CHAPTER 4

THE ORD RIVER IRRIGATION PROJECT

4.1 Large-scale Irrigation Projects in Australia

Irrigation in Australia commenced with the establishment of local irrigation trusts in Victoria in 1886 under which farmers were permitted to borrow money from the Government to construct irrigation channels. In addition, the State was to supply them with water for irrigation from state reservoirs. However, the additional profits from farms were not high enough to enable the trusts to impose a special rate on land from which loans could be repaid and the State reimbursed for the capital it had invested in reservoirs. Thus, the Government was forced to write off the trusts' debts and supply farmers with irrigation water at a price which was only sufficient to maintain the irrigation works (Victoria 1886). Results for irrigation projects in South Australia were the same as in Victoria, even though high-cost reservoirs were not included in the project (South Australia 1925).

In New South Wales, irrigation from the Burrinjuck Reservoir on land on the Murrumbidgee River commenced in 1913. As in Victoria, the farmers were unable to pay the high rents that the Government had expected for land and the State was forced to supply water to farmers at a price only sufficient to cover the operating costs of the scheme (New South Wales 1910).

Davidson (1981) argues that irrigation was an economic failure in southern and eastern Australia, partly because there was no natural storage of water over spring and summer from snow as in Europe and the USA, and large, high-cost reservoirs had to be constructed. In addition, Australia had approximately 12 times as much well-watered land capable of producing crops and high productive pasture per capita as Europe, and four times as much as the USA. Thus, the free market price of

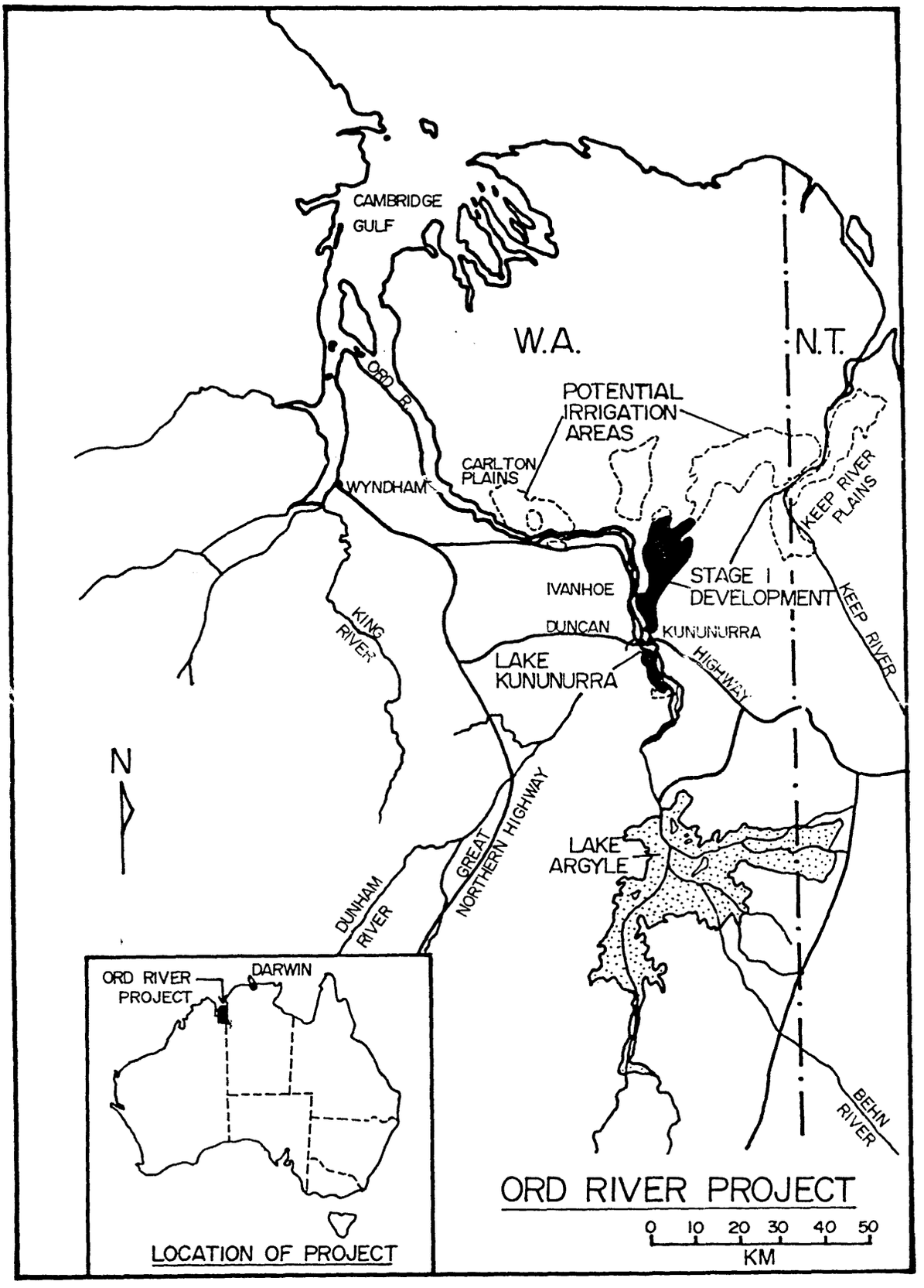
agricultural land in Australia was, and is, lower and the wages of rural labour higher than in other developed countries. Furthermore, there was a limited domestic market for fruit and vegetables, the only products which might have given return high enough to repay the capital invested in irrigation works. The economic problems associated with irrigation are likely to be even greater on the Ord River than in Southern Australia, as wages are twice as high and the costs of all other farm inputs higher than in the latter region. Irrigation can only succeed in the region if yields are very much higher than in southern or eastern Australia, or if economies of size are sufficient to reduce costs greatly.

