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CASE STUDY OF THE FOOD, BEVERAGES AND TOBACCO SECTOR

Sean Foley, Aida Umaya
and Soeharno.

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Preface

NRMP-IEA Technological Scenarios

The Natural Resources Management Project (NRMP) assisted by USAID in association with the Institute for Economic Analysis (IEA) at New York University is carrying out a modelling exercise to project the economic, employment and environmental consequences of different development paths for the Indonesian economy. The purpose is to provide advice to the Indonesian National Planning Agency (BAPPENAS) to assist in the development of the next five-year plan (Repelita VI) and the next Long-Term Development Plan. The first stage of this work has already been completed with the support of the Environmental Programming Support Services Project of CIDA.

The analysis, of which the present paper is a component, will provide advice on the trade-offs and complementarities between the growth of income and employment on the one hand, and the levels of natural resource depletion and degradation of the natural environment on the other. For instance, it is important for policy makers to know how the development of the pulp and cement industries over the next 20 years is likely to affect air and water pollution and how costly or cost-saving it will be to adopt cleaner technologies than are being used now.

The analytical framework includes a dynamic input-output model covering all economic activities. The model is dynamic in two senses. First, it incorporates a representation of investment in which levels of sectoral investment depend on expected growth of output, the technology in use and levels of capacity utilisation. Secondly, the model is dynamic in that it explicitly incorporates projections of changes in technology for a range of sectors in the economy, including agricultural sectors, forestry, energy sectors and key manufacturing sectors.

Technological scenarios are developed for each of these sectors using detailed information about likely technological and institutional changes obtained from technical experts. They include expected changes in intermediate inputs, notably energy and raw materials, capital stocks and human resources of different skill types as well as expected changes in natural resource usage and environmental degradation associated with current and alternative future technologies.

This paper is one of a series of working papers prepared by NRMP and IEA researchers in collaboration with industry experts. The papers will form a vital part of the data base for the numerical computations. In addition, they will be valuable as stand-alone analyses of technological futures for a range of important industries in Indonesia.

It should be noted, however, that some of these working papers (especially those on manufacturing sectors) were prepared under severe time limits and should not be taken to represent the last word on technological change in the industries in question.

1 Introduction

This case study describes current and future technologies in the Indonesian food, beverages and tobacco (FB&T) sector (Sector 11 in the NRMP-IEA 30-sector classification system). It relies on case studies from the palm cooking oil and the flour milling industries to describe the technological changes expected in the period 1985-2020.

The sector has a complex mixture of industries, with processing and production occurring in establishments that vary widely in level of technology and scale of operations. Wheat flour milling, for instance, is effectively a monopoly that uses modern, capital-intensive technology; the oil and fat industry has numerous small- and medium-scale processors (including multi-national corporations) using widely differing production technologies; the tobacco industry is split between labour-intensive hand-rolled clove cigarette manufacturing and highly automated production using quite modern technology; and the sugar refining industry (which is largely state-owned) relies on antiquated equipment and processes dating from the colonial era.

The sector is composed of the following sub-sectors in the BPS 66-sector classification:

27 Food processing and preserving
28 Oil and fat
29 Cereal mill products
30 Flour (all kinds)
31 Sugar
32 Other food products
33 Beverages
34 Cigarettes and other tobacco products

In 1985 the sub-sector cereal mill products accounted for over 50 per cent of total sectoral output (by value), with cigarette and tobacco products and other food products accounting for about 20 per cent and 11 per cent of output respectively (Table 1). The picture is somewhat confounded by the dominance of output by volume by the cereal mill subsector, as most of this output is in fact milled rice that is processed by thousands of rice mills throughout the rice producing areas of Indonesia. Because of its geographical dispersion and simple technology the cereal milling industry was not considered suitable for study, despite its dominance of sectoral output.

