; ball-ram of different diameter; dto. cylinder-ram; dto. cosie-ram)	1.200,- DM
	Total accessories:	3.100,- DM
(3)	Spare-parts recommended:	
	- Spare-parts for farinograph/ resistograph	1.300,- DM
	- Spare-parts for extensograph	900,- DM
	- Spare-parts for anylograph	1.200,- DM
	- Spare-parts for pilot mill	1.200,- DM
	- Spare-parts for struct-O-graph	400,- DM
Total spare-parts:	first equipment:	5.000,- DM
	2nd equipment:	10.000,- DM
(4)	Auxiliary installations (furniture, calculating machines, offices-equipment, etc.)	15.000,- DM
Total investments in Zaria (cif):		
(1)	Equipment	120.600,- DM
(2)	Accessories	3.100,- DM
(3)	Spare-parts (2nd equipment)	10.000,- DM
(4)	Auxiliary installations (furniture, etc.)	15.000,- DM
	Total investment:	148.700,- DM

3.2.2. Investments needed for the experimental bakery in Kano

An in-depth-analysis of the actual equipment of this existing experimental bakery in Kano was impossible to us, because this bakery was closed during our stay in Kano. We were said, however, that a considerable share of total equipment is still in function, so that only quite low investments would be sufficient to have this bakery satisfyingly running. Besides that it should be in mind that we propose (see above) to install some experimental bakery-equipment in Zaria, too: an electric baking-oven and a bread-volume-analyser. We think it better to have this equipment installed directly in Zaria to have a closer link between research and baking-operations. This means that major experimental baking-operations will be realized in Zaria, too, while the experimental-bakery in Kano only has to cover the functions

- both to increase the capacity available for baking-experiments
- and to cover those special operations and functions which cannot be covered in Zaria.

In any way, due to these quite limited functions of the bakery in Kano, and due to the fact that some basic equipment is already installed there, we think it justified to limit the investments in this bakery to about (as first rough estimate) 30.000,- DM (cif). Some de-detailed analysis should be done to establish an in-depth-investment-plan for this bakery.

3.2.3. Investments needed for product-development in Zinder

As indicated above, Zinder should - in the overall-product-development-concept developed by us - cover the function to do some additional product-development-work in the field of using millet-flour in pastry-production: basic product-development should be concentrated in Zaria, and Zinder only should - under the guidance of Zaria-contribute some additional input, specialized for using millet-flour in pastry-production. As far as investments are concerned, this concept means that

- most of the development-operations for which machinery-equipment is used, are done in Zaria

- some minor operations done in Zinder machinery-equipment of Zaria externally could be used

- and that finally for some perhaps remaining, up to now not covered operations the new equipment of newly installed (or planned to be soon installed) pastry-plant could certainly be used, which definitely includes some laboratory- and testing equipment, too.

Seen from this point of view, it may be accepted that at least for the beginning no investments should be planned for the product development-center (or more exactly: sub-center to Zaria) in Zinder. Instead of this, a cooperation-contract should be established being the basis for a cooperation between Zaria and Zinder as closely and intensively as any possible. For some later future, it may be checked for another time whether some additional equipment should be installed or not.

3.2.4. Investments for the Marketing-Board in Niamey and Kano

The most important "investment" in this board will be to have some excellent experts installed, being able

- both to cover all marketing-aspects concerned
- and all physical-distribution-problems
- furtheron all aspects of an intensified new-product-development
- and finally to cover all aspects of a close cooperation between the 3 mills, including a joint spare-provision as well as joint maintenance-efforts, etc.

Besides these "personnel-investments" only some minor further investments should be necessary, mainly the following:

a) each 1 car should be installed both in Niamey and Kano

b) a further car, probably a station car, should later on be bought for the mechanician being in charge of in-depth-service, -repair- and maintenance-functions centrally for all 3 mills: While smaller repairs, etc. should be handled by local personnel in the 3 mills, major repairs should be done by this mechanician.

c) Finally, some office-equipment should be invested.

In total, we sum up the investments in this category for about 90.000,- DM.

3.3 Total investments

The total investment necessary is shown in the following table.

	Niamey-mill, combined with existing rice-mill	Zinder-mill, combined with Sotramil -plant	Kano-mill, combined with existing NNFM-wheat-mill
(1) Direct investments	2.142.600 DM	1.927.600 DM	2.092.600 DM
(2) Investments for the product-development-center in Zaria:			
a) Total		148.700 DM	
b) 1/3 for each mill	49.500 DM	49.500 DM	49.700 DM
(3) Investments for the experimental-bakery in Kano:			
a) Total		30.000 DM	
b) 1/3 for each mill	10.000 DM	10.000 DM	10.000 DM
(4) Investments for the supplementary product-development-center in Zinder		-	
(5) Investments for the marketing-board in Niamey and Kano:			
a) Total		90.000 DM	
b) 1/3 for each mill	30.000 DM	30.000 DM	30.000 DM
Total investments	2.232.100 DM	2.017.100 DM	2.182.300 DM

	Niamey-mill, combined with existing rice-mill	Zinder-mill, combined with Sotramil -plant	Kano-mill, combined with existing NNFM-wheat-mill
From last page:	2.232.100 DM	2.017.100 DM	2.182.300 DM
(6) Engineering + planning 10 %	218.900 DM	198.900 DM	216.700 DM
(7) Total investments	2.451.000 DM	2.216.000 DM	2.399.000 DM
(8) Out of this: to be financed by			
a) foreign exchange	1.827.000 DM	1.771.000 DM	1.787.000 DM
b) domestic capital:			
ba) for investments	624.000 DM	445.000 DM	612.000 DM
bb) + cost of transportation and insurance inside Africa: app. 3 % of foreign deliveries	79.000 DM	78.000 DM	78.000 DM
Total domestic:	703.000 DM	523.000 DM	690.000 DM

Notice: working-capital-demand not yet included

VII. PLANT ORGANIZATION

1. Preliminary remarks

As indicated before, the 3 pilot mills projected will be integrated into already existing mills or plants. As far as the organization-scheme is concerned, it should be based on the already existing organization-schemes, too. The "ideal" organization-schemes which we shall develop in the following thus have to be adapted to the already existing schemes. The lack of efficiency which may to some extent result out of this adaption, is to our experience of lower negative importance as if the existing organization-scheme has to be changed significantly as a consequence of the installation of the new, additional millet-mill. The organization-schemes elaborated by us in the following, should, therefore, be regarded as targets, which should be realized as far as the existing organization-scheme allows this without being changed significantly.

2. Overall-organization of the whole group

As pointed out in a previous chapter, the 3 pilot mills should be organized as parts of an overall group, consisting out of

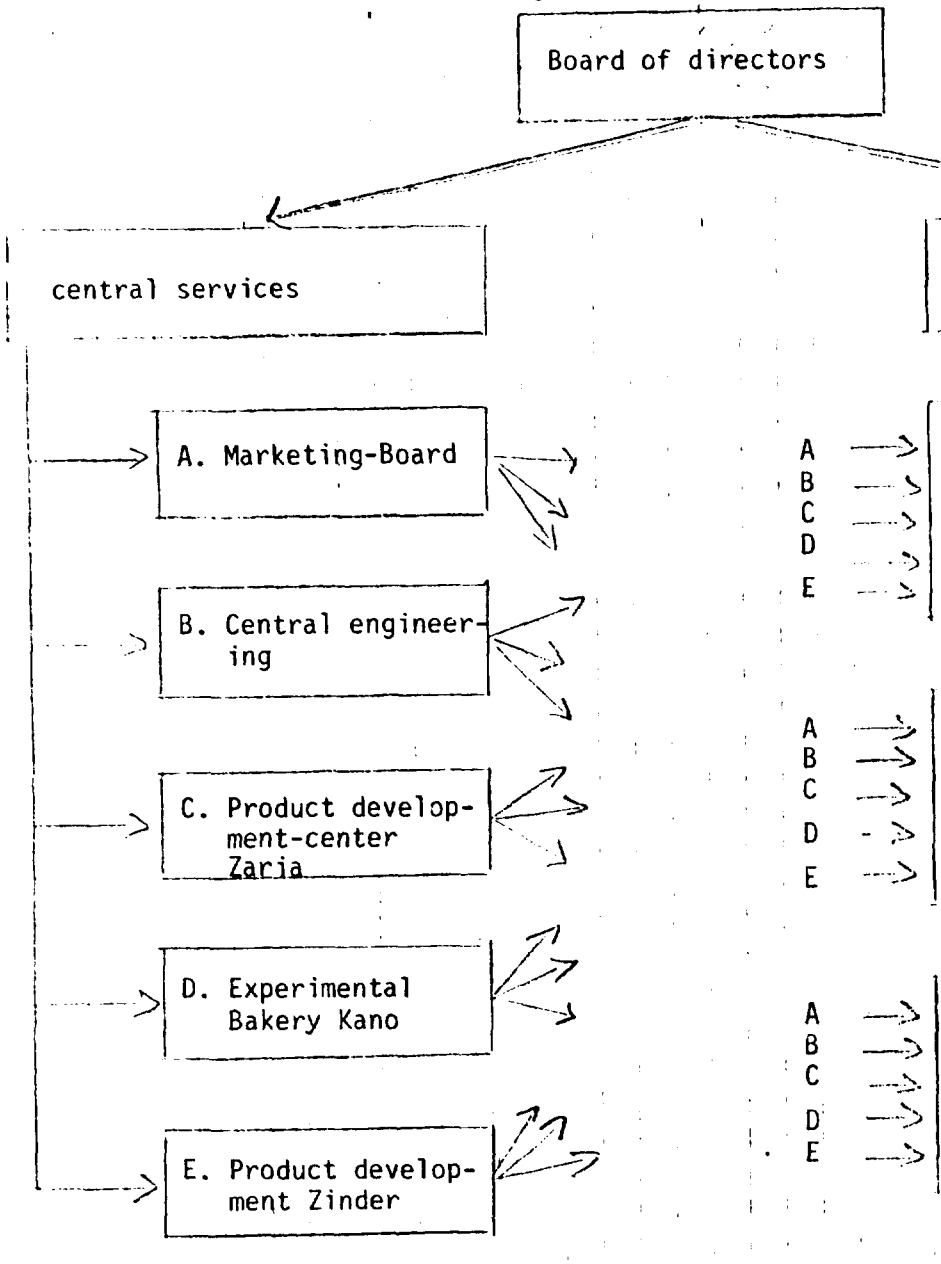
- some centralized institutions
- and the 3 pilot mills;

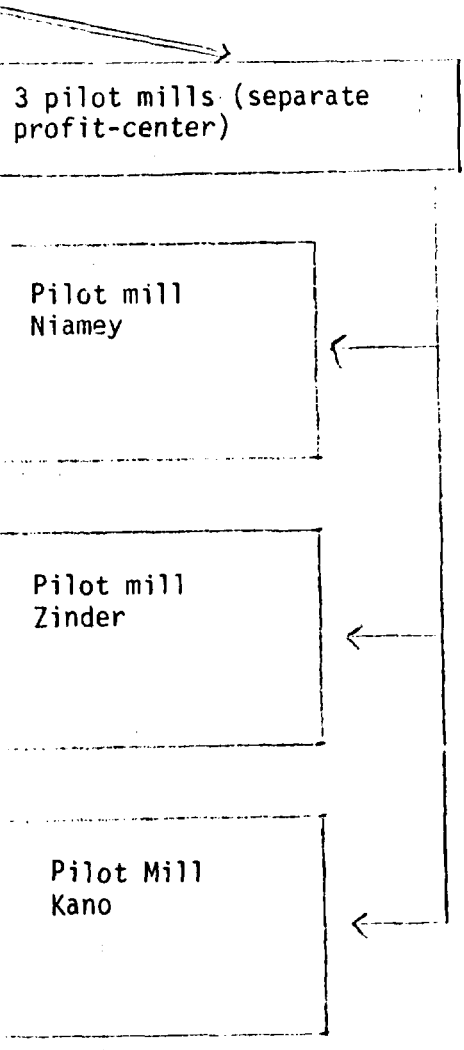
the cooperation inside this group should be as close as any possible.

To reach this aim, we think the following organization for all the group best suited:

(see graph next page)

Overall organization-scheme of the millet-mill-group in Niger/Nigeria




3 pilot mills (separate profit-center)
Pilot mill Niamey
Pilot mill Zinder
Pilot Mill Kano

Some remarks to this overall organization-scheme:

a) Board of directors:

- members:

  . as head: the general secretary of the Joint-Commission
  . the 3 general directors of the 3 pilot mills
  . the head of the Marketing-Board
  . the head of the product-development-center in Zaria
  . the head of central engineering

- permanent Secretary of this board: a senior staff-member of the Joint Commission

- function: ensuring a cooperation between the different units of this group as closely as any possible; supporting the exchange of experiences, knowledges, etc.; promoting the consumption of millet-flour towards public; acting as "pressure-group" towards governments; etc.

- way of working: meetings at least 4 times per year, to fixed dates

b) Central services:

- no additional persons employed in this particular field

- the function of guiding, coordinating, developing, etc. of the central services is covered by the board of directors as whole body

- it may perhaps proof to be wise to appoint a member of the board of directors to be especially in charge of covering this function

c) 3 pilot mills:

- each of these 3 mills has strictly to be managed as own, separate profit-center; the manager of each of these mills is fully responsible for the profit-situation of his mills

- this means, however, that any external institution

  . may it be the board of directors
  . or any of the central service-institutions

  are only allowed and in a position to give advice to each of these mills, nothing more:

  . they are not allowed to give any orders to the managers of the 3 mills

  . and the managers are completely free whether to follow to these advices, recommendations or not

- each activity should strictly be avoided which could change this system towards a reduced responsibility of the managers of the 3 mills for the profit, the costs, the sales, etc. of their mills. We are convinced that this 100 %-profit-center-system is of vital importance for a good development of the 3 mills.

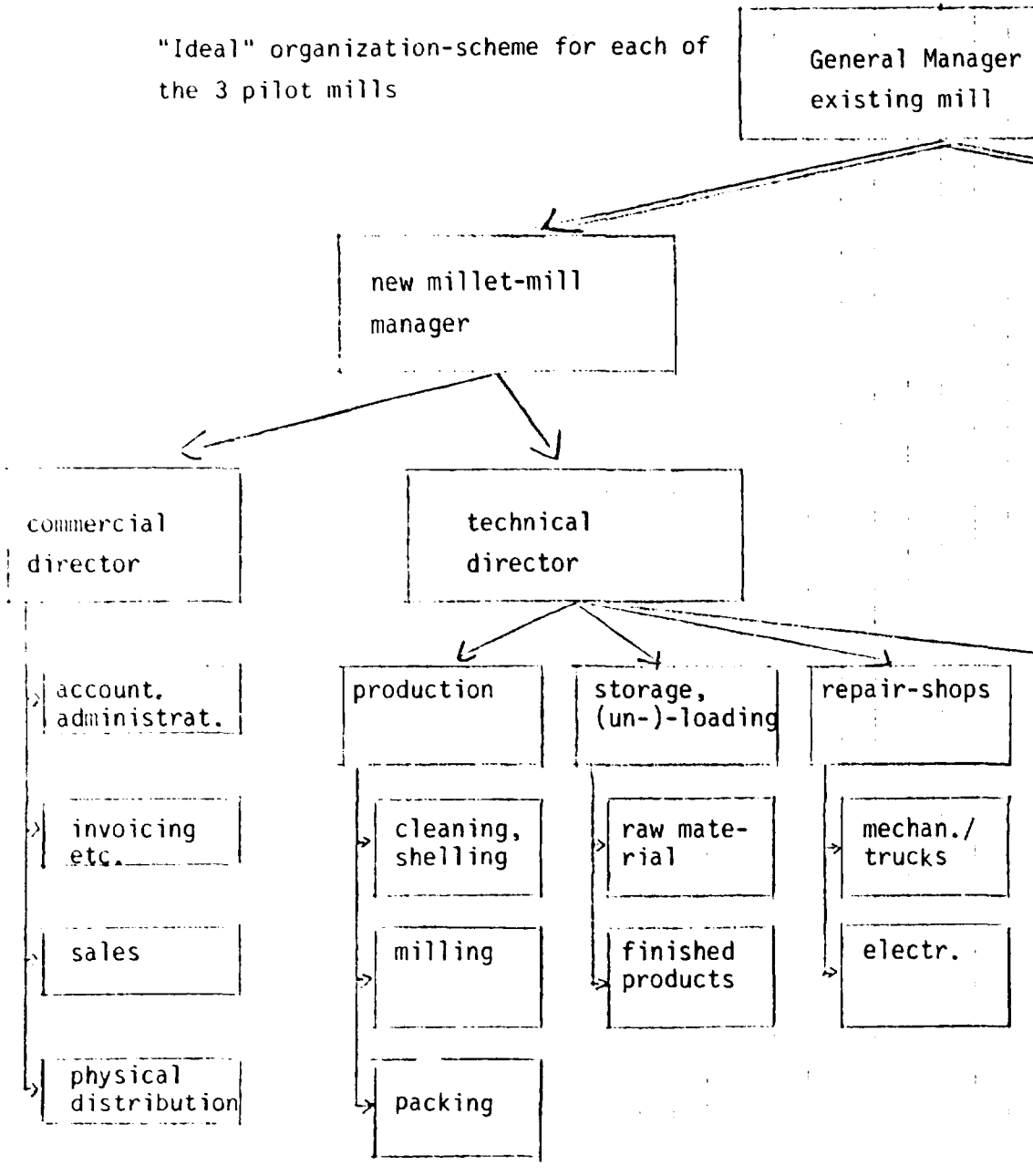
d) Further details concerning the 5 central service-institutions (A - E) were already given in the last chapter.