4.2 The Ord River Irrigation Project - Aims and Description

The Ord River Irrigation Area (ORIA) in this study is defined as Lake Argyle and its catchment area; Lake Kununurra, irrigable area commanded by Lake Argyle and land contained within irrigable areas not suitale for irrigation. A map of the area is shown in Figure 4.1. The ORIA is in the Kimberley region of Western Australia, and is 16°S, 129°E in the north of the State. The region has a southern tropical monsoonal climate and lies within the arid tropics. The wet season of four to five months is in summer, mainly between December and March. The remainder of the year is virtually rain-free. Daily maximum temperatures fall below 33°C for only three months of the year, while mean annual rainfall is 745 mm.

It is 3200 km by road from Perth, the State's capital city, 800 km by road from Darwin, the closest major population center and 3250 km by sea from Singapore. There are two main towns associated with the Ord River Irrigation Area. One is Kununurra, the administrative centre for the project, with population of 3300. The other town is Wyndham, the port for the Ord and surrounding area, situated 100 km from Kununurra and with a population of 2 100. Kununurra is serviced by a daily jet air service between Perth and Darwin, both of which are international airports. The Western Australian Shipping Commission operates a 14-day service to Wyndham while two overseas companies provide a regular export trade. Additionally, a regular trucking service operates between Kununurra and other areas.

Figure 4.1 Ord river irrigation area W.A.



The Ord River Irrigation Project provides for the development of 72 000 hectares of land agriculturally and topographically suitable for irrigation. The project comprises four stages. The first was the construction of a diversion dam to supply water to 12 100 hectares. The second involved the building of a main storage dam with a capacity of 5720 million cubic metres. The other stages are the progressive development of the whole 72 000 hectares and the construction of a hydro-electric power station.

The Kununurra Diversion Dam, situated at Bandicoot Bar about 105 kilometres by road south-east of Wyndham and forty-eight kilometres downstream from where the Ord River Dam is constructed, was officially opened on 20 July 1963. The capacity of this dam is 97.4 million cubic metres and irrigation from the dam commenced in April 1963. Its storage is named Lake Kununurra.

The diversion dam was recognised by the Commonwealth Government in August 1959 as an approved project within the meaning of the Western Australia Grant (Northern Development) Act 1958. This legislation provided for the payment by the Commonwealth Government to the State Government of a non-repayable grant of $10 million for developing part of the State north of 20°S latitude. Of this grant, $8.2 million was spent on the diversion dam. In February 1963 a further approach was made to the Commonwealth Government to request $3.3 million for the completion of channels and drains required to develop the whole of the 12 100 hectares included in the first stage of the project. The request was approved in August 1963 and funds were made available by way of grant in terms of the Western Australia (Northern Development) Agreement Act 1963.

In November 1967, the Commonwealth Government approved the plan for the second phase of the Ord River Irrigation Scheme and agreed to provide financial assistance to the State for the works involved. The terms and conditions for financing the second phase of the scheme were announced in March 1968. In terms of the Western Australia Agreement (Ord River Irrigation) Act 1968, the Commonwealth Government agreed to provide financial assistance to the State in an amount equivalent to expenditure on the works, up to a maximum of $48.18 million. The assistance took the form of a non-repayable grant for the construction of the main Ord dam

($21.80 million) and an interest-bearing loan for the associated irrigation and drainage facilities.

Thirty-five private farms have been developed so far, thirty of which are in the first stage on the Ivanhoe Plain and average 373 hectares each. Prior to 1975, cotton was the main crop. However, owing to high off-farm costs, high costs of insecticides and a decrease in the return for cotton, no commercial crops have been planted since 1974. Lower meat prices have also led to reduced areas of grain sorghum and fodder crops being sown for fattening of cattle. Trial crops of peanuts are being grown and a pilot processing plant has been established. Rice is grown and processed for the Western Australian market. Crops of sunflower, oats, barley, maize and safflower are also being grown. The prospects for the sugar industry in the areas are being investigated and a detailed feasibility study has been undertaken by a major Australian sugar company using the expertise of various agencies in the Queensland sugar industry. A pilot sugar farm has now been established.

The relocation and upgrading of the one t/h pilot rice mill to two t/h commercial mill was completed during 1979, utilising the buildings previously used for cotton ginning. Rice storage facilities now comprise eight silos with a total capacity of 3600 t of paddy rice.

4.2.1 Previous studies and history

The Ord River Project was established in 1963 with the allocation of the first five farms following the construction of a diversion dam on the Ord River. By 1966, 31 farms, averaging 260 ha in area, had been allocated on the Ivanhoe Plains. Construction of the major dam further upstream to create Lake Argyle was completed in 1971. Subsequently, five farms with an average area of 400 ha were allocated bringing the total area under irrigation to 12 000 ha.

The Ord River Dam was constructed over three dry seasons, 1969 to 1971 and was officially opened on 30 June 1972. A pump station and irrigation supply facilities to bring 2020 ha of new irrigation farmland into production on Packsaddle Plain was completed in December 1973. An extension of the scheme covering 770 ha of Ivanhoe Plain was completed in December 1974.

The initial development of the ORIA was based on cotton production. However, successful cotton production required heavy application of insecticides. Under normal conditions, these insecticides kill a broad range of insects. After a few years, the insect Heliothis armigera developed resistance to insecticides, devastating cotton crops and making conventional methods of insect control virtually useless. The Department of Agriculture (DA) entomologists found that if a broad spectrum insecticide such as DDT was not used, Heliothis armigera could be controlled biologically by a local insect. The strategy of biological control includes other methods such as growing crops that are not susceptible to particular insects. It is also possible to grow crops that discourage pests but encourage the parasites and predators of those pests, or to use insecticides that affect only the pests and not the beneficial insects. This system of 'integrated pest control' is being used by farmers in the Ord River Area. The result has been that crops such as sorghum and sunflower can be grown without the automatic use of insecticides. This has reduced on-farm costs, as well as the level of insect damage.

An extensive documentation of the history and development of the ORIA exists, the most recent being Davidson and Graham-Taylor (1981). These authors present a set of studies on the ORIA dealing with economic and other aspects, the latter providing helpful and interesting insights on decisions made on the former.