It was decided to focus efforts on the oil and fat subsector, as this sector is expanding rapidly (due to income-induced changes in composition of diet) and because the production processes are known to have potentially severe environmental impacts, in terms of production wastes. By 1989 the oil and fat subsector had the largest physical output within the sector (3.12 million tonnes) and the second largest output by value (Rp 1.28 billion), exceeded only by cereal milling.

In 1989 the sugar subsector had the second largest physical output (3.03 million tonnes) within the sector as a whole and the largest value of output within the sector (Rp 1.33 billion). Environment impacts from sugar refining were estimated to be potentially severe in rural areas where sugar mills are located, especially in terms of adverse impacts on water quality. In addition, the subsector is growing quite rapidly (4.6 per cent p.a.) and its outputs (refined sugar products) are a major input in the rapidly expanding processed food industries (e.g. beverages). However, lack of ready access to data from sugar mills (which are located in the rural areas of central and east Java) made a case study infeasible.

Cigarette and tobacco products, although important in terms of value of output, were considered to have minor environmental impacts. However, because the subsector is labour-intensive, technological changes in production methods (i.e.. increasing automation) were estimated to have a major potential impact on employment.

The flour milling subsector is a special case, wholly relying on imported raw materials and using modern, highly-automated production processes. Its output is the basic input to much of the processed food industry (e.g. bread and noodles), a rapidly growing industry. While its environmental impact is low to moderate (minor dust and water pollution) it illustrates the likely trend towards highly-automated, capital-intensive food processing industries.

Table 1 Outputs by sub-sectors in the food, beverage & tobacco sector, 1985

Sector	BPS 66-sector no.	Output (Rp m)	Share of total (%)
Cereal mill products	29	7,934,399	47.53
Cigarettes & tobacco prod.	34	3,413,506	20.39
Other food products	32	1,714,324	10.63
Oil & fat	28	1,003,460	6.06
Sugar	31	815,461	4.90
Flour (all kinds)	30	783,338	4.78
Food processing & preserving	27	591,101	4.13
Beverages	33	258,759	1.59

Source: BPS 1989

Overall, the largest intermediate input is from Sector #1 (paddy), which in 1985 accounted for over 50 per cent of total intermediate inputs. Inputs from agricultural sectors (estate crops and other food crops plus paddy) accounted for about 75 per cent of total intermediate inputs. The major intermediate inputs to this sectors are listed in Table 2.

Table 2 Intermediate inputs to food, beverage & tobacco

Sector	NRMP-IEA 30-sector no.	Coefficient (Rp/Rp)	Share of total (%)
Paddy	1	0.40422	51.71
Estate Crops	3	0.13171	16.81
FB&T	11	0.06868	8.80
Other Food Crops	2	0.05150	6.60
Other Manufacturing	17	0.00935	1.20
Pulp, Paper & Product	13	0.00641	0.82
Petroleum Refining	18	0.00566	0.72
Chemicals	15	0.00423	0.54
Livestock and poultry	4	0.00239	0.31
Electricity	20	0.00150	0.19
Water Utilities	22	0.00048	0.06

Source: BPS 1989

2 Case Study; Palm Cooking Oil

The oil and fat sub-sector consists of industries processing vegetable and animal oils. There are three types of primary vegetable oil produced in Indonesia: palm oil, coconut oil and soybean oil. By far the most import of these are palm and coconut oil, with palm oil accounting for 80 per cent of total crude vegetable oil production in 1990 (Table 3).

Table 3 Major types of crude vegetable cooking oil, 1990

	Quantity (tonnes)	Share of total (%)
Palm oil	2,254,543	80.4
Coconut oil	505,555	18.0
Oil from other vegetables	44,795	1.6
Total	*2,804,893*	*100.0*

Source: BPS, *Industrial Statistics 1990*

Within this subsector it was decided to focus on the processing of palm oil, as production of this source of cooking and manufacturing oil is expanding rapidly, averaging 20.7 per cent p.a. over 1986-90. In addition to meeting rapidly rising domestic demand for cooking oil (11.3 per cent p.a. over 1986-90), the palm oil industry is also rapidly increasing exports of processed oil. The industry also supplies basic inputs for the production of non-food products (e.g. soap, wax, resins and surfactants).