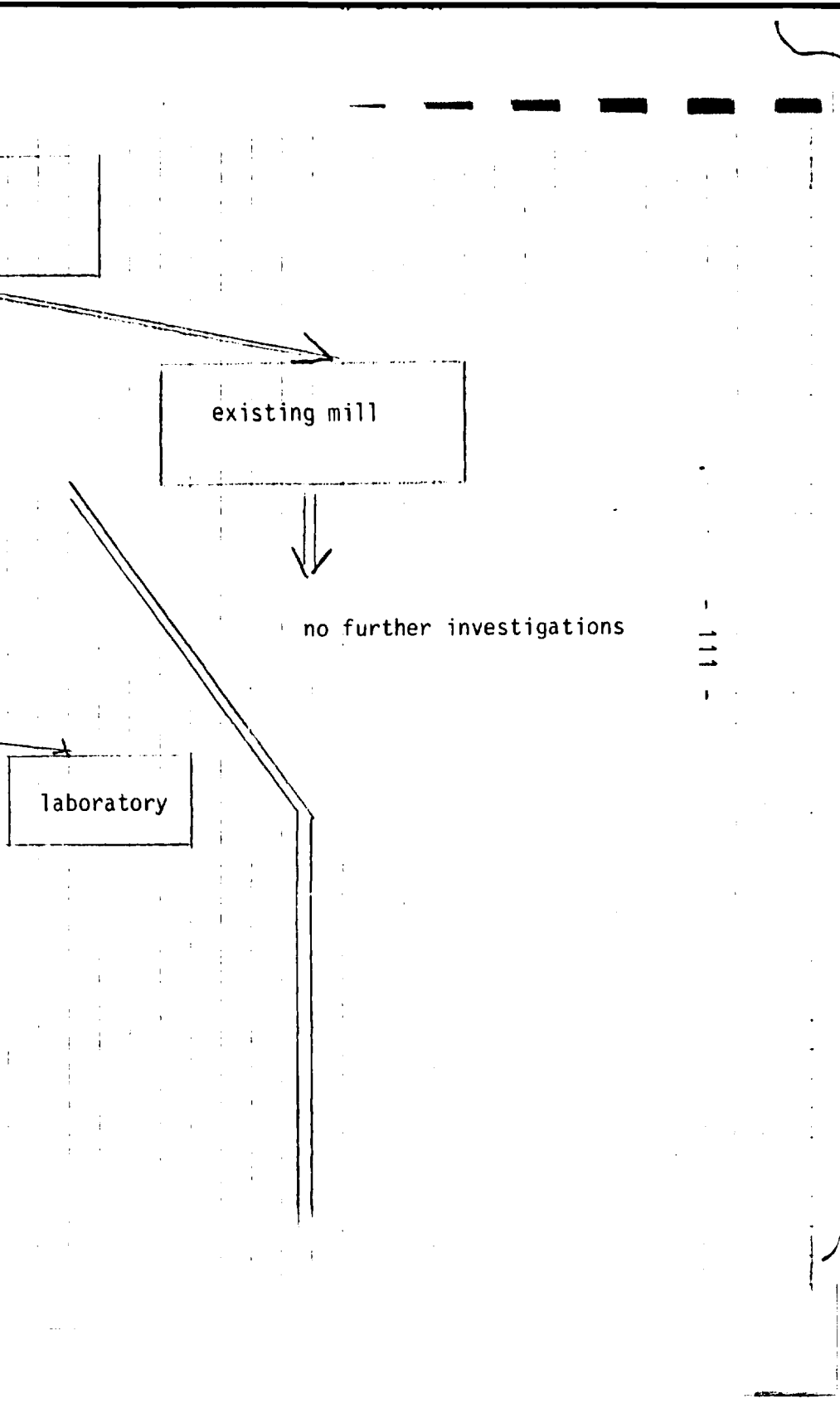
3. The organization of the 3 mills

The "ideal" organization of each of these 3 mills is shown in the following scheme:

(see next page)

"Ideal" organization-scheme for each of the 3 pilot mills




existing mill
no further investigations
laboratory

VIII. MANPOWER

1. Number and structure of manpower required

The manpower required

- both in the central service-institutions of the group
- and in each of the 3 mills concerned

is shown in the following tables. The figures in brackets ( ) and not in brackets mean:

- figures in brackets: number of persons necessary in principle to cover this function

- figures not in brackets: number of persons being definitely necessary in each of the 3 mills to cover this function;

- the difference between these 2 figures and the persons already available in the existing mills being in a position to cover the additional functions of the new millet-mill, too.

On this basis, the manpower-requirements were found out as follows (see next pages):

	No. of shifts	Qualification level	Niamey-mill combined with existing rice-mill[1]	Zinder-mill combined with Sotramil-plant[1]	Kano-mill combined with existing NNFM-wheat mill[1]
1. Management:					
1.1. Commerc.direct.		skilled expert	(1) -	(1) 1	(1) -
1.2. Techn.director		engineer	(1) -	(1) 1	(1) -
1.3. Secretary		skilled clerk	(1) -	(1) -	(1) -
Management in total			(3) -	(3) 2	(3) -
additionally: 1 milling-engineer, being specialized in millet-milling, being located centrally with the Marketing-Board in Niamey, and being obliged to care for all 3 mills to solve their possible technical- and product-problems. Travelling intensively between Niamey and the 3 mills. Should probably be a foreign expert.					
2. Production:	for each shift:				
2.1. 1 miller	2	skilled work.	(2) 2	(2) 2	(2) 2
2.2. 1 helper	2	skilled work.	(2) 2	(2) 2	(2) 2
2.3. 6 fillers	2	unskilled w.	(12) 6	(12) 12	(12) 6
2.4. 4 packers	2	unskilled w.	(8) 4	(8) 8	(8) 4
Total production:			(24) 14	(24) 24	(24) 14
3. Storage, loading/unloading, auxil. services:					
3.1. Raw-mat. unload.,storing, etc.	1	unskilled w.	(4) 2	(4) 4	(4) 2
3.2. Finished prod.-storing, etc.	1	unskilled w.	- (done by the packers)	- (done by the packers)	- (done by the packers)

1) in brackets: total demand; without brackets: real demand (others already existing)

	No. of shifts	Qualification level	Niamey-mill combined with existing rice-mill[1]	Zinder-mill combined with Sotramil-plant[1]	Kano-mill combined with existing NNFM-wheat mill[1]
3.3. Loading + aux. services	1	unskilled w.	(2) 1	(2) 2	(2) 1
3.4. Guards	1	unskilled w.	(2) -	(2) 1	(2) -
Total in this section			(8) 3	(8) 7	(8) 3
4. Auxiliary serv.:					
4.1. Mechanical repair-shop	1	skilled mechanician	(1) 1	(1) 1	(1) 1
4.2. Electrical repair-shop	1	skilled electrician	(1) 1	(1) 1	(1) 1
4.3. Laboratory-assistant	1	skilled assistant	(1) 1	(1) 1	(1) -
4.4. Helpers for repair-shops	1	unskilled w.	(2) 2	(2) 2	(2) 1
Total auxiliary services:			(5) 5	(5) 5	(5) 3
5. Commercial personnel:					
5.1. Head of accounting	1	skilled exp.	(1) -	(1) -	(1) -
5.2. Invoicing/monitoring,etc.	1	skilled clerk	(1) -	(1) -	(1) -
5.3. Typist	1	skilled pers.	(1) -	(1) -	(1) -

[1] in brackets: total demand; without brackets: real demand (others already existing)

	No. of shifts	Qualification level	Niamey-mill combined with existing rice-mill[1)]	Zinder-mill combined with Sotramil-plant[1)]	Kano-mill combined with existing NNFM-wheat mill[1)]
5.4. Head of sales-division	1	skilled exp.	(1) 1	(1) 1	(1) 1
5.5. Outdoor-salesmen + promotion	1	skilled salesman	(1) 1	(1) 1	(1) 1
5.6. Assistant for handl.physical distrib.,stock control,purchasing-mater. etc.	1	skilled junior expert	(1) 1	(1) 1	(1) 1
Total commerc. and sales-division			(6) 3	(6) 4	(6) 3
6. Total manpower needed:					
6.1. Management			(3) -	(3) 2	(3) -
6.2. Production			(24) 14	(24) 24	(24) 14
6.3. Storage etc.			(8) 3	(8) 7	(8) 3
6.4. Aux. services			(5) 5	(5) 5	(5) 3
6.5. Comm. + sales			(6) 3	(6) 4	(6) 3
7. Total manpower needed			(46)	(46)	(46)
8. Out of this:already available:			21	4	23
9. Still needed			25	42	23

1) see page 114

	No. of shifts	Qualification level	Niamey-mill combined with existing rice-mill[1)]	Zinder-mill combined with Sotramil-plant[1)]	Kano-mill combined with existing NNFM-wheat mill[1)]
10. Other personnel needed:					
10.1. Product development-center Zaria		Food-expert with chemic. background	1 expert to be installed and integrated in the already existing expert-team of the Zaria-university		
10.2. Product-development-center Zinder			no special expert to be installed: this function should be covered by the product-development-experts of Sotramil		
10.3. Experimental bakery in Kano		skilled baker	1 skilled baker should be installed there, or (alternatively) in Zaria		
10.4. Marketing-Board					
10.4.1. headquarters in Niamey		skilled exp.	2 skilled marketing-experts should be installed in the headquarters of this board in Niamey		
10.4.2. branch-office in Kano		dto.	in this branch-office, 1 skilled marketing-expert should be installed		
11. Total personnel required:					
11.1. located in the 3 mills			(46) 25	(46) 42	(46) 23
11.2. located in one of the centralized institut				(6) 6	

1) see page 114

	No. of shifts	Qualification level	Niamey-mill combined with existing rice-mill[1)]	Zinder-mill combined with Sotramil-plant[1)]	Kano-mill combined with existing NNFM-wheat mill[1)]
12. Total personnel (centrally located personnel splitted up)			(48) 27	(48) 44	(48) 25
Structure of the personnel needed:					
1. Management			-	2	-
2. Skilled experts:					
2.1. technical			2	2	2
2.2. commercial/ sales			3	4	3
3. Skilled workers			5	5	4
4. Unskilled workers			15	29	14
Total personnel needed + centrally located personnel			25	42	23

1) see page 114

2. Origin of the personnel needed

a) Foreign personnel needed:

- 1 milling engineer, centrally located, caring for all 3 mills

- not necessarily, but possibly: 1 product-development-expert, being located preferably in Zaria, may be in Zinder, too.

b) domestic personnel needed:

- all the other personnel just enumerated
- with partly substantial training needs

The milling engineer and the product development expert should be employed for three years each. This employment should be managed by the German Agency for Technical Cooperation (GTZ), P.O.Box 5180, D-6236 Eschborn 1, Department 153 : Agro-industries.
Officers in charge are Mr. Bohnstedt and Mr.Kiessling.

3. Training needs

On the base of our experiences and of discussions

- with the management of the existing mills
- with potential suppliers of the milling-machinery

we estimate the training needs as follows :

Training needs for the 3 pilot mills and the central service-institutions

Type of personnel	level of qualification	No. of persons	type of training, of training required	duration of training	
				per person (weeks)	total man-weeks
1. Commercial director	skilled expert	(3) 1	no special training necessary	-	-
2. Technical director	engineer	(3) 1	a) training with the machinery-supplier (in foreign countries)	4	12
			b) training on the job, in the spot (both for the already existing engineers, too)	4	12
3. Central engineering officer	engineer	(1) 1	no training necessary	-	-
4. Production:					
4.1. miller	skilled work.	(6) 6	a) training with the machinery-supplier (in foreign countries)	4	only 1/mill: 12
			b) training on the job, in the spot	4	24
4.2. helper	skilled work.	(6) 6	training on the job, in the spot	4	24
4.3. fillers and packers	unskilled w.	(60) 40	training on the job, in the spot	3	120
5. Storage, loading, unloading:					
- storing)					
- loading)	unskilled w.	(24) 13	no special training necessary	-	-
- unloading)					
- guards)					

Training needs for the 3 pilot mills and the central service-institutions

Type of personnel	level of qualification	No. of persons	type of training, of training required	duration of training	
				per person (weeks)	total man-weeks
6. Auxiliary services:					
6.1. mechanical repair-shop	skilled mechanician	(3) 3	a) training with the machinery-supplier (in foreign countries)	2	6
			b) training on the job, in the spot	4	12
6.2. electrical repair-shop	skilled electrician	(3) 3	a) training with the machinery-supplier (in foreign countries)	2	6
			b) training on the job,in the spot	4	12
6.3. laboratory-assistant	skilled assistant	(3) 2	a) training in an university or similar institut.in Niger/Nig.	4	8
			b) training on the job,in the spot	4	8
6.4. helpers for repair-shops	unskilled w.	(6) 5	no special training necessary	-	-
7. Commercial and sales personnel:					
7.1. accounting	skilled expert	(3) 1	no special training necessary	-	-
7.2. invoicing etc.	skilled expert	(3) -	no special traning necessary	-	-
7.3. typist	skilled person	(3) -	no special training necessary	-	-
7.4. sales-manager	skilled expert	(3) 3	sales and marketing-training outside the mills, but on a domestic basis	6	18

Training needs for the 3 pilot mills and the central service-institutions

Type of personnel	level of qualification	No. of persons	type of training, of training required	duration of training	
				per person (weeks)	total man-weeks
7.5. outdoor-salesmen and promot.	skilled salesmen	(3) 3	sales and marketing-training outside the mills, but on a domestic basis	4	12
7.6. physical distribution assistant	skilled junior-expert	(3) 3	training on the job, in the spot	3	9
8. Central-services[1]					
8.1. product development-center Zaria	food expert with chemical background	1	a) training in foreign countries (on food-development-centers)	12	12
			b) additional training on the university of Zaria	12	12
8.2. experimental bakery	skilled baker	1	a) training on the university of Zaria b) ... and in some well-working bakeries in Niger/Nigeria	8	8
8.3. Marketing-Board	skilled experts	3	training in marketing institutions in Niger/Nigeria	8	the 2 other experts = 24

[1] Besides central engineering officer, already mentioned under item 3.

Comprehensive view on training needs and their costs

Type and area of personnel	Type of training/men-weeks per type			Total
	foreign countries	outside plant, inside Niger/ Nigeria	on the job, in the spot	
1. Commercial directors	-	-	-	-
2. Technical directors	12	-	12	24
3. Central engineering officer	-	-	-	-
4. Production	12	-	168	180
5. Storage etc.	-	-	-	-
6. Auxiliary services	12	8	32	52
7. Commercial and sales personnel	-	30	9	39
8. Central services (besides item 3)	12	44	-	56
9. Total training-needs:	48	82	221	351
10. Costs[1] per man-week (DM)	2000	500	120	
11. = total costs:				
a) in foreign currency (DM)	67.000	-	-	67.000
b) in domestic currencies (DM)	29.000	41.000	27.000	97.000
Total	96.000	41.000	27.000	164.000

1) = salaries, wages, social-benefits, travel-expenses, allowances, etc. checked carefully in detail

IX. IMPLEMENTATION SCHEDULING

1. Project implementation management

The Nigeria-Niger-Joint-Commission for Cooperation covers the whole project. It is the Joint-Commission which is the responsible authority for project implementation management in total.

Under assistance of UNDP-expert Dr.Zdenek Svejnar the Joint-Commission should prepare 2 applications to be addressed to the F.R.G via National Governments of the Niger and Nigeria.

1.1 Application concerning the Niger

On the basis of our feasibility study an application should be elaborated with regard to the establishment of industrial pilot mills in Tillabéry and in Zinder. This application should be signed by the Secretary General and forwarded to the Ministère du Plan,Niamey, attention of Mr. Alfred Siegel, Consultant of the German Agency for Technical Cooperation. Mr. Siegel has to channel this application to the Minister.

Now the Minister should bring forward the application to the Ambassador of the F.R.G in Niamey officially.

1.2 Application concerning Nigeria

On the basis of our feasibility study an application should be elaborated with regard to the establishment of an industrial pilot mill in Kano and an experimental backery at Zaria University.

Partner of realization in Kano would be Mr.Fritz G.Jutzi, Managing Director of the Northern Nigerian Flour Mills Ltd. Partners of realization at Ahmadou Bello University Zaria would be Prof.Dr.L.B. Olugbemi and Dr. Norbert Koubicek, Dept. of Plant Science.

This application should be signed by the Secretary General and forwarded to Mr. Merten and Mr. Schlich, Embassy of the F.R.G in Lagos. Mr. Merten and Mr.Schlich have to channel the application to the Nigerian Minister of Planning.

The Minister should bring forward the application officially to the Ambassador of F.R.G in Lagos.