Davidson concentrates on the economic aspects, citing several economic studies on the project, including, e.g., Davidson (1962, 1963, 1964, 1965, 1969), Cannegeiter (1964b), BAE (1964,1970), Patterson (1965) and ORIA Review (1979). He demonstrates the danger of proceeding with any large-scale agricultural development in isolated areas of Australia without a thorough examination of the scheme. Furthermore, this author argues that the decision to build the second stage of the project even though it had been shown that farming was unprofitable suggests that the political advantages of going ahead outweighed the economic disadvantages.

In a critical history of the ORIA, Graham-Taylor compiled and commented on previous studies and publications on the project, including Forest (1880), Steinberg (1948) and the West Australian. She corroborates Davidson's argument and points out the lack of extended prior scientific research on the project. She enumerates 'the inherent high-cost structure and the still incomplete understanding of the basic Ord agronomy' as two of the most important problems with which an administration should have grappled before making any decision involving the ORIA. The available knowledge, although incomplete, could have been geared towards more meaningful and commercially-oriented research, so that planning could have been less haphazard and piecemeal.

4.2.2 Current status and prospects

Crops currently grown in the project include sorghum and other grains, oilseed crops, rice, sugar cane and several other crops. These are discussed individually below.

Grains

Sorghum

Ord River sorghum is now used by meat and poultry producers in Darwin but the market is limited to a few growers. Some sorghum also is being used in Katherine and other centers in the north of Australia. In 1977, the inaugural shipment of grain sorghum was bulk loaded for export from the port of Wyndham and sent to Singapore. The Ord River Area is relatively well-placed to trade with Singapore, there being very little difference in the distances between Wyndham and Singapore and Wyndham and Perth. Conditions in the irrigation area ensure that the sorghum produced has a relatively high protein content. Yields have increased from 4 to 6 t/ha.

Other grains

Yields from DA trials with wheat and maize have indicated that these crops may also become important in the area. A growing market for wheat exists in the Northern Territory and the Kimberleys. Although it is improbable that wheat could become a major crop in the area, it can still

fill an important niche in the overall farming system.

Maize is emerging as a profitable crop for the animal feed grain markets in both Darwin and Perth. Dry season yields of 3.5 to 6.0 t/ha have been attained by commercial farmers, while small experimental plots in 1981 have yielded 6.6 to 9.0 t/ha.

Oilseeds

Sunflower

Sunflower seed for oil and meal is grown commercially and is marketed by the Grain Pool of Western Australia. This crop is grown in the dry season, and a high oil content (52%) is possible. Yields range from 1.0 to 2.3 t/ha with an average of 1.4 t/ha. Experimental yields on small areas have shown that the hybrid varieties are capable of producing 2.8 t/ha with oil contents approaching 50%.

Rice

Long grain rice suitable for both the home and export markets is presently grown and milled at Kununurra. The small commercial mill was commissioned by the State Government in August 1979. Yields for the present variety IRRI 661 are around 6 t/ha of paddy.

During the 1981 dry season the average yield over the 360 ha planted was 7.1 t/ha. The rice is sold in Perth under the Sunwhite Ord brand label.

Hybrid seeds

Production of hybrid seeds for Queensland companies has been undertaken by a number of growers. Crops include hybrid sunflower, pearl millet, and feed grain and Sorghum. Growers generally obtain written contracts prior to planting.

Other crops

Soybeans

During the 1982 wet season over 700 ha were planted. Yields ranged from 1.5 to 2.9 t/ha. The average of approximately 1.8 t/ha suggests that with improved varieties and management techniques this crop will form an important component of the cropping system. The poultry industry in Perth and Darwin should continue to be the main market.

Mung beans

With the majority of the seed being sold overseas for bean sprout production profitability depends on widely fluctuating world market prices. Commercial yields of up to 0.8 t/ha have been obtained, with experimental yields on small areas of 1.8 t/ha.

Peanuts

Peanuts are grown under sprinkler irrigation at Cockatoo Sands. Commercial cropping began in 1980, with yields increasing to over 3.7 t/ha in 1982. Further areas suitable for peanuts have been released as there is scope for increased sales in Western Australia.

Horticultural crops

Over ten years of production, Ord River bananas have become recognised as being of top quality. Sales are mostly to Perth, with some outlets in North-west towns. The area planted has gradually increased to around 9 ha with further land releases planned. The area is expected to increase further as profitability is proven.

Rockmelons, watermelons, cucumbers and pumpkins have been grown during the dry season on both red and black soils. The high quality of produce and competitive back loading freight rates are assisting in the profitable production of these crops. The area planted to horticultural crops is expected to increase further, with the release of land suitable for this purpose.

Sugar

Sugar cane is not grown commercially at present, but experimental crops have produced outstanding yields. In 1981, the top five varieties exceeded 135 t/ha average over one plant and four ratoon crops. Yields on the commercial scale pilot farm have been 142 t/ha for a range of varieties over one plant and two ratoon crops.

The WA Government is discussing with interested companies the development of a sugar cane industry. It is expected that agreement can be reached on the construction of a sugar cane mill and associated infrastructure. However, due to the complex nature of this industry and the large capital expenditure required, negotiations will be lengthy. Combined with the time taken for construction, it is unlikely that a mill could operate before mid 1985.

The area required for sugar cane production and the possible development of new areas will be decided during the negotiation process.

4.3 The Proposed ORIA Industry vis-a-vis the Australian Sugar Industry

4.3.1 Description of the Australian sugar industry

This section is based on IAC (1979) and Anon. (1982) on the sugar industry in Australia.

Sugar cane production has contributed between six and eight per cent of the value of all agricultural output in Australia in recent years and is considered an important rural industry. Cane growing is concentrated mainly in the alluvial lands in the coastal river systems from Grafton in New South Wales to Mossman in the far north of Queensland. About 95 per cent of the sugar cane cut for crushing in Australia is grown in Queensland. While the Western Australian Government currently is undertaking research into the establishment of a sugar industry in the ORIA, the Tasmanian government is investigating the potential for sugar beet production in its own State.

The cane harvesting and milling season usually begins in June and ends in December. In the 1981 season, Australia's 33 raw sugar mills processed about 25.1 Mt of 94 net titre raw sugar. The annual quantity

of cane cut for crushing has been increasing gradually since 1960, with variations arising from seasonal conditions and, on two occasions, from plannned industry expansions.