In 1990 there were 45 registered palm cooking oil processors, compared to 37 in 1985, with a combined registered capacity of some 2.33 million tonnes. However, a report by PT Data Consult (1991) notes that actual installed capacity of most plants typically exceeds their registered capacity by 2-4 times; the company selected for this case study is no exception. Some of these plants are located close to the source of raw material supply (North Sumatera), while a number of the newer plants are located close to major urban areas (e.g. Jakarta, Surabaya).

The information of current technology came from a recent (January 1993) Environmental Impact Assessment of PT Sawit Malinda Edible Oil Industries (PT SME), a cooking oil producer located in Medan, North Sumatera. Their main products are olein (91 t/day or 27,300 t/annum), and stearine (24 t/day or 7,200 t/annum); their registered capacity is 14,000 t/annum. The primary raw materials are crude palm oil (CPO) and crude palm kernel oil (CPKO). PT SME is a relatively small producer, responsible for only about one percent of national production of palm cooking oil in 1990. This information has been augmented by visits to oil palm processing plants in Jakarta.

2.1 Current technology

Material and energy requirements

The current technology used by PT SME involves the use of a series of cooling, degumming, bleaching and deordorising steps prior to separating (fractionating) the olein and stearin components of the CPO and CPKO. The products of fractionation are then heated, centrifuged and filtered. Raw materials and chemicals used are listed in Table 4.

Water consumption is 648 m^3/day, or 5.6 m^3 per tonne of output, and water output 4.4 m^3 per tonne of output. The main source of energy is electricity bought from PLN; the company also owns a generator with a capacity of 1,810 KVA for backup. Total electrical energy used is 48,000 KWh/day, or 417.4 KWh/t of production.

Table 4 Materials used in producing palm cooking oil

Input/impact	*Amount per day*	*Amount per tonne of output*
Raw material	*t/day*	*t/t*
Input CPO	120	1.043
Input CPKO	10	0.087
Chemicals	*t/year*	*t/t*
Sodium Aluminium Sulphate	15.6	0.00045
Magnesium Sulphate	45.6	0.00132
Bleaching Earth	438	0.01269
Phosphate Acid	26	0.00075
Energy		*KWh/t*
Electricity		417.4
Output	*t/day*	*t/t*
Refined Oil Output	115	1.130
Water		*m3/t*
Water Inputs		5.6
Water Output		4.4

Notes: t/t = tonnes of input per tonne of output
Source: AMDAL PT SME, 1993.

Labour requirements

Total labour force at the company is 84 persons. Details of educational background are listed in Table 5.

Table 5 Labour force by educational level, PT SME

Education level	*Number of employees*	*Coefficient (p-y/1000t)*
Elementary	0	
Junior HS	16	0.46
Senior HS	60	1.74
Diploma Holder	6	0.17
University	2	0.06
Total	84	2.43

Source: AMDAL PT SME, 1993.

Waste and pollutant generation

There are two types of waste generated from refining palm oil based cooking oil (see Table 6 for details):

- Solid waste: bleaching earth, which is sold for filling and considered harmless; output is 438 ton/year; and
- Liquid wastes: BOD, COD, TSS, dissolved solids, and oil and greases.

The solid wastes are sold to the construction industry as solid fill, and apparently have no direct adverse environmental impacts. In our estimate, in 1985 the liquid wastes were discharged unprocessed into local water courses, except for some oil being skimmed-off for use in soap production. There has been some improvement since then, but visits to production facilities in Jakarta revealed that in many palm oil plants waste water is still only partially processed, at best, before discharge. Thus, we have assumed that water pollution in 1985 is equivalent to the discharge of untreated waste water, data for which was given in the AMDAL (see Table 6).