1.3 Further proceeding

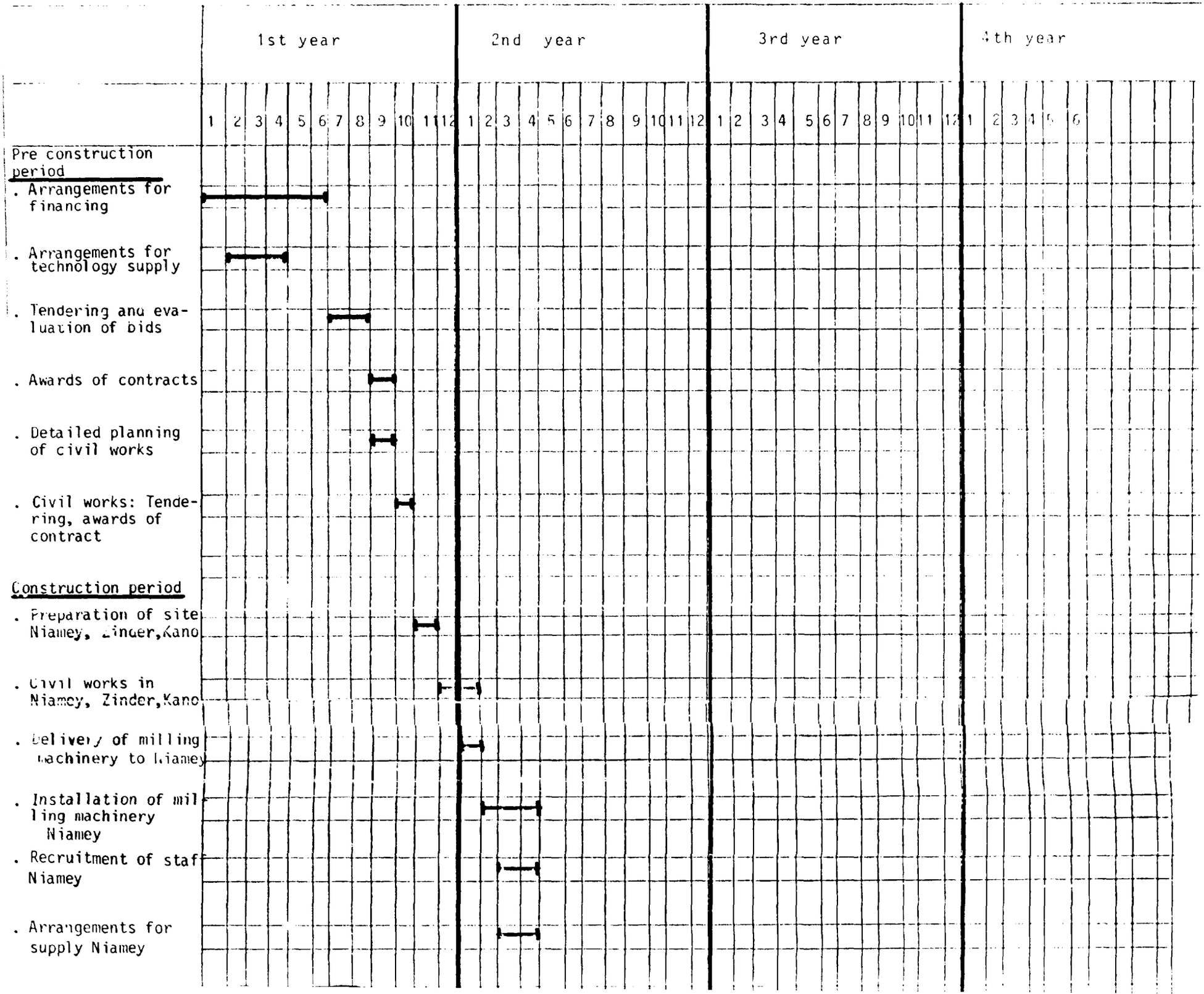
Both German Ambassadors in Niamey and Lagos will forward each application to the Foreign Office (Auswärtiges Amt), Bonn, F.R.G. Having passed Foreign Office, applications get to the Ministry of Economic Cooperation (Ministerium für wirtschaftliche Zusammenarbeit - BMZ). Here the final decision has to be made.

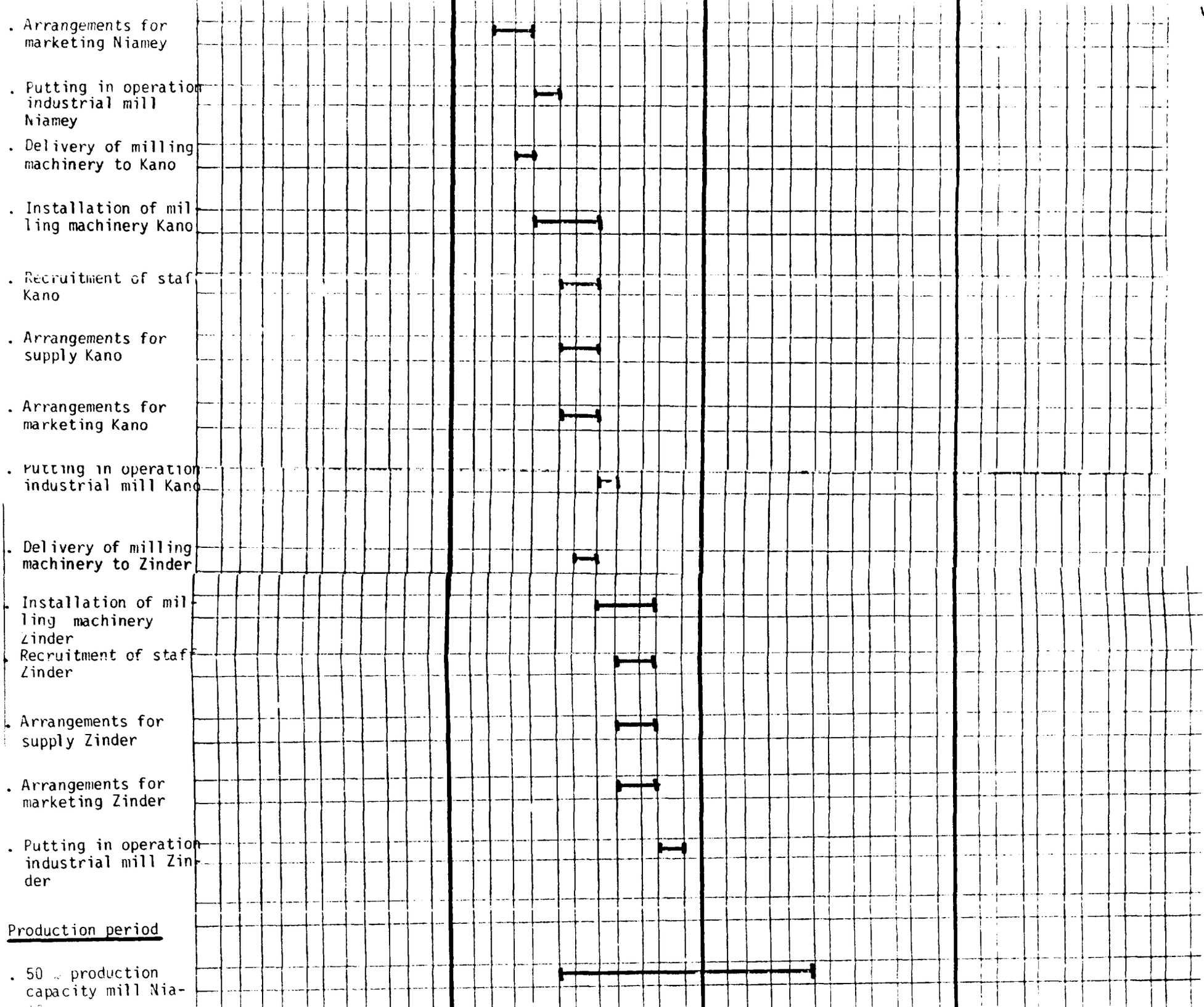
As this project is mainly of technical nature, the German Ministry of Economic Cooperation will authorize the German Agency of Technical Cooperation Ltd. (GTZ) to execute the project in Niger and Nigeria in case of positive approval.

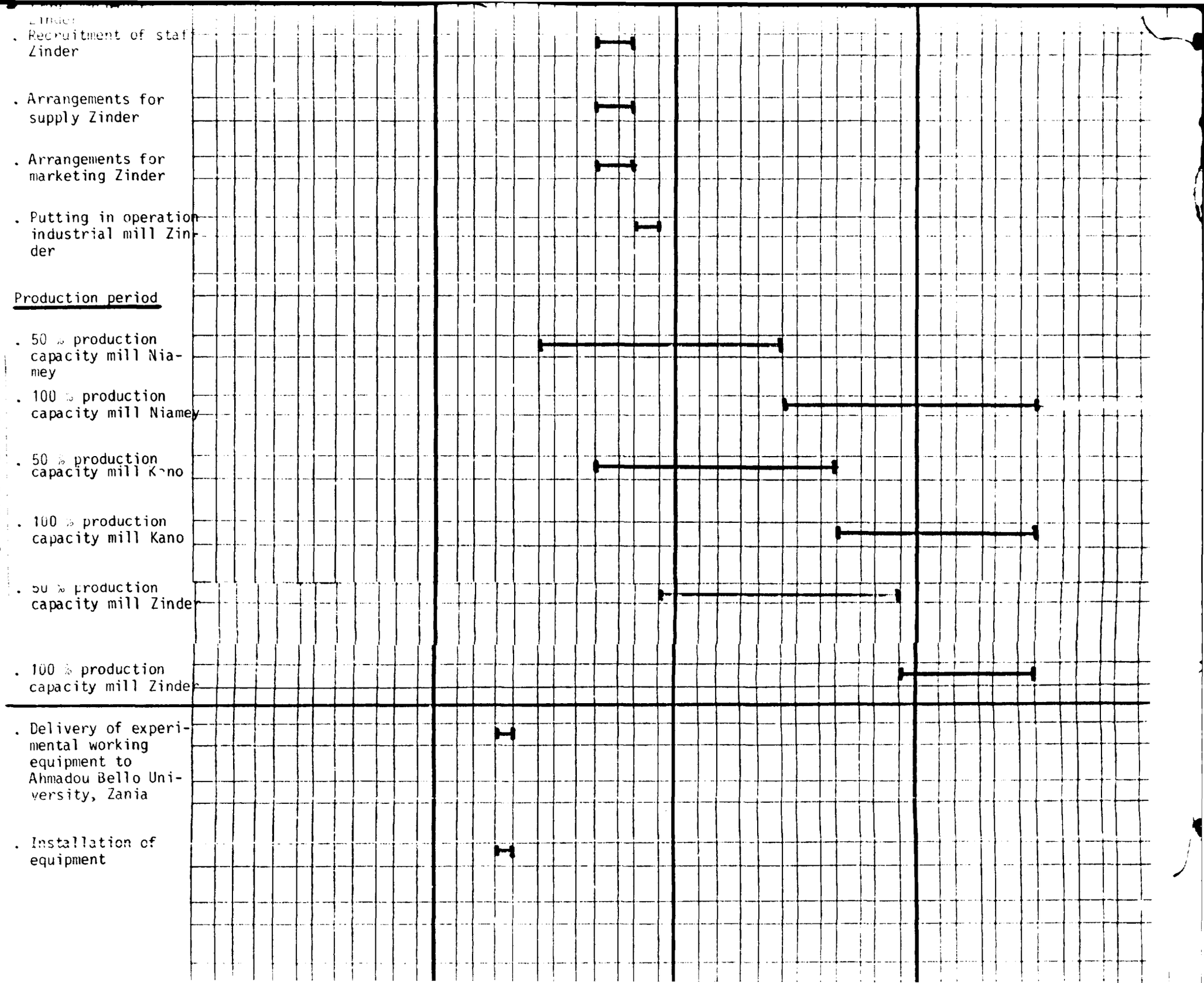
2. Time Schedule

See following page!

Implementation schedule for the establishment of industrial press units




. Arrangements for marketing Niamey
. Putting in operation industrial mill Niamey
. Delivery of milling machinery to Kano
. Installation of mil- ling machinery Kano
. Recruitment of staf Kano
. Arrangements for supply Kano
. Arrangements for marketing Kano
. Putting in operation industrial mill Kano
. Delivery of milling machinery to Zinder
. Installation of mil- ling machinery Zinder
. Recruitment of staff Zinder
. Arrangements for supply Zinder
. Arrangements for marketing Zinder
. Putting in operation industrial mill Zin- der
Production period
. 50 % production capacity mill Nia-


Zinder
. Recruitment of staff Zinder
. Arrangements for supply Zinder
. Arrangements for marketing Zinder
. Putting in operation industrial mill Zinder
Production period
. 50 % production capacity mill Niamey
. 100 % production capacity mill Niamey
. 50 % production capacity mill Kano
. 100 % production capacity mill Kano
. 50 % production capacity mill Zinder
. 100 % production capacity mill Zinder
. Delivery of experimental working equipment to Ahmadou Bello University, Zania
. Installation of equipment

X. FINANCIAL AND ECONOMIC EVALUATION

1. Evaluation of Costs of Millet-Flour Production

These costs are calculated :

a) On a marginal basis : only those costs are included, which arise additionally when installing the new millet-mill in the already existing mills or plants. Costs of already existing personnel, buildings, machinery are not included.

b) A direct and an indirect cost-section :

- direct costs are all costs arising directly in the three mills
- indirect costs are the costs of the central services; they are splitted up to the three mills equally.

c) The costs are calculated in Deutsche Mark (DM). Following rates of exchange are to be drawn into consideration :

1 DM = 140 FCFA (1983)
1 DM = 0,40 $-US (1983)
1 DM = 0,60 Naira (1983)

d) All cost-figures implemented in these calculations are of present importance : They were collected by us during our stay in these countries in 1983.

On this basis, we have calculated the following costing-situation (see next pages) :

1.1 Cost-figures in terms of 1983 as collected during our stay in Niger and Nigeria

Direct marginal costs/mill (DM/year/full capac.used)	Niamey-mill, combined with existing rice-mill	Zinder-mill, combined with Sotramil -plant	Kano-mill, combined with existing NNFM-wheat-mill
A1. Costs of personnel			
A11. Variable costs of personnel (variable with respect to the degree to which the capacity is used (possible reaction: 1 shift instead of 2 shifts; or: decreased personnel/shift in other areas)			
1. Production:			
1.1. Miller	2 x 4000 DM = 8000 DM	2 x 4000 DM = 8000 DM	2 x 15000 DM = 30000 DM
1.2. Helper	2 x 2300 DM = 4600 DM	2 x 2300 DM = 4600 DM	2 x 8600 DM = 17200 DM
1.3. Fillers	6 x 1900 DM = 11400 DM	12 x 1900 DM = 22800 DM	6 x 6000 DM = 36000 DM
1.4. Packers	4 x 1900 DM = 7600 DM	8 x 1900 DM = 15200 DM	4 x 6000 DM = 24000 DM
2. Storage, loading, unloading			
2.1. Raw-material storage	2 x 1900 DM = 3800 DM	4 x 1900 DM = 7600 DM	2 x 6000 DM = 12000 DM
2.2. Loading + unloading	1 x 1900 DM = 1900 DM	2 x 1900 DM = 3800 DM	1 x 6000 DM = 6000 DM
2.3. Guards	-	1 x 1900 DM = 1900 DM	-
Total variable costs of personnel	37300 DM	63900 DM	125200 DM

Direct marginal costs/mill (DM/year/full capac.used)	Niamey-mill, combined with existing rice-mill	Zinder-mill, combined with Sotramil -plant	Kano-mill, combined with existing NNFM-wheat-mill
A12. Fixed costs of personnel:			
1. Management:			
1.1. Commercial director	-	1 x 13000 DM = 13000 DM	-
1.2. Techn. director	-	1 x 13000 DM = 13000 DM	-
1.3. Secretary	-	-	-
2. Auxiliary services:			
2.1. Mechanical repair-shop	1 x 6200 DM = 6200 DM	1 x 6200 DM = 6200 DM	1 x 23000 DM = 23000 DM
2.2. Electrical repair-shop	1 x 6200 DM = 6200 DM	1 x 6200 DM = 6200 DM	1 x 23000 DM = 23000 DM
2.3. Laboratory	1 x 4000 DM = 4000 DM	1 x 4000 DR = 4000 DM	-
2.4. Helpers for repair-shops	2 x 1900 DM = 3800 DM	2 x 1900 DM = 3800 DM	1 x 6000 DM = 6000 DM
3. Commercial and Sales-Personnel:			
3.1. Accounting	-	1 x 6100 DM = 6100 DM	-
3.2. Invoicing etc.	-	-	-
3.3. Typist	-	-	-
3.4. Head of sales	1 x 6100 DM = 6100 DM	1 x 6100 DM = 6100 DM	1 x 22000 DM = 22000 DM
3.5. Salesmen	1 x 5500 DM = 5500 DM	1 x 5500 DM = 5500 DM	1 x 18000 DM = 18000 DM
3.6. Physical distribution	1 x 5500 DM = 5500 DM	1 x 5500 DM = 5500 DM	1 x 18000 DM = 18000 DM
Total fixed costs of personnel	37300 DM	69400 DM	110000 DM