The total land area allocated to cane growing in December 1981, was 374 452 ha. Most Australian cane farms are between 20 and 70 ha in size, the average being about 55 ha. This represents an increase from an average of about 18 ha in 1960.

In Australia, an average of about 80 t of cane is produced per ha. Seven tonnes of cane usually produces one tonne of raw sugar but this varies among and within mill areas.

In general, cane farmers do not produce other crops commercially on their holdings. In most cane growing regions, there is no obvious alternative land use which could sustain the levels of income generated by cane growing. Cane growing is now a relatively capital intensive activity. In 1960, most cane was manually harvested but today virtually the entire crop is harvested by machine.

Cane land is highly developed agricultural land and the capital costs of clearing, levelling, cultivating, irrigating or draining contribute substantially to its value. The largest components of cash costs of cane growing in Queensland are those associated with harvesting (32 per cent), chemicals and fertilisers (21 per cent), repairs and maintenance (16 per cent) and direct wages (12 per cent). These costs were based on summaries of survey data submitted in confidence by the Queensland Cane Growers' Council (QCGC) to the IAC.

Much of the industry's present structure and many of its organizational arrangements have been shaped over the years by Queensland and Federal Government legislation. The farmer's legislation concerning the industry mainly relates to the production of raw sugar and sugar cane. The industry's capacity to produce raw sugar is determind by the amount of land that is allocated (or assigned) for growing sugar cane. This is related to the basic production quotas of raw sugar allocated to each mill, called 'mill peaks'. The Queensland Government's Central Sugar Cane Prices Board determines what land is assigned for cane growing and recommends to the government the mill peaks for each season.

Assignment of land for cane growing essentially permits cane to be grown only on defined areas of land and to be supplied only to a nominated mill. Rezoning of assignments between mill areas is normally permitted with the agreement of all parties concerned. However, this usually only takes place in a major way during industry expansion, when new or increased assignments are granted and some assigned lands are rezoned in order to preserve relative equity between mills and so takes into account the economic benefits to be shared.

Sugar farms are assigned to a particular sugar mill by the Central Sugar Cane Prices Board. Farms are located within a certain mill area and the cane grower must deliver cane for crushing to that mill. Each sugar mill has an annual quota or 'peak' tonnage of raw sugar that it may produce for marketing. The mill peak is distributed by the local Sugar Cane Prices Board to all farms in the mill area, and hence each farm also has an annual quota or 'farm peak' tonnage of cane which it may produce. On each sugar farm, the amount of land on which cane may be grown to meet the farm peak is limited to an area known as the gross assigned area of the farm. Up to 85 per cent only of the assigned area per farm may be harvested per year for delivery to the mill. In some instances, one farm may have more than one sugar assignment.

The aggregate of all mill peaks is set at a level which will allow the industry to be reasonably certain of supplying the requirements of the domestic market and the assured export markets each year. If in any particular year the industry considers it can market more sugar than the sum of the mill peaks, the Queensland Sugar Board will accept overpeak production of up to 20 per cent. In some years, exceptionally adverse weather conditions may mean that certain production areas fail to meet their production, in which case overpeak production may be accepted from other mill areas to make up the deficit.

Within a mill area, overpeak production for the mill is allocated to growers who can produce sugar above their farm peak levels. When some farms cannot supply their farm peaks, such as occurs frequently with dryland farms during drought conditions, their shortfalls may be allocated to other farms (usually with irrigation) in the same mill area that can produce overpeak sugar. Sugar mills receive payment for the raw

sugar when they deliver it to refineries or wharf terminals. These proceeds are divided between millers and growers according to a specified formula. The higher the commercial cane sugar (CCS) content of the cane, the higher the price per tonne of cane received by growers. Mills are paid either a No.1 Pool price or a No.2 Pool price for the sugar they produce. No.1 Pool price is an equalised return from domestic sales and the export sales covered by peak production. Mills therefore receive No.1 Pool price for sugar up to the level of their mill peak. All overpeak production is paid for at No.2 Pool price which is an equalised return from free export market sales and is usually lower than the No.1 Pool price. Growers are paid for their cane by millers at No.1 Pool rates for peak production and for any overpeak production which meets shortfalls in mill peak which they supply. For all other overpeak production, growers are paid at No.2 Pool rates.

A cane grower wishing to increase the size of his assignment and/or farm peak may apply for additional assigned areas and/or peak which are available normally only in periods of general industry expansion. Alternatively, he can at any time purchase land having an existing assignment. The same options are open to a potential new grower. In practice, the Central Board seeks to ensure that persons granted new or increased assignments have sufficient capital and cane growing expertise to adequately develop and work the assignment.

While the Australian sugar industry is highly regulated, it is also generally viewed as being self-contained and self-controlled. There are strong industry associations, among them the Queensland Cane Growers' Association and the Australian Sugar Producers' Association, which represent interests of various groups within the industry. The associations are able to put the views of their members to governments, and to formal industrial bodies including the Central Sugar Cane Prices Board and the Sugar Board. It is this scenario of the Australian sugar industry that the proponents of the Ord sugar industry hope to fit, or if necessary, break into.

4.3.2 Prospects and outlook for sugar in the ORIA

The information contained in this section is based on publications by the WADA, CSR and BAE, and from data collected during a visit to the project.

Sugar cane research in the ORIA commenced in 1950. The volume of work carried out each year since then has varied considerably, with the main determinant being world sugar prices. In the WADA (1981) summary of the history of sugar cane research in the ORIA, three periods -- 1950-73, 1974-76 and 1977-81 -- are used for classifying the research work that has been carried out. Briefly, the first period marked the commencement of sugar cane research in the area, with trials by the CSIRO and the Kununurra Research Station (KRS), Kununurra. This and subsequent work by the CSR showed that sugar cane could grow satisfactorily in the project area and that there were no major pests and diseases. Most of this research was based on a variety which showed a large decline in ratoon yields. In the period covering 1974-76, large-scale plantings showed that ratooning was possible and that reasonable yields could be obtained. In 1975, the CSR, at the request of the WA Government, coordinated, an in-depth feasibility study into all aspects of establishing an Ord sugar industry. The salient points in the report of CSR are discussed in the following section.