Table 6 Water pollution in cooking oil production, 1991

Parameter	*unit*	*level*	*KLH standard*
Dissolved solids	mg/l	450	2000
Suspended solids	mg/l	608	200
COD	mg/l	360	100
BOD	mg/l	248	50
Oil and grease	mg/l	20	5

Note: Pollutant measured prior to treatment, based on water output per tonne of production.
Source: AMDAL PT SME, 1993

2.2 Future Technology

It is expected that in the medium-term (5-10 years) there will be significant changes in cooking oil processing technology. Although this new technology is already in use in Malaysia, its widespread adoption to Indonesia will be delayed, on the whole, until the value of recent investments in processing facilities is amortised. The new technology is called Super Critical Fluid Extraction (SCFE), and is a single-step process. By eliminating most steps required by the older technology, it will markedly reduce electricity, water and labour requirements. The range of chemicals previously used will be totally replaced by CO_2.

Information on the new SCFE technology is based on discussions with Dr Manulung of the Bogor Agricultural Institute (IPB). As the new technology is a single-step process relying only on CO_2 as a chemical reagent, use of chemicals will be reduced to approximately half of present use per tonne of production. Similarly, the elimination of cooling and heating steps in the process will reduce the demand for process energy by an estimated 50 per cent over 1985 levels (Table 7). Because water is no longer used in the new process, water will only be used for domestic and cleansing purposes, and water requirements will decline by approximately 75 per cent per tonne of production.

The simplification of the production process, which will be more fully automated, will also markedly reduce labour requirements while at the same time increasing the proportion of skilled labour required to operate the process. It is estimated, that labour requirements will decline by about 70 per cent per tonne of production. On the other hand, the capital required per unit of output will be double that required with the present technology, substituting capital for chemical, energy and labour inputs.

Table 7 Palm oil: Changes in inputs per unit of output resulting from the use of SCFE technology, 2020

Input	*Change 1985-2020 (%)*
Chemical	-50
Electricity	-75
Labour	-70
Water	-75
Capital	+100

Source: Dr Manulung, food technology expert, Bogor Agricultural University (IPB), pers comm. 1993

Changes in the production process, in particular the elimination of degumming, bleaching and deodorising chemicals, and the reduction in the use of water, will result in significant reductions in environmental impacts from waste water (Table 8). In particular, the new technology will result in a marked reduction in the amount of semi-processed oil discarded in waste water, thus reducing levels of important pollutants (BOD, COD, etc.).

Table 8 Palm oil:- Change in levels of water pollution, 2020

Input	*Change 1985-2020 (%)*
Water input/output	-75
Water output/output	-75
BOD	-73
COD	-75
Dissolved Solids	-80
Suspended Solids	-86

Source: as for Table 7

3. Case Study: Flour Milling

To represent the sub-sector, wheat flour milling was chosen for the case study. Milling imported wheat accounted for some 98 per cent of total production from the sub-sector in 1990. The production of wheat and other types of flour in 1990 is given in Table 9. Because most rice flour is produced for own-consumption by households, the official statistics undoubtedly seriously underestimate actual production.

Table 9 Production of flour by type, 1990

Type	*Quantity (t)*	*Value (Rp '000)*
Wheat flour	1,744,307	387,304,090
Rice flour	8,058	5,282,280
Other flours	21,516	10,588,970
Total	1,773,881	403,175,340

Source: BPS, 1991a

There is only one producer milling wheat flour in Indonesia, PT Bogasari Flour Mills. Domestic demand in Indonesia is supplied by PT Bogasari, while PT. Berdikari (a state-owned company managed by BULOG, the government food procurement agency) acts as a distributor for eastern Indonesia. PT Bogasari has two factories, located in Jakarta and Surabaya. Bogasari's Jakarta production capacity is 4,000 tonnes of milled flour per day. The information used here comes from PT Bogasari production staff, company literature and BPS industrial statistics.

Using sectors

The two major flour using sectors are Bread and Bakery Products (#61 of 169 sector I-O classification) and noodle, macaroni, etc. (#62 of 169 sector I-O) which consume 30 per cent and 27 per cent of the total production respectively (Table 10).