Direct marginal costs/mill (DM/year/full capac.used)	Niamey-mill, combined with existing rice-mill		Zinder-mill, combined with Sotramil -plant		Kano-mill, combined with existing NNFM-wheat-mill	
A2. Capital-costs:	investment	depreciation	investment	depreciation	investment	depreciation
A21. Depreciations	DM	DM/y	DM	DM/y	DM	DM/y
1. Civil works: rate of depreciation: 3,33 %/year	560.000	18.700	380.000	12700	560.000	18.700
2. Machinery equipment: rate of depreciation: 10 %/y.						
2.1. Cleaning section	98.500	9.900	98.500	9.900	98.500	9.900
2.2. Hulling/shelling sect.	226.300	22.600	226.300	22.600	226.300	22.600
2.3. Grinding section	462.500	46.300	462.500	46.300	462.500	46.300
2.4. Conveying/packing sect.	238.400	23.800	238.400	23.800	238.400	23.800
3. Parts, accessories,tools; rate of depreciation: 20 %	161.600	32.300	161.600	32.300	161.600	32.300
4. Storage-equipment; rate of depreciation: 10 %	15.000	1.500	-	-	15.000	1.500
5. Repair-shop-equipment; rate of depreciat.: 10 %	20.000	2.000	15.000	1.500	-	-
6. Laboratory-equipment and -material; rate of depreciation: 33 %	6.300	2.100	6.300	2.100	6.300	2.100
7. Transportation equipment	-	-	-	-	-	-
8. Spare-parts-provision; rate of depreciat.: 33 %	135.000	44.600	135.000	44.600	135.000	44.600

direct marginal costs/mill (DM/year/full capac. used)	Niamey-mill, combined with existing rice-mill		Zinder-mill, combined with Sotramil -plant		Kano-mill, combined with existing NNFM-wheat-mill	
	investment	depreciation	investment	depreciation	investment	depreciation
	DM	DM/y	DM	DM/y	DM	DM/y
9. Assembling-operations; rate of depreciat.:10 %	149.000	14.900	149.000	14.900	149.000	14.900
10. Engineering-costs: 10 %	218.900	21.900	198.900	19.900	216.700	21.700
Total investments and depreciations:	2.291.500	240.600	2.071.500	230.600	2.269.300	238.400
A22. Interests	Interests (DM)		Interests (DM)		Interests (DM)	
1. on invested capital (averagely/year; interest-rate: 10 %)	129.000		109.000		124.000	
2. on working capital						
2.1. capital in stocks: assumption: 1 months-product.on stocks = 8 %, interests: 10 %	36.000		36.000		88.800	
2.2. capital in debtors:2-months-sales as debtors interests: 10 %	72.000		72.000		177.600	
Total interests (DM)	237.000		217.000		390.400	
A23. Total capital costs (= depreciations + interests)	477.600		447.600		628.800	

direct marginal costs/mill (DM/year/full capac. used)	Niamey-mill, combined with existing rice-mill	Zinder-mill, combined with Sotramil -plant	Kano-mill, combined with existing NNFM-wheat-mill
A3. Costs of current supply			
1. Bags and other packaging materials	90.000	90.000	300.000
2. Energy (electricity, fuel, etc.)	127.000	127.000	142.000
3. Other costs of current supply	50.000	50.000	56.000
Total costs of current supply (without taxes)	267.000	267.000	498.000
A4. Raw-material:			
(Millet)-costs:			
1. Consumption of millet, if capacity is used to 90 %: 5400 t/mill/year			
2. Costs per t millet(1982):			
2.1. producer-price	530 DM/t	600 DM/t	750 DM/t
2.2. Commiss. for cooperative or assembler	20 DM/t	20 DM/t	190 DM/t
2.3. Transportation to mill	30 DM/t	30 DM/t	100 DM/t
3. Total costs of raw-material per ton	580 DM/t	650 DM/t	1040 DM/t

direct marginal costs/mill (DM/year/full capac. used)	Niamey-mill, combined with existing rice-mill	Zinder-mill, combined with Sotramil -plant	Kano-mill, combined with existing NNFM-wheat-mill
4. Raw-material costs per year (consumption = 5400 to millet)	3.132.000 DM	3.510.000 DM	5.616.000 DM
5. ./. Bran-sales	190.000 DM	190.000 DM	310.000 DM
6. = Net raw-material costs per year	2.942.000 DM	3.320.000 DM	5.306.000 DM
A5. Direct marginal costs in total: (DM)			
1. Costs of personnel:			
a) variable	37.300	63.900	125.200
b) fixed	37.300	69.400	110.000
Total costs of personnel	74.600	133.300	235.200
2. Capital costs:			
a) Depreciations	240.600	230.600	238.400
b) interests (on invested and current capital)	237.000	217.000	390.400
Total capital costs	477.600	447.600	628.800
3. Costs of current supply	267.000	267.000	498.000
4. Total milling costs (= positions 1+2+3)	819.000	847.900	1.362.000
5. = per kg flour	0,19	0,20	0,32

Direct marginal costs/mill (DM/year/full capac. used)	Niamey-mill, combined with existing rice-mill	Zinder-mill, combined with Sotramil -plant	Kano-mill, combined with existing NNFM-wheat-mill
6. Raw-material costs(DM):			
a) total costs/year	2.942.000 DM	3.320.000 DM	5.306.000 DM
b) per kg flour	0,68 DM	0,77 DM	1,23 DM
B. Indirect marginal costs = costs of the central services:			
B1. Personnel-costs:			
1. Central engineering: 1 milling engineer (foreign)			
Total costs:249.000 DM per mill 1/3 =	83.000	83.000	83.000
2. Food expert for product development-center in Zaria:domestic expert: 60.000 DM, per mill 1/3 =	20.000	20.000	20.000
3. Skilled baker for experimental bakery in Kano 15.000 DM; per mill 1/3 =	5.000	5.000	5.000
4. Marketing-board:			
4.1. 2 experts in Niamey, each 15.000 DM = 30.000 DM			
4.2. 1 expert in Kano 30.000 DM			
4.3. total: 60.000 DM;per mill 1/3 =	20.000	20.000	20.000

Direct marginal costs/mill (DM/year/full capac. used)	Niamey-mill, combined with existing rice-mill	Zinder-mill, combined with Sotramil -plant	Kano-mill, combined with existing NNFM-wheat-mill
Total costs of personnel in central services	128.000	128.000	128.000
B2. Capital-costs of central services:	already included (as being not important) in the direct capital-costs		
B3. Current operating-costs of central serv.:			
1. Travelling-expenses,etc.	10.000	10.000	10.000
2. Advertizing, sales-promotion-activites	30.000	30.000	30.000
3. Current-supply with raw-materials, chemicals, etc. of the product-development-centers in Zaria + Zinder, + the bakery in Kano	20.000	20.000	20.000
4. Other current operating costs of central serv.	8.000	8.000	8.000
Total current operating-costs	68.000	68.000	68.000
B4. Total costs of central services (without capit. costs): (DM)			
1. Costs of personnel	128.000	128.000	128.000
2. Current operating-costs	68.000	68.000	68.000

Direct marginal costs/mill (DM/year/full capac. used)	Niamey-mill, combined with existing rice-mill	Zinder-mill, combined with Sotramil -plant	Kano-mill, combined with existing NNFM-wheat-mill
3. Total costs of central services	196.000	196.000	196.000
4. Per kg flour	0,04	0,04	0,04
C. Total marginal costs:			
C1. Total marginal milling-costs			
C11. Direct milling costs (DM):			
1. Costs of personnel	74.600	133.300	235.200
2. Capital costs	477.600	447.600	628.800
3. Costs of current supply	267.000	267.000	498.000
4. Total direct milling c.	819.000	847.900	1.362.000
C12. Indirect milling costs= costs of central serv.			
1. Costs of personnel	128.000	128.000	128.000
2. Current operating costs	68.000	68.000	68.000
Total indirect milling costs	196.000	196.000	196.000

direct marginal costs/mill (DM/year/full capac. used)	Niamey-mill, combined with existing rice-mill	Zinder-mill, combined with Sotramil -plant	Kano-mill, combined with existing NNFM-wheat-mill
C13. Total (direct + indir.) milling costs			
1. DM/year, capacity used to 90 %	1.015.000	1.043.900	1.558.000
2. Per kg flour:			
a) direct	0,19	0,20	0,32
b) indirect	0,04	0,04	0,04
c) Total	0,23	0,24	0,36
C2. Costs of raw-material			
1. DM/year, capacity used to 90 %	2.942.000	3.320.000	5.306.000
2. per kg flour	0,68	0,77	1,23
C3. Total ex-factory costs			
1. DM/year (capacity used to 90 %)			
1.1. milling costs	1.015.200	1.043.900	1.558.000
1.2. Raw-material costs	2.942.000	3.320.000	5.306.000
1.3. Total costs	3.957.200	4.363.900	6.864.000
2. Costs per kg millet-flour:			
2.1. Milling costs	0,23	0,24	0,36
2.2. Raw-material costs	0,68	0,77	1,23
2.3. Total costs (without profit)	0,91	1,01	1,59

Direct marginal costs/mill (DM/year/full capac. used)	Niamey-mill, combined with existing rice-mill	Zinder-mill, combined with Sotramil -plant	Kano-mill, combined with existing NNFM-wheat-mill
D. Calculation of the ex-factory sales-price for millet-flour:(DM/kg)			
1. Cost-price	0,91	1,01	1,59
2. + remuneration of pre-production costs:			
a) training)	0,03	0,03	0,03
b) inland-transport)			
3. + security-margin (5 %)	0,05	0,05	0,03
4. + profit: 10 %	0,11	0,11	0,18
5. Selling price, if capac. is used to 90 % (ex-fact)	1,10 DM/kg	1,20 DM/kg	1,83 DM/kg
6. Probable market-price for consumers			
6.1. Ex-factory-price (DM/kg millet-flour in bags)	1,10	1,20	1,83
6.2. + costs of transportat.	0,03	0,03	0,11
6.3. + margins for intermediate traders	0,12	0,13	0,50
6.4. = price for industrial consumers (pastry-plants, bakeries, etc.)	1,25	1,36	2,44
6.5. + wholesale-margins (8 %) *)	0,10	0,11	0,52

*) in Nigeria more than 20 %

Direct marginal costs/mill (DM/year/full capac. used)	Niamey-mill, combined with existing rice-mill	Zinder-mill, combined with Sotramil -plant	Kano-mill, combined with existing NNFM-wheat-mill
6.6. + retail-margins	0,22	0,22	0,55
6.7. = retail-price for private consumers	1,57	1,69	3,51
7. Some price-comparisons (on a retail basis): actual market prices 1983			
7.1. 1 kg millet-flour	1,50 DM	1,59 DM	3,55 DM
7.2. 1 kg millet	1,14 DM	0,89 DM	2,00 DM
7.3. 1 kg wheat-flour	3,07 DM	3,20 DM	app. 3,80 DM
8. Checking the price-competitiveness of the 3 pilot mills (assumed: capacity used to 90 %, no profit, no security-margin included)			
8.1. Retail-market price of millet-flour out of the 3 pilot mills:	1,41 DM/kg	1,53 DM/kg	3,30 DM/kg
8.2. Actual retail-market prices	1,57 DM/kg	1,69 DM/kg	3,51 DM/kg
8.3. Conclusion: competitiveness:	given	given	given

1.2 Selected figures characterizing cost-structures in the three millet mills

Shares of
- variable costs
- raw-materials costs
- fixed costs

in total costs

Shares of different cost-centres and types of costs in total costs of
- Niamey-mill
- Zinder-mill
- Kano -mill

1. Shares of variable-, raw-material- and fixed costs in total costs

	Niamey-mill, combined with existing rice-mill	Zinder-mill, combined with Sotramil -plant	Kano-mill, combined with existing NNFM-wheat-mill
1. Variable costs: (DM)			
1.1. Personnel	37.300	63.900	125.200
1.2. Capital-costs: interests on working cap.	108.000	108.000	266.400
1.3. Costs of current supply (bags, energy,others)	267.000	267.000	498.000
1.4. Total variable costs	412.300	438.900	889.600
2. Raw-material costs:(net)	2.942.000	3.320.000	5.306.000
3. Fixed costs:			
3.1. Personnel			
3.1.1. Direct (in mills)	37.300	69.400	110.000
3.1.2. indirect (central)	128.000	128.000	128.000
3.2. Capital-costs:			
3.2.1. Depreciations	240.600	230.600	238.400
3.2.2. Interests on invested capital	129.000	109.000	124.000
3.3. Current operating-costs of central services (mostly fixed)	68.000	68.000	68.000
3.4. Total fixed costs	602.900	605.000	668.400

	Niamey-mill, combined with existing rice-mill	Zinder-mill, combined with Sotramil -plant	Kano-mill, combined with existing NNFM-wheat-mill
4. Total cost-structure:			
4.1. Variable costs	412.300 = 10,4 %	438.900 = 10,1 %	889.600 = 13,0 %
4.2. Raw-material costs	2.942.000 = 74,3 %	3.320.000 = 76,1 %	5.306.000 = 77,3 %
4.3. Fixed costs	602.900 = 15,3 %	605.000 = 13,8 %	668.400 = 9,7 %
5. Total costs	3.957.200 = 100 %	4.363.900 = 100 %	6.864.000 = 100 %

2. Shares of different cost-centers and types of costs in total costs of

2.1 Niamey

Cost-centers / Types of costs	1. Production					2. Overhead-Areas				Total costs
	Raw-mater. (11)	Product. (12)	load.,un-load.,sto-ring(13)	auxiliary services (14)	Total	Admin. (21)	Sales (22)	Central services (23)	Total	
1. Costs of personnel	-	31.600	5.700	20.200	57.500	-	17.100	128.000	145.100	202.600
2. Interests on										
2.1. invested	-	129.000			129.000	-	-	-	-	129.000
2.2. working capital	-	36.000	-	-	36.000	-	72.000[1)]	-	72.000	108.000
3. Depreciations	-	235.000	1.500	4.100	240.600	included in production			-	240.600
4. Current operating supply-costs	-	240.300	26.700	-	267.000	-	-	68.000	68.000	335.000
5. Raw-materials	2.942.000	-	-	-	2.942.000	-	-	-	-	2.942.000
6. Total costs	2.942.000	671.900	33.900	24.300	3.672.100	-	89.100	196.000	285.100	3.957.200
7. Major figures:										
a) Shares in total c.	74,3 %	17,0 %	0,9 %	0,6 %	92,8 %	-	2,2 %	5,0 %	7,2 %	100,0 %
b) Shares in total internal costs(=without raw-materials)	-	66,1 %	3,5 %	2,3 %	71,9 %	-	8,6 %	19,5 %	28,1 %	100,0 %

1) interests on debtors

2.2. Zinder

Cost-centers / Types of costs	1. Production					2. Overhead-Areas				Total costs
	Raw-mater. (11)	Product. (12)	load.,unload.,storing(13)	auxiliary services (14)	Total	Admin. (21)	Sales (22)	Central services (23)	Total	
1. Costs or personnel	-	63.600	13.300	20.200	97.100	19.100	17.100	128.000	164.200	261.300
2. Interests on										
2.1. invested	-	109.000		-	109.000	-	-	-	-	109.000
2.2. working capital	-	36.000	-	-	36.000	-	72.000[1]	-	72.000	108.000
3. Depreciations	-	227.000	-	3.600	230.600	included	in production		-	230.600
4. Current operating supply-costs	-	240.300	26.700	-	267.000	-	-	68.000	68.000	335.000
5. Raw-materials	3.320.000	-	-	-	3.320.000	-	-	-	-	3.320.000
6. Total costs	3.320.000	675.900	40.000	23.800	4.059.700	19.100	89.100	196.000	304.200	4.363.900
7. Major figures:										
a) Shares in total c.	76,0 %	15,5 %	0,9 %	0,6 %	93,0 %	0,4 %	2,1 %	4,5 %	7,0 %	100,0 %
b) Shares in total internal costs (= without raw-materials)	-	64,5 %	3,8 %	2,5 %	70,8 %	1,7 %	8,8 %	18,7 %	29,2 %	100,0 %

1) interests on debtors

2.3. Kano

Cost-centers / Types of costs	1. Production					2. Overhead-Areas				Total costs
	Raw-mater. (11)	Product. (12)	load.,unload.,storing(13)	auxiliary services (14)	Total	Admin. (21)	Sales (22)	Central services (23)	Total	
1. Costs of personnel	-	107.200	18.000	52.000	177.200	-	58.000	128.000	186.000	363.200
2. Interests on										
2.1. invested	-	124.000	-	-	124.000	-	-	-	-	124.000
2.2. working capital	-	88.800	-	-	88.800	-	177.600[1]	-	177.600	266.400
3. Depreciations	-	234.800	1.500	2.100	238.400	included in production			-	238.400
4. Current operating supply-costs	-	448.000	50.000	-	498.000	-	-	68.000	68.000	566.000
5. Raw-materials	5.306.000	-	-	-	5.306.000	-	-	-	-	5.306.000
6. Total costs	5.306.000	1.002.800	69.500	54.100	6.432.400	-	235.600	196.000	431.600	6.864.000
7. Major figures:										
a) Shares in total c.	77,3 %	14,6 %	1,0 %	0,8 %	93,7 %	-	3,4 %	2,9 %	6,3 %	100,0 %
b) Shares in total internal costs (= without raw-materials)	-	64,3 %	4,4 %	3,5 %	72,2 %	-	15,0 %	12,8 %	27,8 %	100,0 %

1) interests on debtors

1.3 Project financing

1.3.1 Source of financing

The distinction between "equity" and "loan financing" is not necessary in this case, as the whole project should be financed by the F.R.G according to the Rules of German Technical Cooperation. In the case of a positive decision made by German Government the whole capital needed would be given within the framework of a technical-cooperation-project executed by the GTZ. Therefore the whole capital needed would be regarded as "equity".