In early 1975, the Premiers of WA and Queensland discussed the possibility of assistance by the Queensland Government and the Queensland Sugar Industry to the WA Government in carrying out a detailed study of the viability of sugar production in the Ord region. Subsequently, an Agricultural Study Group was appointed to examine agricultural aspects of sugar cane farming on the Ord. The group included representatives from the Queensland sugar industry. The conclusions of the group were taken into account by the CSR group which carried out an in-depth feasibility study into all aspects of establishing a sugar industry in the Ord. Other authorities in the sugar industry assisted in the study to ensure that it had the benefit of a broad range of expertise. WA Government Departments provided information on the costs of infrastructure, roads, ports and environmental matters.

The feasibility report was completed in August 1976 and made available to the Queensland Government, the Sugar Industry Associations, and the Commonwealth Government. A summary of the report was made available to the press through its publication in full in the Australian Sugar Journal, December, 1976. The summary is presented in full in Appendix I and its salient points are outlined below.

Rather than make recommendations, the report endeavours to set out the facts in perspective so that its readers can make their decision in the light of good information.

However, the report suggests that the best proposition would be to establish a sugar mill with an initial capacity of 120 000 t of raw sugar but designed for expansion to 220 000 t in three to five years. A mill of this size would be one of the largest in the world. By comparison Australia's largest, Victoria Mill at Ingham, has a mill peak of 208 400 t.

Accordingly, capital costs of establishing an industry on the Ord have been assessed, on 1981 costs, at $151.7 m for a 120 000 t capacity industry and infrastructure, and $230.7 m for 220 000 t capacity.

Annual operating costs for each of the two capacities have been assessed at $290 and $229 per t of sugar, respectively. Each of these figures includes a profit component for growers and millers.

In comparison with these cost figures, Queensland's No.1 Pool price in 1981 was $281.69 and in 1980, $372.44.

The pilot farm has conducted trials aimed at establishing yields and costs of cane production. A legume crop has already been planted on the farm, and the first cane planting on the farm occurred in May 1977.

The feasibility report indicates that 30 000 ha of land would be required to provide full production for a 220 000 t mill. The total irrigable area that could be made available for cane growing would be about 70 000 ha, which could lift ultimate production in the Ord above 500 000 t. The report visualises construction of the mill some 42 km towards the coast from the town of Kununurra, with a new sugar port to be established at Cape Domett, about 112.6 km from the mill. The port of

Wyndham is too restricted for some of the vessels that are envisaged for sugar cargoes with the construction of a new sugar terminal since it can only accommodate vessels up to 20 000 t.

Since the publication of the above summary, major developments have occurred regarding the feasibility of the sugar industry in the ORIA. The results of the pilot farm on a commercial scale have been promising and have enhanced the technical prospects for the establishment of a cane industry to produce sugar.

High yielding varieties have produced 259 t/ha of plant cane. In Queensland, which produces 95 per cent of Australia's sugar, the average plant cane production is about 115 t/ha.

Plant cane is the name given to the first crop from a planting. Subsequent crops from the same planting are called ratoon cane, which produce less tonnage but have higher sugar content. First, second and third ratoon crops on the Ord pilot farm have yielded up to 150 t/ha. The sugar yield from the plant cane has been as high as 33 t/ha, compared with the Australian average of about 12 t/ha.

Since 1977, the sugar cane research program has been intensified with further agronomic trials and the establishment of a commercial scale pilot farm. The 80 ha pilot farm was managed by an experienced Queensland farmer. A full assessment of the pilot farm under commercial sized areas of plant and second and third ratoon crops has been made but this report is confidential. In January 1983, the consortium started a one-year feasibility study of the sugar industry in the area. The decision to implement the industry will be deferred until the proponents of the Ord sugar industry can see signs of recovery in world sugar prices.

Should the consortium decide to implement the project, such an industry could be operating at full capacity within the next five years. The likely impacts of the ORIA sugar development on the Australian sugar industry as assessed by the BAE (1982) are as follows:

(a) It is possible that the need to accommodate Ord sugar in the national quota could pose problems for the Queensland industry. However, the extent, and even the existence, of such problems will depend on a number of highly uncertain factors, viz., future world prices and stipulations in any new International Sugar Agreement (ISA) that may be negotiated to replace the existing agreement.

(b) There would be the tendency for erosion of the capitalised value of sugar assignments, because potential new entrants to the industry may find it more attractive to establish on the Ord River than to pay high premiums for an existing assignment in Queensland. Land values in the Ord have, in fact, increased sharply since the announcement by the West Australian Government seeking expressions of interest in the commercial development of a cane sugar industry in the Ord River. Any reduction in the value of existing Queensland sugar assignments is likely to be small if the impact of Ord sugar on average export returns, and therefore on farm returns, is also insignificant.

(c) It is unlikely that Ord sugar exports will have a significant impact on world prices. Should sugar production from the Ord eventually reach the forecast maximum potential output, the impact on prices would be greater, but this would be modified to some extent by other exporters reducing their output due to lower prices. This offsetting supply adjustment could be expected to affect less efficient high-cost producers throughout the world, who would progressively leave the market because sugar exporting would no longer be profitable to them, assuming other market prices remained constant. Since the existing Australian sugar industry compares favourably in terms of cost-efficiency with most of its competitors, it would bear only a very small proportion of the adjustment. Overall, Australian exports to the world free market would increase by almost the full extent of Ord production, and national sugar export returns would increase accordingly.

CHAPTER 5

CONSTRUCTION OF THE BCA MODEL FOR APPRAISAL

5.1 Evaluation of the ORIA

To evaluate the total benefits and costs to the nation of the ORIA from 1959 to 1978, the Commonwealth-State Review Committee (ORIA Review 1979) examined financial data pertaining to expenditure and receipts on the project during the period. The committee considered these data as adequate indications of the relative magnitude of national benefits and costs of the ORIA during the period such that a formal BCA was not undertaken. Details of expenditure and return on the project are presented in Table 5.1 and a summary of the evaluation by the ORIA Review are presented.