Table 10 Sector using wheat flour, 1985

Sector name	*BPS 169-sector classification*	*Value (Rp m)*	*Share of total (%)*
Bread and Bakery	61	46285	30.35
Noodle, macaroni, etc.	62	41925	27.49
Plywood & other products	85	21986	14.42
Restaurant	147	19204	12.59
Other Foods	69	15519	10.12
Health Service	163	3274	2.12
Hotels	148	1591	1.04
Others	-	2867	1.88

Source: BPS 169-sector input-output table, 1985, on disk

3.1 Current technology

The raw material for wheat flour milling is imported wheat grain. In the first step of the milling process wheat grains are separated from other grains or foreign materials and cleaned. Sometimes wheat with different characteristics is blended after the cleaning process to obtain the required qualities for milling and various types of flour.

Moisture is added before the milling process begins. Corrugated rollers break the grains into coarse particles, and succeeding rollers reduce these particles to flour. The crushed wheat is sifted through successively finer screens; air currents and sieves separate bran and classify particles.

PT Bogasari produces wheat flour (74 per cent of grain) and pollard and bran (26 per cent). Based on this milling ratio the quantity of wheat required to produce a tonne of flour is 1.35 tonnes.

Total production of wheat flour in the Jakarta factory in 1985 was 511,251 tonnes and 190,593 tonnes of bran and pollard by-products; equivalent to 1,639 t/day of flour and 611 t/day of by-products. Projected production for 1993 is 793,800 tonnes of flour and 278,903 tonnes of pollard; equivalent to production of 2,544 t/day of flour and 894 t/day of by-products.

Water is used for moistening the grain prior to milling and also for domestic and cleaning purposes. Total water consumption in 1985 was 114,660 m ^{3}(367.5 m ^{3}/day).

The main source of energy in 1985 was industrial diesel oil (IDO), used for own-generation of electricity. In 1985, IDO consumption was 23,400 m ^{3}(75 m ^{3}/day or 63.8 t/day), or 0.05 m^3/t of milled flour.

Raw material, water and fuel inputs required for producing one tonne of flour are listed in Table 11.

Table 11 Materials used in producing wheat flour

	Units	Inputs per tonne of flour
Wheat Grain	t/t	1.35
Water	m^3/t	0.224
IDO	m^3/t	0.05

Source: PT Bogasari, pers. comm.

Labour requirements

In 1985, the total labour at the company's Jakarta plant was 996 persons, with a slight decline in numbers to 980 by 1993. However, this represents a 40 per cent decline over 1985 in the amount of labour required per tonne of production. Composition of labour by educational background is presented in Table 12.

Table 12 Labour requirements in flour milling, 1985 and 1993

	No.	*No.*	*Labour per unit output (p-y/1000t)*	
Education	*1985*	*1993*	*1985*	*1993*
Elementary	298	225	0.60	0.28
Junior HS	349	245	0.68	0.31
Senior HS	334	490	0.65	0.62
University & diploma	15	19	0.03	0.024
Total	996	980	2.0	1.2

Source: PT Bogasari, pers. comm.

Fixed capital investment

Total fixed capital investment in 1987 was Rp 191,256 million. The value represents all assets related to production process including milling units, grain storage, flour storage, power station, buildings and 30 ha of land. Based on information from interviews, it seems that this value will remain unchanged in 1993, as no expansion or asset sales are planned.

Based on this, the ratio of investment to output is estimated as follows :

Investment in 1993:	Rp 191,256,000,000,
Production in 1993:	793,800 tonnes
Investment/output:	Rp 240,937/tonne

Pollution

The main sources of pollution from wheat milling are flour dust and waste water from domestic uses. As flour 'dust' is in fact the main product and is valuable and relatively easy to collect, effective dust control equipment has been installed. Hence, air pollution generated by milling is minimal, this is confirmed from a visual inspection of the plant and surroundings, which are in fact quite free of dust. In the case of waste water, there is no water treatment unit to ensure that waste water is within the environmental standards, and there is no information on water quality available from the company.