1.3.2 Financing institution

Financing institution would be the "Bundesministerium für wirtschaftliche Zusammenarbeit" (BMZ) of the Federal Republic of Germany.

As this project is mainly of technical nature, the GTZ would act as executing agency.

We recommend to address to the "Bundesministerium für wirtschaftliche Zusammenarbeit" (BMZ) via German Embassies in Niamey and Lagos according to the procedure indicated in the "Executive Summary" and in the "Implementation Schedule".

2. Financial and economic analysis

(1) Cost-Sensitivity-Analysis: costs if capacity is alternatively used to 100 %, 90 % ....40 % (cost-basis: 1983)

All figures in DM and DM/kg flour

A. Niamey: Costs 1983 (DM)

Types of costs	Capacity being used to .... %						
	100 %	90 %	80 %	70 %	60 %	50 %	40 %
1. Fixed costs (DM	602.900	602.900	602.900	602.900	602.900	602.900	602.900
2. Costs of raw-materials	3.268.900	2.942.000	2.615.100	2.288.200	1.961.300	1.634.400	1.307.600
3. Variable costs:							
3.1. Personnel: changing from 2 to 1 shift if capacity is used to 60 % and less	37.300	37.300	37.300	37.300	18.700	18.700	18.700
3.2. Capital costs: interests on working capital: decreasing proportionally	120.000	108.000	96.000	84.000	72.000	60.000	48.000
3.3. Costs of current supply: decreasing proportionally	296.700	267.000	237.600	207.900	178.200	148.500	118.800
4. Total costs	4.325.800	3.957.200	3.588.900	3.220.300	2.833.100	2.464.500	2.096.000
5. Costs per kg flour	0,90	0,92	0,94	0,96	0,98	1,03	1,09

B. Zinder: Costs 1983 (DM)

Types of costs	Capacity being used to .... %						
	100 %	90 %	80 %	70 %	60 %	50 %	40 %
1. Fixed costs (DM)	605.000	605.000	605.000	605.000	605.000	605.000	605.000
2. Costs of raw-materials	3.688.900	3.320.000	2.952.000	2.583.000	2.214.000	1.845.000	1.476.000
3. Variable costs:							
3.1. Personnel: changing from 2 shifts to 1 shift if capacity is used to 60 % and less (DM)	63.900	63.900	63.900	63.900	32.000	32.000	32.000
3.2. Capital costs: interests on working capital: decreasing proportionally	120.000	108.000	96.000	84.000	72.000	60.000	48.000
3.2. Costs of current supply: decreasing proportionally	296.700	267.000	237.600	207.900	178.200	148.500	118.800
4. Total costs	4.774.500	4.363.900	3.954.500	3.543.800	3.101.200	2.690.500	2.279.800
5. Costs per kg flour	0,99	1,01	1,03	1,05	1,08	1,12	1,19

C. Kano: Costs 1983 (DM)

Types of costs	Capacity being used to .... %						
	100 %	90 %	80 %	70 %	60 %	50 %	40 %
1. Fixed costs (DM)	668.400	668.400	668.400	668.400	668.400	668.400	668.400
2. Costs of raw-materials	5.895.600	5.306.000	4.716.500	4.126.900	3.537.400	2.947.800	2.358.200
3. Variable costs:							
3.1. Personnel: changing from 2 shifts to 1 shift if capacity is used to 60 % and less (DM)	125.200	125.200	125.200	125.200	62.600	62.600	62.600
3.2. Capital costs: interests on working capital: decreasing proportionally	296.000	266.400	236.800	207.200	177.600	148.000	118.400
3.3. Costs of current supply: decreasing proportionally	553.300	498.000	442.400	387.100	331.800	276.500	221.200
4. Total costs	7.538.500	6.864.000	6.189.300	5.514.800	4.777.800	4.103.300	3.428.800
5. Costs per kg flour	1,57	1,59	1,61	1,64	1,66	1,71	1,79

(2) Forecasting the further development of costs;
assumption: cost-increase of 3 % per year

(all figures in 1000 DM)

A. Niamey: Forecasting the further development of costs;
Assumption: + 3 %/year

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Capacity used to : (Costs in 1000 DM)										
100 %	4455,6	4589,3	4726,9	4868,8	5014,9	5165,3	5320,3	5479,9	5644,3	5813,6
90 %	4075,9	4198,2	4324,1	4453,9	4587,5	4725,1	4866,9	5012,9	5163,3	5318,1
80 %	3696,6	3807,5	3921,7	4039,3	4160,5	4285,3	4413,9	4546,3	4682,7	4823,2
70 %	3316,9	3416,4	3518,9	3624,5	3733,2	3845,2	3960,5	4079,4	4201,8	4327,8
60 %	2918,1	3005,6	3095,8	3188,7	3284,4	3382,9	3484,4	3588,9	3696,6	3807,5
50 %	2538,4	2614,6	2693,0	2773,8	2857,0	2942,7	3031,0	3121,9	3215,6	3312,1
40 %	2158,9	2223,7	2290,4	2359,1	2429,9	2502,8	2577,8	2655,1	2734,8	2816,8

B. Zinder:

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Capacity used to: (Costs in 1000 DM)										
100 %	4917,7	5065,3	5217,2	5373,7	5534,9	5701,0	5872,0	6048,2	6229,6	6416,5
90 %	4494,8	4629,7	4768,6	4911,7	5059,0	5210,8	5567,1	5528,1	5693,9	5864,7
80 %	4073,1	4195,3	4321,2	4450,8	4584,4	4721,9	4863,6	5009,5	5159,7	5314,5
70 %	3650,1	3759,6	3872,4	3988,6	4108,2	4231,5	4358,4	4489,2	4623,9	4762,6
60 %	3194,2	3290,1	3388,8	3490,5	3595,2	3703,0	3814,1	3928,5	4046,4	4167,8
50 %	2771,2	2854,4	2940,0	3028,2	3119,0	3212,6	3309,0	3408,3	3510,5	3615,8
40 %	2348,2	2418,6	2491,2	2565,9	2642,9	2722,2	2803,9	2888,0	2974,6	3063,8

C. Kano:

	1984	1985	1986	1987
Capacity used to: (Costs in 1000 DM)				
100 %	7764,7	7997,6	8237,5	8484,6
90 %	7079,9	7282,0	7500,5	7725,5
80 %	6374,9	6566,2	6763,2	6966,1
70 %	5680,2	5850,7	6026,7	6207,0
60 %	4921,1	5068,8	5220,8	5377,4
50 %	4226,3	4353,1	4483,7	4618,2
40 %	3531,7	3637,6	3746,7	3859,1

1988	1989	1990	1991	1992	1993
8739,2	9001,3	9271,3	9549,5	9835,9	10130,1
7957,3	8196,0	8441,9	8695,2	8956,0	9224,7
7175,1	7390,0	7612,0	7840,4	8075,6	8317,9
6393,1	6584,9	6782,4	6985,9	7195,5	7411,4
5538,7	5704,9	5876,0	6052,3	6233,9	6420,9
4756,8	4899,5	5046,5	5197,9	5353,8	5514,5
3974,9	4094,1	4216,9	4343,4	4473,7	4607,9

(3) Evaluation of the competitive ex-factory-price for 1 kg millet-flour 1982 + 1983 (DM/kg)

Evaluation of the competitive ex-factory-price for 1 kg millet-flour 1982 and 1983

	Niamey	Zinder	Kano
A. 1982:			
1. Present market price for millet-flour (DM/kg)	1,50	1,59	3,55
2. ./. margins for traders, wholesalers, retailers, etc.	./.0,29	./.0,32	./.0,77
3. ./. margins for assemblers, cooperatives, etc.	./.0,09	./.0,13	./.0,95
4. ./. transportation costs (raw-material + flour)	./.0,06	./.0,06	./.0,22
5. = Costs of mills (incl. raw-materials) 1982:	1,06	1,08	1,61
B. 1983: + 3 % =	1,09	1,11	1,66
6. Market-price for wheat-flour (DM/kg):	3,07	3,20	3,80
C. Competitive ex-factory-price for the 3 mills in future (assumed an increase of 3 %/year: DM/t):			
1983	1090	1143	1708
1984	1123	1177	1759
1985	1157	1212	1812
1986	1192	1248	1866
1987	1228	1285	1922
1988	1265	1323	1979

The profit/loss calculations are based on these prices.

(4) On this basis: forecasting the sales-volume of each of the 3 pilot mills 1984 - 1993 (%; t ; DM/t ; 1000 DM)

A. Niamey (capacity: 6000 t millet = 4800 t millet-flour)

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1. Degree to which capacity is used *)	40 %	50 %	60 %	70 %	80 %	90 %	90 %	90 %	90 %	90 %
2. = Production of millet-flour(t)	1920 [1)]	2400	2880	3360	3840	4320	4320	4320	4320	4320
3. Ex-factory-price accepted by the market (DM/ t) **)	1123	1157	1192	1228	1265	1303	1342	1382	1423	1466
4. Sales-volume (1000 DM) to current prices	2156,2	2776,8	3432,9	4126,1	4857,6	5629,0	5797,8	5971,4	6147,4	6333,1

*) price -increase-rate assumed: 3 %/year

**) due to technical and to market reasons

1) partly perhaps to be stocked due to slow development of the market

B. Zinder (capacity: 6000 t millet = 4800 t millet-flour)

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1. Degree to which capacity is used	40 %	50 %	60 %	70 %	80 %	90 %	90 %	90 %	90 %	90 %
2. = Production of millet-flour(t)	1920 [1]	2400	2880	3360	3840	4320	4320	4320	4320	4320
3. Ex-fact.-price, accepted by the market (DM)t)*)	1143	1177	1212	1248	1285	1323	1363	1404	1446	1489
4. Sales volume (1000 DM) to current prices	2194,6	2824,8	3490,6	4193,3	4934,4	5715,4	5886,8	6064,8	6246,7	6432,5

*) price-increase-rate assumed: 3 %/year

1) partly perhaps to be stocked due to the slow development of the market

C. Kano (capacity: 6000 t millet = 4800 t millet-flour)

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1. Degree to which capacity is used	40 %	50 %	60 %	70 %	80 %	90 %	90 %	90 %	90 %	90 %
2. = Production of millet-flour(t)	1920	2400	2880	3360	3840	4320	4320	4320	4320	4320
3. Ex-fact.-price accepted by the market (DM/t)*)	1708	1759	1812	1866	1922	1979	2039	2100	2163	2228
4. Sales volume 1000 DM) to current prices	3279,4	4221,6	5218,6	6269,8	7380,5	8549,3	8808,5	9072,0	9344,2	9624,9

*) price-increase-rate assumed: 3 % / year

(5) Forecasting the overall-development of costs, sales and profits per pilot mill up to 1993 (in 1000 DM)

Forecasting the development of costs, sales and profits up to 1993

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
A. Niamey:										
1. Sales-volume (1000 DM)	2156,2	2776,8	3432,9	4126,1	4857,6	5629,0	5797,8	5971,4	6147,4	6333,1
2. ./. costs (1000 DM)	2158,9	2614,6	3095,8	3624,5	4160,5	4725,1	4866,9	5012,9	5163,3	5318,1
3. = profit/loss (1000 DM)	- 2,7	+116,2	+337,1	+501,6	+697,1	+903,9	+930,9	+958,5	+984,1	+1015,1
B. Zinder:										
1. Sales volume(1000 DM)	2194,6	2824,8	3490,6	4193,3	4934,3	5715,4	5886,8	6064,8	6246,7	6432,5
2. ./. costs (1000 DM)	2348,2	2854,4	3388,8	3988,6	4584,4	5210,8	5367,1	5528,1	5693,9	5864,7
3. = profit/loss (1000 DM)	-153,6	-29,6	+101,8	+204,7	+350,0	+504,6	+519,7	+536,7	+552,8	+567,8
C. Kano:										
1. Sales-volume(1000 DM)	3279,4	4221,6	5218,6	6269,8	7380,5	8549,3	8808,5	9072,2	9344,2	9624,9
2. ./. costs (1000 DM)	3531,7	4353,1	5220,8	6207,0	7175,1	8196,0	8441,9	8695,2	8956,2	9224,7
3. = profit/loss (1000 DM)	-252,3	-131,5	- 2,2	+ 62,8	+205,4	+353,3	+366,6	+376,8	+388,0	+400,2

(6) Break-Even-Point-Analysis under market-competitive point-of-view 1984
(1000 DM; t)

A. Niamey: Break-Even-Point-Analysis 1984

	Capacity being used to .... %						
	100 %	90 %	80 %	70 %	60 %	50 %	40 %
1. Costs in 1984 (1000 DM)	4455,6	4075,9	3696,6	3316,9	2918,1	2538,4	2158,9
2. Sales in 1984 (1000 DM)	5390,4	4851,4	4312,2	3773,3	3234,2	2695,2	2156,2
3. Profit/loss	+934,8	+775,5	+615,6	+456,4	+316,1	+156,8	- 2,7
4. In % of sales	+ 17,3 %	+ 16,0 %	+ 14,3 %	+ 12,1 %	+ 9,8 %	+ 5,8 %	- 0,1 %
5. Break-Even-Point:	a) If 1928 t of millet-flour are sold per year, the break-even-point is reached. The degree to which the capacity has to be used is 41 %.						
	b) This only comes true, however, with respect to the marginal-cost-analysis done here: if all costs would be included, the break-even-point would to some limited extent be higher.						

Zinder:

	Capacity being used to .... %						
	100 %	90 %	80 %	70 %	60 %	50 %	40 %
1. Costs in 1984 (1000 DM)	4917,7	4494,8	4073,1	3650,1	3194,2	2771,2	2348,2
2. Sales in 1984 (1000 DM)	5486,4	4937,8	4389,1	3840,5	3291,8	2743,2	2194,6
3. Profit/loss	+568,7	+443,0	+316,0	+190,4	+97,6	-28,0	-153,4
4. In % of sales	+ 10,4 %	+ 9,0 %	+ 7,2 %	+ 4,9 %	+ 3,0 %	- 1,0 %	- 7,0 %
5. Break-Even-Point:	a) If 2508 t of millet-flour are sold per year, the break-even-point is reached. The degree to which the capacity has to be used is about 52 %. b) This only comes true, however, with respect to the marginal-cost analysis done here; if all costs would be included, the break-even-point would to some limited extent be higher.						

Kano:

	Capacity being used to .... %						
	100 %	90 %	80 %	70 %	60 %	50 %	40 %
1. Costs in 1984 (1000 DM)	7764,7	7069,9	6374,9	5680,2	4921,1	4226,3	3531,7
2. Sales in 1984 (1000 DM)	8198,4	7378,6	6558,7	5738,9	4919,0	4099,2	3279,4
3. Profit/loss	+433,7	+308,7	+183,8	+58,7	- 2,1	-127,1	-252,3
4. In % of sales	+ 5,3 %	+ 4,2 %	+ 2,8 %	+ 1,0 %	- 0,1 %	- 3,1 %	- 7,7 %
5. Break-even-point:	a) If 2897 t of millet flour are sold per year, the break-even-point is reached. The degree to which the capacity has to be used is about 61 %.						
	b) This only comes true, however, with respect to the marginal cost-analysis done here, if all costs would be included, the break-even-point would to some limited extent be higher.						