Total expenditure on the ORIA to 30 June 1978 amounted to $97.3 m and comprised:

	$m
Capital Cost of Stage One	18.2
Capital Cost of Stage Two	25.0
Services and Infrastructure	18.5
Farm Produce Processing Facilities -	
Cotton Gins	0.5
Rice Mill	0.5
Peanut Processing Plant	0.2
Regeneration Expenditure (Capital)	0.9
Research Expenditure (incl. regeneration; excl. CSIRO after (1974-75)	8.7
Maintenance of facilities, financial assistance to farmers, etc.	24.8
	97.3

Table 5.1. Government expenditure and returns : Ord River Irrigation area : 1958-59 to 1977-79

EXPENDITURE

	1958-59	1959-60	1960-61	1961-62	1962-63	1963-64	1964-65	1965-66	1966-67	1967-68	1968-69	1969-70	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78	Totals
CAPITAL COST																					
Stage 1																					
Diversion dam			124	7,460	741	153	185	182													8,845
Irrigation and drainage channels	4		220	730	1,157	957	1,200	1,129	1,147	16	13		290	202			458	189	177	149	8,048
Farm development			22	107	328	394	209	5	66	2		155	11	4							1,303
SUB TOTAL	4		366	8,297	2,226	1,504	1,594	1,316	1,213	18	13	155	301	205			458	189	177	149	18,196
Stage 2																					
Main dam			32	96	22	387	64		1	94	5,098	5,943	5,705	4,488	333	85	122				22,471
Irrigation and drainage channels													78	112	887	1,369	99			18	2,563
SUB TOTAL			32	96	22	387	64		1	94	5,098	5,943	5,784	4,600	1,220	1,454	221			18	25,034
Infrastructure																					
Townsite development including water, sewerage, electricity			482	30	700	210	624	296	560	936	401	575	390	286	261	119	726	737	434	155	7,922
Housing		61	238	240	800	430	374	322	197	8	32	6	85	115	42		23	177	450	275	3,865
Public buildings	3	12	3	40	18	85	90	208	191	53	8	46	179	15	39	27	8	68	1,351	335	2,779
Roads		4	64	13	186	58	73	194	77	3	609	178	107	225	68	68	82	131	65	89	2,294
Airport							25	15	26	105	6	100	250	250	100			31	16		924
Port facilities										83	63							1	5	600	753
SUB TOTAL	3	77	787	323	1,704	783	1,186	1,075	1,041	1,188	1,119	905	1,011	891	510	214	839	1,145	2,322	1,454	18,537
Enterprises																					
Cotton gins					150	205	10		2					55	47	50					529
Rice mill																	29	131	62	280	502
Peanut mill																25		120	30	16	193
Regeneration		26	92	110	101	108	101	59	59		13	7	6	4	13	75	5	6	22	43	850
Other	8	19	21	15	1	1															
TOTAL CAPITAL	15	122	1,298	8,841	4,214	2,988	2,955	2,410	2,316	1,300	6,243	7,010	7,102	5,756	1,790	1,818	1,562	1,591	2,613	1,962	63,906
Recurrent Costs																					
Irrigation						114	141	199	151	301	562	534	661	623	656	645	701	845	1,052	909	8,145
Town services					1	91	136	183	191	221	215	302	358	353	404	439	147	679	706	203	4,629
Other, including Enterprises and assistance to growers	92	101	128	144	150	145	181	185	221	360	434	457	594	894	1,194	1,101	1,506	1,818	1,270	1,004	11,979
Total recurrent	92	101	128	144	151	350	458	567	664	882	1,211	1,293	1,613	1,870	2,254	2,185	2,354	3,354	2,978	2,115	24,753
Research (State and Commonwealth)[a]	26	108	308	314	194	116	143	190	158	159	156	303	270	294	377	527	732	1,643	1,523	1,157	8,698
GRAND TOTAL	133	331	1,734	9,299	4,559	3,454	3,556	3,167	3,138	2,341	7,610	8,606	8,985	7,920	4,421	4,530	4,648	6,576	7,114	5,253	97,357

RECEIPTS

Lease payments							4	4	4	4	22	23	42	29	29	92	9	9	28	34	333
Irrigation charges						33	40	132	130	127	91	86	168	119	175	138	120	147	78	50	1,634
House rental							42	44	46	50	56	61	74	75	102	130	144	160	201	199	1,384
Enterprises							5	28	4	57	55										149
Electricity					3	52	130	146	176	222	211	258	245	293	334	322	329	297	368	350	3,736
Town services						1	17	32	28	33	23	32	40	51	55	71	91	112	98	100	784
Other	49	47	68	107	89	82	139	156	149	246	311	344	374	382	406	494	166	162	139	117	4,027
TOTAL RECEIPTS	49	47	68	107	92	168	377	542	537	739	769	804	943	949	1,101	1,247	859	987	912	850	12,047

[a] Includes expenditure by Western Australian Department of Agriculture on regeneration. Excludes expenditure by CSIRO after 1974-75

Source: Ord River Irrigation Area, Review 1978, p. 85.

The cost of the Ord project has been funded by -

	$m
Commonwealth	
Grants for Stage One	12.1
Grants for Stage Two	21.9
Loan for Stage Two irrigation works	2.5
Cotton Bounty and KRS expenditure to 30/6/75	6.4
	42.9
Western Australia	
Capital and Recurrent purposes	54.5
	97.3

Returns, or benefits to the nation have been assessed as net farm gate returns (i.e., gross farm gate returns less cash costs of production, depreciation and interest on borrowed funds) less bounty. Net farm gate return is the residual to meet returns to private capital, management and the owner's labour, and a return to public capital. Net returns from 1963-64 to 1973-74 were based mostly on cotton and although returns from other crops are unknown these were considered not to have contributed to net farm gate returns significantly. The State Government received $12 million in water charges during the period of the evaluation. However, Government receipts were always less than the recurrent costs to Government in Table 5.1 and net farm gate returns over 15 years of operating the ORIA are zero even before any allowance is made for returns on farmers' capital, labour and management. Thus, the net expenditure by the Government on the ORIA has not resulted in a net benefit to the nation, in terms of contribution to the net increase in national output.