3.2 Future Technology

Potential technological development in the coming 25 years is expected to increase the efficiency of milling and refining machinery from 74 per cent to 82 per cent. The improved milling yield will result from improvements in both roller technology and in the control systems used to separate milling products (flour and bran). This will reduce the amount of grain required for one tonne of flour from 1.35 tonnes (74 per cent milling efficiency) to 1.22 tonnes (82 per cent efficiency). As a result, the production of bran and pollard milling by-products will be reduced to 18 per cent of output.

Currently, PT Bogasari operates seven milling units in its Jakarta mill, and it has installed three additional units which are expected to be in operation soon. This will give it an installed capacity of 5,500 t/day wheat input. As the plant usually operates 24 hours/day and 312 days/annum, their potential flour output will increase to 3,634 t/day or 1.13 million t/annum.

Water consumption per tonne of flour production will decline in line with increased milling efficiency, from 0.224 m^3/t to 0.193 m^3/t, a decline of 14 per cent. Consumption of diesel

fuel will decline at an identical rate, from 0.05 m ^{3} to 0.037 m ^{3}, a 14 per cent reduction per unit of flour produced.

Labour requirements

Increasing automation will also lead to a change in the composition of the labour force, with the proportion of people with only elementary or junior high school qualifications declining, and being these replaced by those with senior high school or technical college qualifications (Table 13).

Table 13 Estimated labour requirements in the wheat flour industry, 2020

Labour	*No.*	*Employees per 1000 tonnes flour*
Elementary School	48	0.040
Junior High School	96	0.040
Senior High School	768	0.635
Diploma & Univ.	48	0.040
Total	960	0.790

Source: Pers. comm., PT Bogasari.

The reduction in labour required, from 2.0 person-years/1000 tonne in 1985 to 0.79 person-years/1000 tonne in 2020 is equivalent to a 60 per cent reduction in labour requirements per tonne of production.

Table 14 summarises the expected changes in technologocal coefficients for inputs to flour milling in the year 2020.

Table 14 Flour Milling: Changes in inputs per unit of output, 1985-2020

Input	*Change 1985-2020 (%)*
Wheat	-10
IDO	-14
Labour	-60
Capital	+10
Water	-14

Source: NRMP calculations

4. Technological Change in the Food, Beverages and Tobacco Sector

This sector is dominated by rice milling, the technology for which is not expected to change significantly by the year 2020. Moreover, the relative importance of rice milling is expected to decline, due to rapid growth in the rest of the sector. Rapid changes in technology are anticipated in other types of food and beverage processing, similar to those occurring in the cooking oil industry, with major impacts on capital intensity, energy and labour requirements and environmental impacts. In industries such as flour milling, improvements in computer-based process control will result is continuing reductions in energy and labour requirements, and moderate increases in capital requirements per unit of production. Labour intensive industries, such as cigarette manufacturing, are also expected to become much more highly mechanised and automated, with consequent declines in labour requirements, and increases in energy and capital requirements per unit of output.

Changes in technological coefficients for the food, beverages and tobacco sector for 1985 and 2020 (S1 scenario only), based on the foregoing assumptions and estimations, are presented below in Table 15.

Table 15 Food, beverages and tobacco: Technological coefficients for one scenario

		Change between 1985 & 2020 (%) S1
Intermediate inputs		
3	Estate crops	0
13	Pulp and paper	+5
15	Chemicals	-25
17	Other manufacturing	-3
18	Petroleum refining	-25
20	Electricity	-35
Labour inputs		
Total employment per unit output		-50
Capital inputs		
Total new capital requirements		+75
17	Other manufacturing	+75
23	Construction	+75

Natural resource impacts

	Unit	1985 level	
Water input/output	m3/t	5 5	-75
Water output/output	m3/t	4.4	-75
BOD	mg/l	248	-73
COD	mg/l	360	-75
Dissolved solids	mg/l	450	-80
Suspended solids	mg/l	608	-86

Note: Intermediate inputs use the NRMP-IEA 30-sector classification.
Sources: see text

References

BPS 1991a Survey of Large and Medium Manufacturing Industries, Volume II, Biro Pusat Statistik, Jakarta.