(7) Sensitivity-Analysis with respect to

- costs
- cost-covering-contribution-calculation

1984 (1000 DM)

A. Niamey - 1984

all figures in 1000 DM	Capacity being used to .... %						
	100 %	90 %	80 %	70 %	60 %	50 %	40 %
1. Sales	5390,4	4851,4	4312,3	3773,3	3234,2	2695,2	2156,2
2. ./. raw-material input	3367,0	3030,0	2693,6	2356,8	2020,1	1683,0	1346,8
3. = cost-cov.contrib.I	2023,4	1821,4	1618,7	1416,5	1214,1	1012,2	809,4
4. ./. cost of direct manpow	38,4	38,4	38,4	38,4	19,2	19,2	19,2
5. = cost-cov.contrib. II	1985,0	1783,0	1580,3	1378,1	1194,9	993,0	790,2
6. ./. cost of curr.supplies	305,6	275,0	244,7	214,1	183,5	153,0	122,4
7. = cost-cov.contrib. III	1679,4	1508,0	1335,6	1164,0	1011,4	840,0	667,8
8. ./. factory overhead costs = manpower	20,8	20,8	20,8	20,8	20,8	20,8	20,8
9. = cost-cov.contrib. IV	1658,6	1487,2	1314,8	1143,2	990,6	819,2	647,0
10. ./. other overhead costs							
10.1. Administration	-	-	-	-	-	-	-
10.2. Sales	17,6	17,6	17,6	17,6	17,6	17,6	17,6
10.3 Central services	201,9	201,9	201,9	201,9	201,9	201,9	201,9
11. = cost-cov.contrib. V	1439,1	1267,7	1095,3	923,7	771,1	599,7	427,5
12. Financial costs:							
12.1. Interests	256,5	244,1	231,8	219,4	207,4	194,7	182,3
12.2. Depreciations	247,8	247,8	247,8	247,8	247,8	247,8	247,9
13. Profit/loss	+934,8	+775,8	+615,7	+456,5	+315,9	+157,2	- 2,6

B. Zinder - 1984

all figures in 1000 DM	Capacity being used to .... %						
	100 %	90 %	80 %	70 %	60 %	50 %	40 %
1. Sales	5486,4	4937,8	4389,1	3840,5	3291,8	2743,2	2194,6
2. ./. raw-material-input	3799,6	3419,6	3040,6	2660,5	2280,4	1900,4	1520,3
3. = cost-cov.contrib. I	1686,8	1518,2	1348,5	1180,0	1011,4	842,8	674,3
4. ./. cost of direct manp.	65,8	65,8	65,8	65,8	32,9	32,9	32,9
5. = cost-cov.contrib. II	1621,0	1452,4	1282,7	1114,2	978,2	809,9	641,4
6. ./. cost of curr.supplies	305,6	275,0	244,7	214,1	183,5	153,0	122,4
7. = cost-cov.contrib. III	1315,4	1177,4	1038,0	900,1	795,0	656,9	519,0
8. ./. factory overhead costs = manpower	34,2	34,2	34,2	34,2	34,2	34,2	34,2
9. = cost-cov.contrib. IV	1281,2	1143,2	1003,8	865,9	760,8	622,7	484,8
10. ./. other overhead-costs							
10.1. Administration	19,7	19,7	19,7	19,7	19,7	19,7	19,7
10.2. Sales	17,6	17,6	17,6	17,6	17,6	17,6	17,6
10.3 Central services	201,9	201,9	201,9	201,9	201,9	201,9	201,9
11. = cost-cov.contrib. V	1042,0	904,0	764,6	626,7	521,6	383,5	245,6
12. Financial costs:							
12.1. Interests	235,8	223,5	211,1	198,2	186,5	174,0	161,5
12.2. Depreciations	237,5	237,5	237,5	237,5	237,5	237,5	237,5
13. Profit/loss	+568,7	+443,0	+316,0	+190,4	+ 97,6	- 28,0	-153,4

C. Kano - 1984

all figures in 1000 DM	Capacity being used to .... %						
	100 %	90 %	80 %	70 %	60 %	50 %	40 %
1. Sales	8198,4	7378,6	6558,7	5738,9	4919,0	4099,2	3279,4
2. ./. raw-material-input	6072,5	5465,2	4858,0	4250,7	3643,5	3036,2	2429,0
3. = cost-cov.contrib. I	2125,9	1913,4	1700,7	1488,2	1275,5	1063,0	850,4
4. ./. cost of direct manpow.	129,0	129,0	129,0	129,0	64,5	64,5	64,5
5. = cost-cov.contrib. II	1996,9	1784,4	1571,7	1359,2	1211,0	998,5	785,9
6. ./. costs of curr.supplies	569,9	512,9	455,7	398,7	341,8	284,8	227,8
7. = cost-cov.contrib. III	1427,0	1271,5	1116,0	960,5	869,2	713,7	558,1
8../.factory overhead costs = manpower	53,6	53,6	53,6	53,6	53,6	53,6	53,6
9. = cost-cov.contrib. IV	1373,4	1217,9	1062,4	906,9	815,6	660,1	504,5
10. ./. other overhead-costs:							
10.1. Administration	-	-	-	-	-	-	-
10.2. Sales	59,7	59,7	59,7	59,7	59,7	59,7	59,7
10.3. Central services	201,9	201,9	201,9	201,9	201,0	201,9	201,9
11. = cost cov. contrib. V	111,8	956,3	800,8	645,3	554,0	398,5	242,9
12. Financial costs:							
12.1. Interests	432,5	402,0	371,4	341,0	310,5	280,5	249,6
12.2. Depreciations	245,6	245,6	245,6	245,6	245,6	245,6	245,6
13. Profit/loss	+433,7	+308,7	+183,8	+ 58,7	- 2,1	-127,1	-252,3

(8) Capital - demand:

- invested and working capital
- foreign and domestic capital
- demand in 1984, 1985, 1986, 1987, 1988

of each of the 3 pilot mills

(in 1000 DM)

Capital demand of millet-mill Niamey (in 1000 DM)

			1984	1985	1986	1987	1988
A. Invested capital		Total					
1. Civil works	FC	42,0	30,0	12,0			
	DC	518,0	330,0	138,0	50,0		
	Tot.	560,0	360,0	150,0	50,0		
2. Machinery-equipment	FC	1187,3	1000,0	187,3	-		
	DC	-	-	-	-		
	Tot.	1187,3	1000,0	187,3	-		
3. Storage-equipm.	FC	-	-				
	DC	15,0	15,0				
	Tot.	15,0	15,0				
4. Repair-shop-equipment	FC	20,0	10,0	10,0			
	DC	-	-	-			
	Tot.	20,0	10,0	10,0			
5. Laboratory-equipment	FC	6,3	4,0	2,3			
	DC	-	-	-			
	Tot.	6,3	4,0	2,3			
6. Transportation-equipment	no investments						
7. Spare-parts	FC	135,0	70,0	65,0			
	DC	-	-	-			
	Tot.	135,0	70,0	65,0			
8. Assembling-Operations	FC	129,0	114,0	15,0			
	DC	20,0	15,0	5,0			
	Tot.	149,0	129,0	20,0			

FC = foreign capital; DC = domestic capital

Niamey

			1984	1985	1986	1987	1988
9. Training-costs		Total					
	FC	28,0	28,0	-			
	DC	42,0	30,0	12,0			
	Tot.	70,0	58,0	12,0			
10. Engineering and planning	FC	190,0	150,0	40,0			
	DC	28,9	22,0	6,9			
	Tot.	218,9	172,0	46,9			
11. Transportation inside Africa	FC	-	-	-			
	DC	79,0	65,0	14,0			
	Tot.	79,0	65,0	14,0			
12. Shares in investments in central services:							
a) Zaria/product-developm.center	FC	49,5	40,0	9,5			
	DC	-	-	-			
	Tot.	49,5	40,0	9,5			
b) Kano/experimental bakery	FC	10,0	-	10,o			
	DC	-	-	-			
	Tot.	10,0	-	10,0			
c) Marketing-Board	FC	30,0	-	30,0			
	DC	-	-	-			
	Tot.	30,0	-	30,0			
13. Total invested capital	FC	1827	1446	381			
	DC	703	477	176	50		
	Tot.	2530	1923	557	50		

FC = foreign capital; DC = domestic capital

Niamey

		1984	1985	1986	1987	1988
B. Working capital						
1. Capital invested in stocks; assumption: in the long run 1 month-production on stocks = 84 %, annual production, in the starting time up to 15 %						
1.1. Stocks		323	360	343	347	408
1.2. = interests 10 %		32	36	34	35	41
1.3. Capital needed:	FC	-	-	-	-	-
	DC	323	360	343	347	408
	Total	323	360	343	347	408
2. Capital invested in customers'debts; assumption: 2 months sales as average debts = 17 % of annual production, in the starting time still more						
2.1. Debts		474	555	618	701	826
2.2. = interests (10 %)		48	56	62	70	83
2.3. Capital needed:	FC	-	-	-	-	-
	DC	474	555	618	701	826
	Total	474	555	618	701	826
3. Total working capital needed	FC	-	-	-	-	-
	DC	800	900	950	1050	1250
	Total	800	900	950	1050	1250
additional capital:		+800	+100	+50	+50	+200

FC = foreign capital; DC = domestic capital

Niamey

		1984	1985	1986	1987	1988
C. Total capital needed						
1. Foreign: capital:	Total					
1.1. invested	1827	1446	381	-		
1.2. working	-	-	-	-		
1.3. Total	1827	1446	381			
2. Domestic:						
2.1. invested	703	477	176	50	-	-
2.2. working max.	1250	800	900	950	1050	1250
2.3. Total: max.	1953	1277	1076	1000	1050	1250
3. Total capital needed: (accumulated)		2723	3380	3480	3580	3780

FC = foreign capital; DC = domestic capital

Capital demand of millet-mill Zinder (in 1000 DM)

			1984	1985	1986	1987	1988
A. Invested capital		Total					
1. Civil works	FC	15,0	10,0	5,0			
	DC	365,0	230,0	100,0	35,0		
	Tot.	380,0	240,0	105,0	35,0		
2. Machinery-equipment	FC	1187,3	1000,0	187,3	-		
	DC	-	-	-	-		
	Tot.	1187,3	1000,0	187,3	-		
3. Storage-equipment	FC	-	-	-			
	DC	-	-	-			
	Tot.	-	-	-			
4. Repair-shop-equipment	FC	15,0	8,0	7,0			
	DC	-	-	-			
	Tot.	15,0	8,0	7,0			
5. Laboratory-equipment	FC	6,3	4,0	2,3			
	DC	-	-	-			
	Tot.	6,3	4,0	2,3			
6. Transportation-equipment	no investments						
7. Spare-parts	FC	135,0	70,0	65,0			
	DC		-	-			
	Tot.	135,0	70,0	65,0			
8. Assembling operations	FC	129,0	114,0	15,0			
	DC	20,0	15,0	5,0			
	Tot.	149,0	129,0	20,0			

FC = foreign capital; DC = domestic capital

Zinder

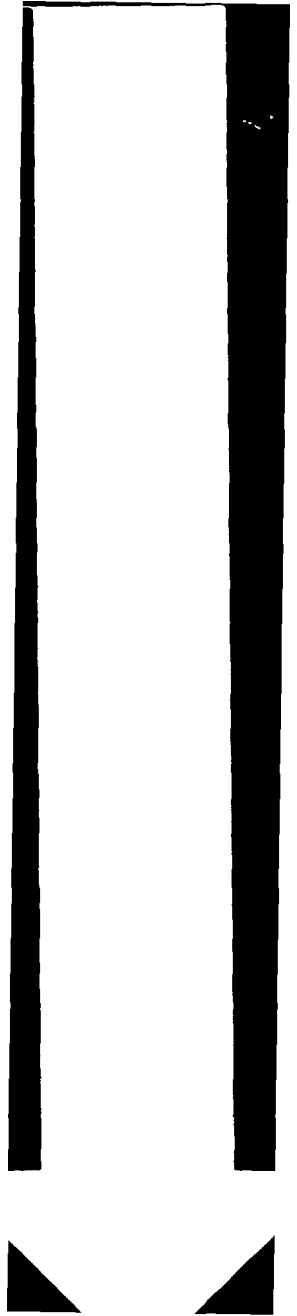
			1984	1985	1986	1987	1988
9. Training-costs	FC	22,0	22,0	-			
	DC	33,0	23,0	10,0			
	Tot.	55,0	45,0	10,0			
1o. Engineering and planning	FC	172,0	136,0	36,0			
	DC	26,9	20,0	6,9			
	Tot.	198,9	156,0	42,9			
11. Transportation inside Africa	FC	-	-	-			
	DC	78,0	64,0	14,0			
	Tot.	78,0	64,0	14,0			
12. Shares in investments in central services:							
a) Zaria/product-development-center	FC	49,5	40,0	9,5			
	DC	-	-	-			
	Tot.	49,5	40,0	9,5			
b) Kano/experimental bakery	FC	10,0	-	10,0			
	DC	-	-	-			
	Tot.	10,0	-	10,0			
c) Marketing-board	FC	30,0	-	30,0			
	DC	-	-	-			
	Tot.	30,0	-	30,0			
13. Total invested capital	FC	1771,0	1404,0	367,0	-		
	DC	523,0	352,0	136,0	35,0		
	Tot.	2294,0	1756,0	503,0	35,0		

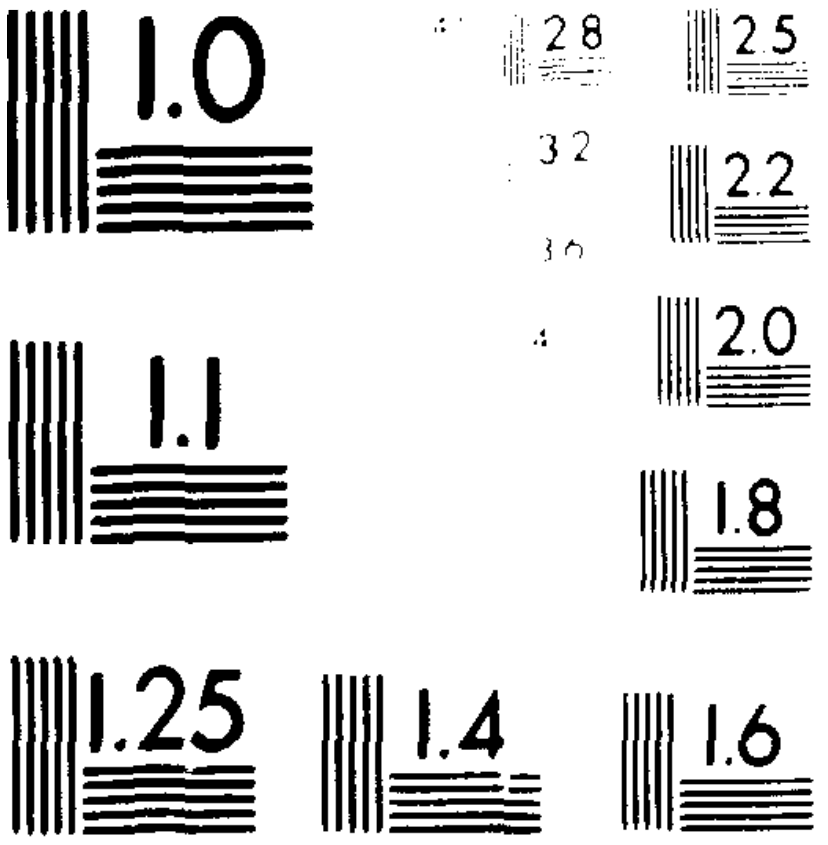
FC = foreign capital; DC = domestic capital

Zinder

		1984	1985	1986	1987	1988
B. Working capital						
1. Capital invested in stocks; assumption: in the long run, 1 month-production on stocks = 8,4 % of annual production; in the starting time: up to 15 %						
1.1. Stocks		329	367	349	335	395
1.2. = investments: 10 %		33	37	35	34	40
1.3. Capital needed:	FC	-	-	-	-	-
	DC	329	367	349	335	395
	Total	329	367	349	335	395
2. Capital invested in customers' debts; assumption: 2 months sales as average debts = 17 % of annual production, in the starting time still more						
2.1. Debts		483	565	628	713	839
2.2. = interests (10 %)		48	57	63	71	84
2.3. Capital needed :	FC	-	-	-	-	-
	DC	483	565	628	713	839
	Total	483	565	628	713	839
3. Total working capital needed						
	FC	-	-	-	-	-
	DC	812	932	977	1048	1234
	Total	812	932	977	1048	1234
additional capital		+812	+120	+ 45	+ 71	+186

FC = foreign capital; DC = domestic capital





Zinder

		1984	1985	1986	1987	1988
C. Total capital needed						
1. Foreign capital	Total					
1.1. invested	1771	1404	367			
1.2. working	-	-	-			
1.3. Total	1771	1404	367			
2. Domestic capital						
2.1. invested	523	352	136	35	-	-
2.2. working max.	1234	812	932	977	1048	1234
2.3. Total max.	1757	1152	1068	1012	1048	1234
3. Total capital needed (accumulated)		2568	3191	3271	3342	3528

1 = foreign capital; 2 = domestic capital

Capital demand of millet-mill Kano

			1984	1985	1986	1987	1988
A. Invested capital							
		Total					
1. Civil works:	FC	42,0	30,0	12,0	-		
	DC	518,0	330,0	138,0	50,0		
	Total	560,0	360,0	150,0	50,0		
2. Machinery-equipment	FC	1187,3	1000,0	187,3	-		
	DC	-	-	-	-		
	Tot.	1187,3	1000,0	187,3	-		
3. Storage-equipment	FC	-	-	-	-		
	DC	15,0	15,0	-	-		
	Total	15,0	15,0	-			
4. Repair-shop-equipment	FC	-	-	-			
	DC	-	-	-			
	Total	-	-	-			
5. Laboratory-equipment	FC	6,3	4,0	2,3			
	DC	-	-	-			
	Total	6,3	4,0	2,3			
6. Transportation-equipment	no investments						
7. Spare-parts	FC	135,0	70,0	65,0			
	DC	-	-	-			
	Total	135,0	70,0	65,0			
8. Assembling-operations	FC	129,0	114,0	15.0			
	DC	20,0	15,0	5,0			
	Total	149,0	129,0	20,0			

FC = foreign capital; DC = domestic capital

Kano

			1984	1985	1986	1987	1988
9. Training costs	FC	16,0	16,0	-			
	DC	24,0	17,0	7,0			
	Total	40,0	33,0	7,0			
10. Engineering and planning	FC	182,0	145,0	37,0			
	DC	34,7	25,0	9,7			
	Total	216,7	170,0	46,7			
11. Transportation inside Africa	FC	-	-	-			
	DC	78,0	64,0	14,0			
	Total	78,0	64,0	14,0			
12. Shares in investments in central services:							
a) Zaria/product development center	FC	49,7	40,0	9,7			
	DC	-	-	-			
	Total	49,7	40,0	9,7			
b) Kano/experimental bakery	FC	10,0	-	10,0			
	DC	-	-	-			
	Total	10,0	-	10,0			
c) Marketing-board	FC	30,0	-	30,0			
	DC	-	-	-			
	Total	30,0	-	30,0			
13. Total invested capital	FC	1787	1419	368			
	DC	690	466	174	50		
	Total	2477	1885	542	50		