Since 1978 to the present, Government receipts and expenditure on the project are considered to follow the same pattern. The updated information about costs and returns on the project used for the appraisal are discussed.

5.2 Construction of the Model for Appraisal

Economic analysis of agricultural projects is undertaken to compare costs with benefits, so that the most remunerative alternative can be determined or, at least, those projects which exceed a predetermined acceptable return can be isolated. In constructing the BCA model for appraisal of a sugar industry in the Ord, the first step is to identify the costs and benefits. These items then are assigned proper prices representing economic values so that they may be compared. The economic justification for the project can be established or rejected, based on measures of project worth. For the study, the criteria selected to measure the worthiness of the project are NPV and IRR.

5.2.1 Identifying costs and benefits

In project analysis, objectives provide the standard against which costs and benefits are defined. Cost is anything that reduces an objective and benefit is anything that contributes to it. For the proposed sugar industry in the ORIA, the three main participants, the farmers, the consortium of private investors and the WA Government, have many objectives among them. Farmers will most likely participate in the proposed sugar industry if they think that it is a profitable proposition in terms of the prospect for increased incomes from their farms. The consortium of private investors presumably will be willing to finance a proportion of the project if the relevant decision makers consider the sugar industry to be an attractive investment in terms of increased net income or profit for the firm, as measured by the gross margins in producing sugar and other crops.

The WA Government might have several objectives determining its willingness to finance its share of the project, but increased national income should be one of its major goals, measured in terms of incremental net benefits.

The objective of achieving efficiency is selected in this study both because the critics of the ORIA have extolled the need for its economic justification (Davidson and Graham-Taylor 1981), and because this objective has been widely used in BCA studies in Australia.

The change in domestic consumers' surplus is assumed to be valued at zero since sugar produced from the Ord will be exported. Other crops grown in the project are likely to be exported as well but even if the domestic market is used, the contribution of the revenue from other crops to the project may be considered minimal. The producers' surplus is equivalent to the annual net benefit in the project. The world market price for sugar is used to derive the gross value of production since the demand for exported sugar from the Ord is elastic, with significant impact on world market prices being unlikely.

Costs in the ORIA prior to the sugar industry are not considered in appraising the project and are considered sunk.

The residual values of capital investment are not determined and, due to the long project life assumed in the appraisal, are presumed to have zero present value. In fact their real value 50 years hence is likely to be very small.

Taxes, subsidies, lease payments and other related costs are considered as transfer payments and were excluded from the costs.

Appropiate treatment of externalities, intangibles and secondary net benefits is recommended for future studies as refinements of the BCA framework used here in applying risk analysis.

5.2.2 Determining economic values through proper prices

Once costs and benefits have been identified, appropriate prices are used to reflect values. That is, by making the reasonable assumption that a competitive economy exists in the area, market prices can be used to value costs and benefits which are marshalled into pattern accounts, i.e., into model farm budgets for individual farms.

The farm budgets are analysed, adjusted to reflect economic values in those cases where market prices are not strictly appropriate, and aggregated to determine the net benefit to society. Although this analysis is quite similar to that of ordinary farm management studies, there is a difference in emphasis. That is, the pattern farm budgets are not evaluated for ways to improve the management of particular individual farmers, an emphasis central to much of farm management analysis.

When the farm budgets were prepared for the analysis of the proposed sugar industry in the ORIA, it was not required to take a sample of farms in the project area (Gittinger 1982). Instead, the major farm types which were expected to exist in the future were purposively selected and assessed, with reference to the possible impact of the sugar industry on them. The farm budget for sugar was prepared using CSR (1976), Robertson (1979) and Abbott (1980) data, while farm budgets for other crops were prepared by modifying items in the WADA budgets, using data collected from a visit to the site. A report on this trip is presented in Appendix II. The budgets used for the BCA model were summaries, showing major revenue sources and expenses, including various investment items. Details of the budgets are presented in Appendix III. The model format and terminology adopted in this study are discussed below.

In the pattern format presented in Table 5.2 and Figure 5.1, the terminology used is based on CSR (1976) for the sugar industry and WADA budgets for other crops. The incremental net benefit is derived as follows.

The first column in the budget shows the without-project situation. It is assumed that there will be no change in production during the life of the project in the absence of the sugar industry in the ORIA.

For the with-project situation, project benefit is defined as the gross value of production, determined by areas grown, yields and prices for all crops grown in the ORIA in 1982.

Costs of the project include:

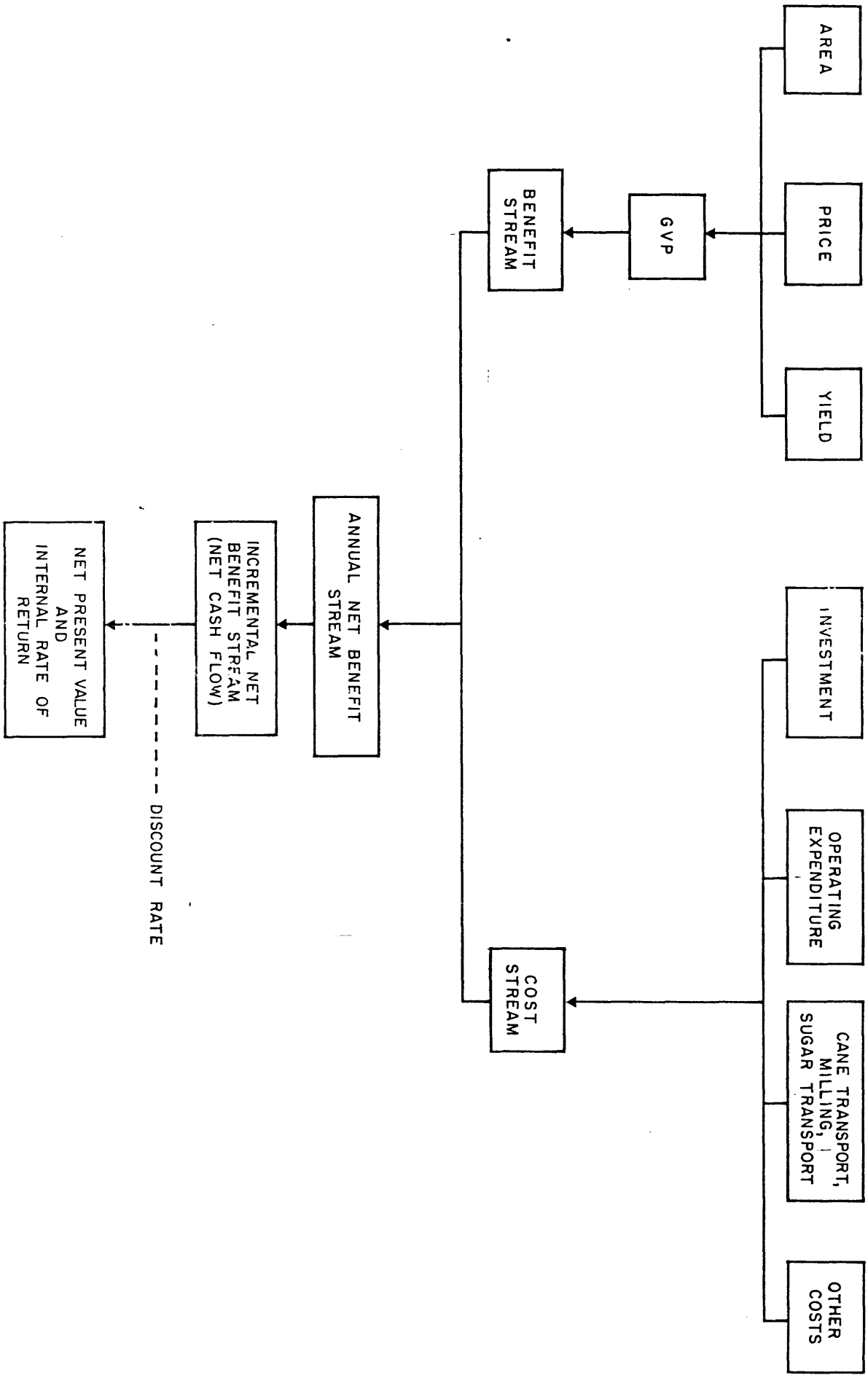
Investment - This refers to the capital required to establish a sugar industry, e.g., for infrastructure development, for establishing mills, for transporting cane and sugar and other costs.

Operating expenditure - This term is used rather than the more common 'cost' since the latter implies an element of depreciation not included when the budget is laid out annually for discounted cash flow analysis. Operating expenses are categorised into those for sugar and an aggregate for the other crops.

TABLE 5.2 BCA model for the appraisal of the sugar industry in the ORIA

	Without project	With project (A$M)								
		1	2	3	4	5	. . . .	48	49	50
A. Benefit										
Gross value of production										
1. Sugar										
2. Rice										
3. Sunflower										
4. Soybeans										
4. Peanuts										
6. Horticultural crops										
B. Cost										
1. Investment										
2. Operating expenditure										
i. sugar										
ii. other crops										
3. Annual cost										
i. cane transport, milling and sugar transport										
ii. infrastructure and other costs, sugar										
C. Net Benefit (A-B)										
D. Increment Net Benefit (net cash flow)										

Figure 5.1 Schematic representation of the BCA model



Annual cost - This refers to annual operating costs other than farm production cost and includes items such as milling and transport costs etc.

The net benefit stream is derived by taking the difference between annual benefits and annual costs. To obtain the incremental net benefit, the gross value of production without the project is subtracted from the annual net benefit. In the early years, this generally is negative, reflecting the large capital investment in the case of the sugar industry in the ORIA. The stream of the incremental net benefits is defined as the cash flow.

In adjusting the farm budgets to reflect economic values, transfer payments were eliminated because they do not constitute incremental contributions to national income.

It was necessary to impute certain prices to derive the net social benefit. The main problem pertains to the true shadow wage rate for labour associated with the proposed sugar industry.

The issue about the worth of measuring shadow prices remains one of controversy. Given an objective function of the Pareto-Hicks-Kaldor type, shadow prices are seen to be related to the marginal cost for goods and services and to the value of the marginal product for the inputs. These shadow prices will be the same as the requisite shadow prices only under perfect competition. Theoretically, due to the more realistic cases of imperfection in the economic system, market prices should be adjusted to represent the correct shadow price.

However, deriving the correct shadow prices can be extremely difficult, and given the degree of arbitrariness involved, many economists have argued that the results do not justify the effort. However, Dasgupta and Pearce (1972) insist that shadow wage rates be derived.

In this study, the shadow price of labour is derived as follows.

The proposed Ord sugar industry is expected to generate work for approximately 650 full-time employees (i.e., farm workers, harvesting workers, transport employees, mill employees) from a 220 kt of sugar-

per-year-industry (Abbott 1980). If this work force is to be comprised of the aboriginal population and the unemployed in the area, the true cost to society of this employment is zero (following Dasgupta and Pearce 1972). However, Bauer (1977) notes that the work force required in the capital-intensive industry in the area must have a level of technical competence and a stability which is not widely found in Northern Australia. This might disqualify aborigines and the unemployed from being included in the work force. One of the serious problems in the ORIA is how to attract, train and retain such a work force. Financial incentives have been provided by the WA Government but have not been notably successful. The northern aborigines have been ignored as a potential source of farm labour and their natural unfamiliarity with planting has reinforced this. It is not yet known whether these people wish to be involved in agricultural pursuits, or whether they can be trained to play a significant role in them.

Considering this labour market environment and given the expectation that there will be no lasting recession, the future labour costs in the appraisal are valued at the likely ruling wage rate in the area to reflect the shadow price for labour (Dasgupta and Pearce 1972).