BPS 1991b Annual Survey of Large and Medium Manufacturing Establishments, Biro Pusat Statistik, Jakarta.

Data Consult 1991 The Indonesian Palm Oil Industry and its Downstream Industry: Current State and Prospects, PT Data Consult, Jakarta.

NRMP-IEA 1993 Natural Resource Management Project, Input-Output Table 30, 75 & 169 Sectors, Jakarta, 1992.

AMDAL 1993 PT Sawit Malinda Edible Oil Industry: Laporan Penyajian Evaluasi Lingkungan (Environmental Impact Assessment Report), Jakarta.

PT Boga Sari Flour Mills, 1971 - 1987, Jakarta, 1987

AMDAL 1992 PT Perkebunan XXI-XXII (Persero) Jawa Timur, Studi Penyajian Evaluasi Lingkungan (Environmental Impact Assessment Report).

World Bank 1984 Environmental Guidelines, Office of Environmental Affairs, Washington D.C..

Annex 1: Intermediate Input Coefficients for Food, Beverage, and Tobacco Sector - 1985

Description	#	Coeff.	% of total
Paddy	1	0.40422	52
Estate crops	3	0.13171	17
Food, beverages & tobacco	11	0.06868	9
Other food crops	2	0.05150	7
Wholesale & retail trade	24	0.05086	7
Transport & communication	26	0.01798	2
Real estate, financial etc	27	0.01130	1
Other manufacturing	17	0.00935	1
Fisheries	6	0.00681	1
Pulp, paper & products	13	0.00641	1
Petroleum refining	18	0.00566	1
Chemicals	15	0.00423	1
Restaurants and hotels	25	0.00239	0
Livestock and poultry	4	0.00239	0
Social & other services	29	0.00237	0
Electricity	20	0.00150	0
Construction	23	0.00109	0
Water utilities	22	0.00048	0
Forest products	5	0.00039	0
Unspecified	30	0.00039	0
Fertiliser & pesticides	14	0.00031	0
Wood products	12	0.00030	0
Other mining	10	0.00024	0
Gas utilities	21	0.00017	0
Cement & limestone	16	0.00007	0
Coal	7	0.00001	0
Total Intermediate inputs	190	0.78081	

Source: NRMP-IEA I-O Table, 30-sectors, 1985

Annex 2 Sectors Using Output from Food, Beverage and Tobacco Sector - 1985

Description	#	Coeff.	% of total
Food, beverages & tobacco	11	0.06868	9
Chemicals	15	0.02071	6
Restaurants and hotels	25	0.15850	4
Fisheries	6	0.01226	3
Wood products	12	0.00898	3
Livestock and poultry	4	0.07773	2
Social & other services	29	0.00584	2
Pulp, paper & products	13	0.00216	1
Transport & communication	26	0.00112	0
Other manufacturing	17	0.00053	0
Real estate, financial, etc	27	0.00022	0
Wholesale & retail trade	24	0.00015	0
Fertiliser & pesticides	14	0.00002	0
Cement & limestone	16	0.00000	0
Construction	23	0.00000	0
Other mining	10	0.00000	0
Crude oil	8	0.00000	0
Natural gas	9	0.00000	0
Coal	7	0.00000	0
Liquified natural gas	19	0.00000	0
Forest products	5	0.00000	0
Gas utilities	21	0.00000	0
Estate crops	3	0.00000	0
Paddy	1	0.00000	0
Public administration, etc	28	0.00000	0
Electricity	20	0.00000	0
Petroleum refining	18	0.00000	0
Water utilities	22	0.00000	0
Other food crops	2	0.00000	0
Unspecified	30	0.00000	0
Total		0.35689	

Source: NRMP I-O Table 30-sector, 1985