FC = foreign capital; DC = domestic capital

Kano

		1984	1985	1986	1987	1988
B. Working Capital						
1. Capital invested in stocks; assumption: in the long run: 1 month-production on stocks = 8,4 % of annual production; in the starting time up to 15 %						
1.1. stocks		492	549	522	502	590
1.2. = interests 10 %		49	55	52	50	59
1.3. Capital needed:	FC	-	-	-	-	-
	DC	492	549	522	502	590
	Total	492	549	522	502	590
2. Capital invested in customers' debts; assumption: 2 months' sales as average debts = 17 % of annual production in the starting time still more						
2.1. Debts		722	844	939	1066	1255
2.2. Interests (at least 10 %)		72	84	94	107	126
2.3. Capital needed:	FC	-	-	-	-	-
	DC	722	844	939	1066	1255
	Total	722	844	939	1066	1255
3. Total working capital needed:	FC	-	-	-	-	-
	DC	1214	1393	1461	1568	1845
	Total	1214	1393	1461	1568	1845
additional capital		+1214	+179	+ 68	+107	+277

FC = foreign capital; DC = domestic capital

Kano

			1984	1985	1986	1987	1988
C. Total capital needed							
		Total					
1. Foreign capital							
1.1. invested		1787	1419	368			
1.2. working		-	-	-			
1.3. Total		1787	1419	368			
2. Domestic capital							
2.1. invested		690	466	174	50	-	-
2.2. working	max.	1845	1214	1393	1461	1568	1845
2.3. Total	max.	2535	1680	1567	1511	1568	1845
3. Total capital needed							
(accumulated)			3099	3641	3579	3866	4143

FC = foreign capital; DC = domestic capital

(9) Profitability-indicators

Profitability-indicator No. 1: Profit/loss (before taxes) in % of sales, investments and capital (invested and current), if capacity is used as forecasted before

		1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1. Profit/loss in % of sales:											
	Niamey	- 0,1%	+ 5,8%	+ 9,8%	+12,2%	+14,4%	+16,1%	+16,1%	+16,1%	+16,1%	+16,1%
	Zinder	- 7,0%	- 1,1%	+ 2,9%	+ 4,9%	+ 8,0%	+ 8,8%	+ 8,8%	+ 8,8%	+ 8,8%	+ 8,8%
	Kano	- 7,7%	- 3,1%	- 0,1%	+ 1,0%	+ 2,8%	+ 4,1%	+ 4,2%	+ 4,2%	+ 4,2%	+ 4,2%
	Ranking:	Niamey: very good (even compared with international standards; Zinder: fairly good; Kano: just sufficient									
2. Profit/loss in % of total investments:											
	Niamey	- 0,1%	+ 6,4%	+ 13,3%	+19,8%	+27,6%	+35,7%	+36,8%	+37,9%	+39,0%	+40,1%
	Zinder	- 6,7%	- 1,3%	+ 4,4%	+ 8,9%	+15,2%	+22,0%	+22,7%	+23,4%	+24,1%	+24,8%
	Kano	- 10,2%	- 5,3%	- 0,1%	+ 2,5%	+ 8,3%	+14,3%	+14,8%	+15,2%	+15,7%	+16,1%
	Ranking:	as above: Niamey best, Zinder in a middle position, Kano worst, but still sufficient									
3. Profit/loss in % of total capital needed:*)											
(simple rate of return)	Niamey	- 0,1%	+ 4,8%	+ 9,7%	+14,0%	+18,4%					
	Zinder	- 6,0%	- 0,9%	+ 3,1%	+ 6,1%	+ 9,9%					
	Kano	- 8,1%	- 3,6%	- 0,1%	+ 1,6%	+ 5,0%					
	Ranking:	as above									

*) invested and current

Profitability-indicator No. 2: Cash-flow (= profit/loss and depreciations*) and pension-fund-contribution in % of sales, investment and capital, if capacity is used as forecasted before

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1. Cash-flow in % of sales										
Niamey	+11,4 %	+15,0 %	+17,5 %	+18,7 %	+20,0 %	+21,2 %	+21,2 %	+21,2 %	+21,2 %	+21,2 %
Zinder	+ 3,8 %	+ 7,6 %	+10,1 %	+11,1 %	+12,5 %	+13,6 %	+13,6 %	+13,7 %	+13,7 %	+13,7 %
Kano	- 0,2 %	+ 2,9 %	+ 5,0 %	+ 5,3 %	+ 6,5 %	+ 7,5 %	+ 7,5 %	+ 7,5 %	+ 7,5 %	+ 7,5 %
Ranking:	Niamey by far in the best position, Kano still acceptable									
2. Cash-flow in % of total investments:										
Niamey	+ 9,7 %	+16,5 %	+23,7 %	+30,5 %	+38,6 %	+47,1 %	+48,5 %	+49,9 %	+51,3 %	+52,9 %
Zinder	+ 3,7 %	+ 9,4 %	+15,4 %	+20,2 %	+26,9 %	+34,0 %	+35,0 %	+36,1 %	+37,2 %	+38,3 %
Kano	- 0,2 %	+ 4,9 %	+10,4 %	+13,4 %	+19,5 %	+25,8 %	+26,6 %	+27,4 %	+28,2 %	+29,1 %
Ranking:	Niamey best, Kano in the worst position again									
3. Cash-flow in % of total capital needed										
Niamey	+ 9,0 %	+12,3 %	+17,2 %	+21,6 %	+25,8 %					
Zinder	+ 3,3 %	+ 6,7 %	+10,8 %	+13,9 %	+17,5 %					
Kano	- 0,2 %	+ 3,3 %	+ 6,9 %	+ 8,6 %	+11,6 %					
Ranking:	see above									

*) included depreciations on replacement-demand

As appendix to profitability-indicator - No .2 - table: calculation of the cash-flow for the 3 mills, if capacity is used as forecasted before

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1. Niamey:										
a) Depreciations	247,8	255,2	262,9	270,8	278,9	287,3	295,9	304,8	313,9	323,3
b) Profit/loss	- 2,7	+162,2	+337,1	+501,6	+697,1	+903,9	+930,9	+958,5	+984,1	+1015,1
c) Cash-flow	245,1	417,4	600,0	772,4	976,0	1191,2	1226,7	1263,3	1298,0	1338,4
2. Zinder:										
a) Depreciations	237,5	244,6	252,0	259,5	267,3	275,3	283,6	292,1	300,9	309,9
b) Profit/loss	-153,6	- 29,6	+101,8	+204,7	+350,0	+504,6	+519,7	+536,7	+552,8	+567,8
c) Cash-flow	83,9	215,0	353,8	464,2	617,3	779,9	803,3	828,8	853,7	877,7
3. Kano:										
a) Depreciations	245,5	252,9	260,5	268,3	276,3	284,6	293,1	301,9	311,0	320,3
b) Profit/loss	-252,3	-131,5	- 2,2	+62,8	+205,4	+353,3	+366,6	+376,8	+388,0	+400,2
c) Cash-flow	- 6,8	121,4	258,3	331,1	481,7	637,9	659,7	678,7	699,0	720,5

Profitability-indicator No. 3: Sales in % of total investments, if capacity is used as forecasted above

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1. Niamey	85,2 %	109,8 %	135,7 %	163,1 %	192,0 %	222,5 %	229,2 %	236,0 %	243,0 %	250,3 %
2. Zinder	95,7 %	123,1 %	152,2 %	182,8 %	215,1 %	249,2 %	256,6 %	264,3 %	272,3 %	280,4 %
3. Kano	132,4 %	170,4 %	210,7 %	253,1 %	298,0 %	345,2 %	355,6 %	366,2 %	377,2 %	388,6 %

Profitability-incidator No. 4: Sales in % of total capital needed,

	1984	1985	1986	1987
1. Niamey	79,2 %	82,2 %	98,6 %	115,3 %
2. Zinder	85,5 %	88,5 %	106,7 %	125,5 %
3. Kano	105,8 %	116,0 %	138,8 %	162,2 %

if capacity is used as forecasted above

1988	1989	1990	1991	1992	1993
128,5 %					
139,9 %					
178,1 %					

Profitability-indicator No. 5: Pay-back-period on invested capital, if capacity is used as forecasted before
(1000 DM)

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
A. Niamey										
1. Invested capital	2530,0	2155,9	1686,7	1118,3	455,7					
2. ./. Pay-back:										
a) interests on invested capital:	129,0	132,9	136,9	141,0	145,2					
b) depreciations	247,8	255,2	262,9	270,8	278,9					
c) profit/loss (after tax)*)	- 2,7	+81,1	+168,6	+250,8	+348,6					
d) = total pay-back	374,1	469,2	568,4	662,6	772,7					
3. Remaining amount	2155,9	1686,7	1118,3	455,7	+317,0					
4. Pay-back-period					4,6 years					

*) assumption: 50 % tax on profits

Profitability-indicator No. 5: Pay-back-period on invested capital, if capacity is used as forecasted before (1000 DM)

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
B. Zinder										
1. Invested capital	2294,0	2097,8	1767,2	1345,2	860,8	292,1				
2. ./. pay-back:										
a) Interests on invested capital	112,3	115,6	119,1	122,7	126,4	130,2				
b) depreciations	237,5	244,6	252,0	259,5	267,3	275,3				
c) Profit/loss (after tax)*)	-153,6	- 29,6	+ 50,9	+102,4	+175,0	+252,3				
d) = total pay-back	196,2	330,6	422,0	484,4	568,7	657,8				
3. Remaining amount	2097,8	1767,2	1345,2	860,8	292,1	+365,7				
4. Pay-back-period:						5,4 years				

*) assumption: 50 % tax on profits

Profitability-indicator No. 5: Pay-back-period on invested capital, if capacity is used as forecasted before
(1000 DM)

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
C. Kano										
1. Invested capital	2477,0	2356,1	2103,1	1709,3	1277,8	755,0	145,6			
2. ./. pay-back:										
a) Interests on invested capital	127,7	131,6	135,5	139,6	143,8	148,1	152,5			
b) Depreciations	245,5	252,9	260,5	268,3	276,3	284,6	293,1			
c) Profit/loss (after tax)*)	-252,3	-131,5	- 2,2	+ 31,4	+102,7	+176,7	+183,3			
d) = total pay-back	120,9	253,0	393,8	431,5	522,8	609,4	628,9			
3. Remaining amount	2356,1	2103,1	1709,3	1277,8	755,0	145,6	+483,3			
4. Pay-back-period							6,2 years			

*) assumption: 50 % tax on profits

Profitability-indicator No. 6 : Internal rate of return, if capacity is used as forecasted before (1000 DM)

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
A. Niamey										
1. Invested capital	2530,0	2282,2	2027,0	1764,1	1493,3					
2. ./. paid back (depreciat.)	247,8	255,2	262,9	270,8	278,9					
3. = remaining invested capital	2282,2	2027,0	1764,1	1493,3	1214,4	+ capital for replacement-demand				
4. Return:										
a) Interests on invested capital	129,0	132,9	136,9	141,0	145,2					
b) Profit/loss (before tax)	- 2,7	+162,2	+337,1	+501,6	+697,1					
c) Total return	+126,3	+295,1	+474,0	+642,6	+842,3					
5. Return in % of remaining invested capital = internal rate of return	+ 5,5 %	+14,6 %	+26,9 %	+43,0 %	+ 69,3 %					

Zinder

	1984	1985	1986	1987	1988
B. Zinder					
1. Invested capital	2294,0	2056,5	1811,9	1559,9	1300,4
2. ./. paid back (depreciat.)	237,5	244,6	252,0	259,5	267,3
3. = remaining invested capital	2056,5	1811,9	1559,9	1300,4	1033,1
4. Return:					
a) Interests on invested capital	112,3	115,6	119,1	122,7	126,4
b) Profit/loss (before tax)	-153,6	- 29,6	+101,8	+204,7	+350,0
c) Total return	- 41,3	+ 86,0	+220,9	+327,4	+476,0
5. Return in % of remaining invested capital = internal rate of return	- 2,0%	+ 4,8%	+ 14,2%	+25,2%	+46,1%

	1989	1990	1991	1992	1993
+ capital for replacement-demand					

Kano

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
C. Kano										
1. Invested capital	2477,0	2231,5	1978,1	1718,1	1449,8					
2. ./. paid back (depreciat.)	245,5	252,9	260,5	268,3	276,3					
3. = Remaining invested capital	2231,5	1978,6	1718,1	1449,8	1173,5	+ capital for replacement-demand				
4. Return:										
a) Interests on invested capital	127,7	131,6	135,5	139,6	143,8					
b) Profit/loss (before tax)	-252,3	-131,5	- 2,2	+ 62,8	+205,4					
c) Total return	-124,6	+ 0,1	+133,3	+204,4	+349,2					
5. Return in % of remaining invested capital = internal rate of return	- 5,6 %	± 0 %	+ 7,8 %	+ 14,0 %	+ 29,8 %					

3. Socio-economic evaluation

3.1 Socio-economic benefits Niamey

Following jobs will be created in Niamey:

Type of job	No.	Gross payments in DM/year
1. Production labour		
Millers	2	8.000
Helpers	2	4.600
Fillers	6	11.400
Packers	4	7.600
2. Storage labour		
Raw-material storage hands	2	3.800
Loading + unloading hands	1	1.900
Guards	-	-
3. Maintenance and repair staff		
Mechanical repair shop manpower	1	6.200
Electrical repair shop manpower	1	6.200
Laboratory staff	1	4.000
Helpers for repair shops	2	3.800
4. Functional staff		
Commercial director	-	
Technical director	-	
Accountants	-	
Invoicing staff	-	
Typists	-	
Head of sales	1	6.100
salesmen	1	5.500
Physical distribution staff	1	5.500
T o t a l	25	74.600

3.2 Socio-economic benefits Zinder

Following jobs will be created in Zinder :

Type of job	No.	Gross payments in DM/year
1. Production labour		
Millers	2	8.000
Helpers	2	4.600
Fillers	12	22.800
Packers	8	15.200
2. Storage labour		
Raw-material storage hands	4	7.600
Loading + unloading hands	2	3.800
Guards	1	1.900
3. Maintenance and repair staff		
Mechanical repair shop manpower	1	6.200
Electrical repair shop manpower	1	6.200
Laboratory staff	1	4.000
Helpers for repair shops	2	3.800
4. Functional staff		
Commercial director	1	13.000
Technical director	1	13.000
Accountants	1	6.100
Invoicing staff	-	-
Typists	-	-
Head of sales	1	6.100
salesmen	1	5.500
Physical distribution staff	1	5.500
T o t a l	42	133.300

3.3 Socio-economic benefits Kano

Following jobs will be created in Kano :

Type of job	No.	Gross payments in DM/year
1. Production labour		
Millers	2	30.000
Helpers	2	17.200
Fillers	6	36.000
Packers	4	24.000
2. Storage labour		
Raw-material storage hands	2	12.000
Loading + unloading hands	1	6.000
Guards	-	
3. Maintenance and repair staff		
Mechanical repair shop manpower	1	23.000
Electrical repair shop manpower	1	23.000
Laboratory staff	-	
Helpers for repair shops	1	6.000
4. Functional staff		
Commercial director	-	
Technical director	-	
Accountants	-	
Invoicing staff	-	
Typists	-	
Head of sales	1	22.000
salesmen	1	18.000
Physical distribution staff	1	18.000
T o t a l	23	235.200

Result :

90 jobs will be created by the project in Niger and Northern Nigeria.

XI. FINAL CONCLUSIONS: FEASIBILITY OF THE 3 PILOT MILLS SUFFICIENTLY GIVEN

1. Checking the feasibility of the 3 pilot mills in all aspects and items analysed

This study was realized to find out the feasibility of installing 3 pilot mills for millet in Niger and Nigeria: Is this feasibility sufficiently given or not? This question had to be answered in this report.

As this project is quite a complex one, there were many different aspects and items for which the feasibility had to be checked separately:

- the consumption-potential for industrial millet-flour
- had to be checked in the same way and intensity as all project-engineering-aspects
- as investments-
- and manpower-aspects
- and as financial and economical aspects.

The detailed results of all these checks and investigations were carefully described in the report delivered here. In the following chapter it shall be checked in a short, summarized way, whether in all these aspects and items the feasibility of the 3 pilot mills is sufficiently given or not.

	Niamey-mill, combined with existing rice-mill	Zinder-mill, combined with Sotramil -plant	Kano-mill, combined with existing NNFM-wheat-mill
A. The consumption-potential for industrial millet-flour (t):			
1984	100		900
1985	2100		7600
1986	8800		23000
1987	13000		32200
1988	18400		42200
1989	24900		55400
1990	32600		67300
Result: Feasibility given?	With some restrictions (=government-interventions necessary): yes. We think, however, this the most critical aspect of all this project: will the acceptance of the market for industrial millet-flour be big enough?		
B. Milling-capacities for millet-flour needed (min.):			
1985/1986	3000 -	10.000 t (millet)	10.000-30.000 t (millet
1989/1990	32.000 -	42.000 t (millet)	70.000-85.000 t (millet)
Result: Feasibility given?	Yes: Capacities/mill in a range of magnitude to be accepted from the technical, organizational, financial point of view		

	Niamey-mill, combined with existing rice-mill	Zinder-mill, combined with Sotramil -plant	Kano-mill, combined with existing NNFM-wheat-mill
C. The development-model for millet-milling in Niger/Nigeria	C.1. Central services: - product-development-center Zaria - experimental bakery Kano - product-development-center Zinder (pastries) - marketing-board in Niamey (+ Kano) - central engineering		
	C.2. 1 mill in Niamey (6000 t capacity)	1 mill in Zinder (6000 t capacity)	1 mill in Kano (6000 t capacity)
	- Each mill combined with the already existing mills or plants		
	- combined with the existing rice-mill	- combined with the existing pastry-plant and former mill	- combined with the existing wheat-mill
Result: Feasibility given?	Yes: If the 3 mills are installed as integrated parts of this overall-concept, the feasibility of these projects would positively be influenced.		
D. Project-engineering	1. Described in full detail: concept based on the FAO-millet-milling-system 2. Using as many facilities of the already existing mills as any possible.		
Result: Feasibility given?	Yes: the engineering-concept developed in this report would allow to produce millet-flour to both qualitative and economical conditions. As this concept is proved several times in practice (under similar conditions as in Niger/ Nigeria), the risk of failure should said to be minimized.		

	Niamey-mill, combined with existing rice-mill	Zinder-mill, combined with Sotramil -plant	Kano-mill, combined with existing NNFM-wheat-mill
E. Investments needed (on a marginal basis):			
1. Civil works	560,0	380,0	560,0
2. Machinery equipment	1.187,3	1.187,3	1.187,3
3. Storage equipment	15,0	-	15,0
4. Repair-shop-equipment	20,0	15,0	-
5. Laboratory	6,3	6,3	6,3
6. Transportation	-	-	-
7. Spare-parts	135,0	135,0	135,0
8. Assembling-operations	149,0	149,0	149,0
9. Costs of training	70,0	55,0	40,0
Total direct investments	2.142,6	1.927,6	2.092,6
10. Investments in the central services, splitted up to the 3 mills:			
a) Product-development-center Zaria:total 148,7	49,5	49,5	49,7
b) Experimental bakery Kano: total: 30,0	10,0	10,0	10,0
c) Marketing-board Niamey/ Kano, total 90,0	30,0	30,0	30,0

	Niamey-mill, combined with existing rice-mill	Zinder-mill, combined with Sotramil -plant	Kano-mill, combined with existing NNFM-wheat-mill
Total direct + indirect investments (cif Abidjan/ Lagos)	2.232,1	2.017,1	2.182,3
11. + engineering	218,9	198,9	216,7
12. + transportation inside Africa	79,0	78,0	78,0
Total investment	2.530,0	2.294,0	2.477.0
Result: Feasibility given?	Yes: the investments needed are not too high; it should be possible to finance them both in their foreign- and in their domestic capital shares.		
F. Organization and manpower			
1. Organization	see 2 organization-charts developed (page 107 and 111)		
	1. the first with the overall organization of all the group, consisting out of a) a central board of directors b) 4 central services (see above) c) 3 pilot mills being organized and strictly managed as profit-centers 2. the second with the organization to be realized in each of the 3 mills		

	Niamey-mill, combined with existing rice-mill		Zinder-mill, combined with Sotramil -plant		Kano-mill, combined with existing NNFM-wheat-mill	
2. Manpower required: - figures in ( ) = manpower required - figures without ( ) : manpower additionally to the already in the existing mill available personnel needed						
a) Management	(3)	-	(3)	2	(3)	-
b) Production	(24)	14	(24)	24	(24)	14
c) Storage, loading, etc.	(8)	3	(8)	7	(8)	3
d) Auxiliary services (repair-shop, laboratory, etc.)	(5)	5	(5)	5	(5)	3
e) Commercial personnel	(6)	3	(6)	4	(6)	3
Total personnel per mill + personnel in central services: - 1 food-expert for Zaria - 1 engineering expert for central engineering - 3 experts for the marketing-board	(46)	25	(46)	42	(46)	23

	Niamey-mill, combined with existing rice-mill	Zinder-mill, combined with Sotramil -plant	Kano-mill, combined with existing NNFM-wheat-mill
3. Training needs:	- 48 men-weeks training in foreign countries - 82 men-weeks training outside plant, but inside Niger/Nigeria -221 men-weeks training on the job, in the spot - total costs of training: 164.000 DM		
Result: Reasibility given?	Yes, in all aspects analysed: - manpower sufficiently available - domestic manpower by far predominant - training-needs quite limited - organization easily to be realized		
G. Financial and Economical Analysis			
1. Costs per year 1983 (if capacity is used to 90 % = 5.400 to millet)			
1.1. Direct costs (1000 DM)			
a) personnel	74,6	133,3	235,2
b) capital-costs	477,6	477,6	628,8
c) current supply	267,0	267,0	498,0
d) = total milling costs	819,0	847,9	1.362,0
= DM/kg flour	0,19	0,20	0,32

	Niamey-mill, combined with existing rice-mill	Zinder-mill, combined with Sotramil -plant	Kano-mill, combined with existing NNFM-wheat-mill
e) Raw-material-costs	2.942,0	3.320,0	5.306,0
= DM/kg flour	0,68	0,77	1,23
f) Total direct costs	3.761,0	4.167,9	6.668,0
= DM/kg	0,87	0,97	1,55
1.2. Indirect costs (= costs of central services)*)			
a) Personnel	128,0	128,0	128,0
b) capital costs	already included	in the direct capital-costs	
c) current operating costs	68,0	68,0	68,0
d) total costs of central services	196,0	196,0	196,0
= DM/kg flour	0,04	0,04	0,04
1.3. Total costs:			
1.3.1. in 1000 DM/year (base 1983)	3.957,2	4.363,9	6.804,0
1.3.2. = DM/kg flour	0,91	1,01	1,59
1.3.3. + remuneration of production-costs (DM/kg)	0,03	0,03	0,03
1.3.4. Total cost-price/kg flour (without profit + security-margin):DM /kg flour	0,94	1,04	1,62

*) splitted up equally to the 3 mills

	Niamey-mill, combined with existing rice-mill	Zinder-mill, combined with Sotramil -plant	Kano-mill, combined with existing NNFM-wheat-mill
2. To compare with this cost-price: the actual ex-factory-price for 1 kg millet-flour:			
2.1. net (= page 143)	1,09	1,11	1,66
2.2. included some profit + security margin (= page 125)	1,10	1,20	1,83
2.3. Conclusion: the cost-price/kg millet-flour is located ....% below the actual competitive level, is therefore said to be	14 % very competitive	6 % sufficiently competitive	3 % quite competitive
3. Shares in total costs:			
3.1. shares of different categories of costs in total costs:			
a) personnel	5,1 %	6,0 %	5,3 %
b) capital costs	12,1 %	10,3 %	9,2 %
c) cost of current supplies	8,5 %	7,7 %	8,2 %
d) raw-material costs	74,3 %	76,0 %	77,3 %
	100,0 %	100,0 %	100,0 %

	Niamey-mill, combined with existing rice-mill	Zinder-mill, combined with Sotramil -plant	Kano-mill, combined with existing NNFM-wheat-mill
3.2. shares of			
a) variable costs:			
- raw material	74,3 %	76,0 %	77,3 %
- others	10,4 %	10,2 %	13,0 %
total variable	84,7 %	86,2 %	90,3 %
b) fixed costs	15,3 %	13,8 %	9,7 %
in total costs =	100,0 %	100,0 %	100,0 %
3.3. shares of different cost-centers in total costs:			
a) raw materials	74,3 %	76,0 %	77,3 %
b) production	17,0 %	15,5 %	14,6 %
c) loading, unloading, stor.	0,9 %	0,9 %	1,0 %
d) auxiliary services	0,6 %	0,6 %	0,8 %
e) total production area	92,8 %	93,0 %	93,7 %
f) administration	-	0,4 %	-
g) sales	2,2 %	2,1 %	3,4 %
h) central services	5,0 %	4,5 %	2,9 %
total overhead area	7,2 %	7,0 %	6,3 %
total costs	100,0 %	100,0 %	100,0 %

	Niamey-mill, combined with existing rice-mill		Zinder-mill, combined with Sotramil -plant		Kano-mill, combined with existing NNFM-wheat-mill	
4. Costs-sensitivity-analys.						
Costs per kg millet-flour if capacity is used to						
100 %	0,90		0,99		1,57	
90 %	0,91		1,01		1,59	
80 %	0,94		1,03		1,61	
70 %	0,96		1,05		1,64	
60 %	0,98		1,08		1,66	
50 %	1,03		1,12		1,71	
40 %	1,09		1,19		1,79	
5. Forecasting the millet-flour-production and sales in the 3 mills 1984 - 1993 (%,t ,1000DM)						
Capacity used (equal in all 3 mills) to:	t	1000 DM[2)]	t	1000 DM[2)]	t	1000 DM[2)]
1984 40 %	1920[1)]	2156,2	1920[1)]	2194,6	1920	3279,4
1985 50 %	2400	2776,8	2400	2824,8	2400	4221,6
1986 60 %	2880	3432,9	2880	3490,6	2880	5218,6
1987 70 %	3360	4126,1	3360	4192,3	3360	6269,8
1988 80 %	3840	4857,6	3840	4934,4	3840	7380,5
1989 90 %	4320	5629,0	4320	5715,4	4320	8549,3
1990 90 %	4320	5797,8	4320	5886,8	4320	8808,5
1991 90 %	4320	5971,4	4320	6064,8	4320	9072,0
1992 90 %	4320	6147,4	4320	6246,7	4320	9344,2
1993 90 %	4320	6333,1	4320	6432,7	4320	9624,9

1) partly perhaps to be stocked due to slow development of the market

2) to market prices

	Niamey-mill, combined with existing rice-mill		
6. Forecasting the profit/ loss-development in the 3 mills up to 1993 (1000 DM)			
1984		./. 2,7	
1985		+ 116,2	
1986		+ 337,1	
1987		+ 501,6	
1988		+ 697,1	
1989		+ 903,9	
1990		+ 930,9	
1991		+ 958,5	
1992		+ 984,1	
1993		+ 1015,1	
7. Profit-sensitivity- and break-even-point analysis 1984:			
7.1. Profit/loss (1000 DM), if capacity is used to			in % of sales
100 %	+ 934,8	=	+ 17,3 %
90 %	+ 775,5	=	+ 16,0 %
80 %	+ 615,6	=	+ 14,3 %
70 %	+ 456,4	=	+ 12,1 %
60 %	+ 361,1	=	+ 9,8 %
50 %	+ 156,8	=	+ 5,8 %
40 %	- 2,7	=	- 0,1 %
7.2. Break-even-point: reached, if capacity is used to .... %:		41 %	

Zinder-mill, combined with Sotramil -plant			Kano-mill, combined with existing NNFM-wheat-mill		
./. 153,6			./. 252,3		
./. 29,6			./. 131,5		
+ 101,8			./. 2,2		
+ 204,7			+ 62,8		
+ 350,0			+ 205,4		
+ 504,6			+ 353,6		
+ 519,7			+ 366,6		
+ 536,7			+ 376,8		
+ 552,8			+ 388,0		
+ 567,8			+ 400,2		
		in % of sales			in % of sales
+ 568,7	=	+ 10,4 %	+ 433,7	=	+ 5,3 %
+ 443,0	=	+ 9,0 %	+ 308,7	=	+ 4,2 %
+ 316,0	=	+ 7,2 %	+ 183,8	=	+ 2,8 %
+ 190,4	=	+ 4,9 %	+ 58,7	=	+ 1,0 %
+ 97,6	=	+ 3,0 %	- 2,1	=	- 0,1 %
- 28,0	=	- 1,0 %	- 127,1	=	- 3,1 %
- 153,4	=	- 7,0 %	- 252,3	=	- 7,7 %
		52 %			61 %

	Niamey-mill, combined with existing rice-mill		Zinder-mill, combined with Sotramil -plant		Kano-mill, combined with existing NNFM-wheat-mill	
8. Capital demand (1000 DM)	invested cap.	current cap.	invested cap.	current cap.	invested cap.	current cap.
Foreign	1827	-	1771	-	1787	-
Domestic	703	950	523	977	690	1461
Total	2530	950	2294	977	2477	1461
	(1984-86)	(1984-86)	(1984-86)	(1984-86)	(1984-86)	(1984-86)
9. Some profitability-indicators:						
9.1. Profit/loss in % of sales						
1984	./. 0,1 %		./. 7,0 %		./. 7,7 %	
1985	+ 5,8 %		./. 1,1 %		./. 3,1 %	
1986	+ 9,8 %		+ 2,9 %		./. 0,1 %	
.	.		.		.	
.	.		.		.	
.	.		.		.	
1990	+ 16,1 %		+ 8,8 %		+ 4,2 %	
	= very good		= fairly good		just sufficient	

	Niamey-mill, combined with existing rice-mill
9.2. Profit/loss in % of total investment:	
1984	./. 0,1 %
1985	+ 6,4 %
1986	+ 13,9 %
.	.
.	.
.	.
1990	+ 36,8 %
9.3. Profit/loss in % of total capital needed:	
1984	./. 0,1 %
1985	+ 4,8 %
1986	+ 9,7 %
1987	+ 14,0 %
1988	+ 18,4 %
9.4. Cash-flow in % of sales	
1984	+ 11,4 %
1985	+ 15,0 %
1986	+ 17,5 %
.	.
.	.
.	.
1990	+ 21,2 %

Zinder-mill, combined with Sotramil -plant	Kano-mill, combined with existing NNFM-wheat-mill
./. 6,7 %	./. 10,2 %
./. 1,3 %	./. 5,3 %
+ 4,4 %	./. 0,1 %
.	.
.	.
.	.
+ 22,7 %	+ 14,8 %
./. 6,0 %	./. 8,1 %
./. 0,9 %	./. 3,6 %
+ 3,1 %	./. 0,1 %
+ 6,1 %	+ 1,6 %
+ 9,9 %	+ 5,0 %
+ 3,8 %	./. 0,2 %
+ 7,6 %	+ 2,9 %
+ 10,1 %	+ 5,0 %
.	.
.	.
.	.
+ 13,6 %	+ 7,5 %

	Niamey-mill, combined with existing rice-mill
9.5. Cash-flow in % of total capital needed:	
1984	+ 9,0 %
1985	+ 12,3 %
1986	+ 17,2 %
1987	+ 21,6 %
1988	+ 25,8 %

Zinder-mill, combined with Sotramil -plant	Kano-mill, combined with existing NNFM-wheat-mill
+ 3,3 %	./. 0,2 %
+ 6,7 %	+ 3,3 %
+ 10,8 %	+ 6,9 %
+ 13,9 %	+ 8,6 %
+ 17,5 %	+ 11,6 %

	Niamey-mill, combined with existing rice-mill	Zinder-mill, combined with Sotramil -plant	Kano-mill, combined with existing NNFM-wheat-mill
9.6. Pay-back-period on invested capital	4,6 years	5,4 years	6,2 years
9.7. Internal rate of return:			
1984	+ 5,5 %	./. 2,0 %	./. 5,6 %
1985	+ 14,6 %	+ 4,8 %	+ 0,0 %
1986	+ 26,9 %	+ 14,2 %	+ 7,8 %
1987	+ 43,0 %	+ 25,2 %	+ 14,0 %
1988	+ 69,3 %	+ 46,1 %	+ 29,8 %
Result for chapter X. feasibility given?	Yes, in all aspects analysed: - quite moderate costs of production - ex-factory-price very competitive, compared with the present market situation - high share of variable costs = high built-in-flexibility - low shares of overhead-costs - costs of central services to be accepted by the market, too - quite high cost-sensitivity - price to be accepted by the market significantly higher than the cost-covering-price in the 3 mills - therefore, very, or at least sufficient profit/loss-situation to be expected . mainly in Niamey . something more limited in Zinder . significantly more limited, but still acceptable in Kano - break-even-point quite low = easily to be reached		

	Niamey-mill, combined with existing rice-mill	Zinder-mill, combined with Sotramil -plant	Kano-mill, combined with existing NNFM-wheat-mill
	- capital demand limited, with a significant share of domestic capital included		
	- all profitability-indicators look favourable, with some difference, however, between the 3 mills:		
	. Niamey shows the best profitability-outlook	. Zinder the second-best (but still fully satisfying at all)	. Kano shows the worst outlook in this respect, but still acceptable

2. Final result and recommendation

As just pointed out, the feasibility of installing each a pilot-mill in Niamey, Zinder, and Kano, plus some central service-institutions in Zaria, Zinder and Niamey is given in all aspects and items just analysed

- at least to a sufficient, still acceptable degree
- mostly even to a good, or even very good degree.

Therefore, we recommend to all authorities concerned to install these 3 mills, plus the central service-institutions as soon as possible. The restrictions as far as the acceptance of industrial millet-flour by the consumers are concerned (see the beginning of this report), should however, be observed very carefully; intensive efforts (as indicated in the first chapters) should be made by

- government
- the central service-institutions proposed
- and the 3 mills each by itself

to diminish the objections and prejudices against this type of millet-flour and to promote

- as well the direct consumption (within household-meals)
- as the consumption of this flour in bread-production
- and in pastry-industry.

If such promotion-efforts are done by all parties concerned, and with the best possible intensity, we are sure that these 3 pilot mills for millet to be established as proposed in Niamey, Zinder and Kano will work successfully.

Annex A : Pictures of already existing industrial mills for millet taken in the Sudan (FAO-type as recommended in this study, too)