CENTRE FOR
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THE AUSTRALIAN COTTON INDUSTRY: AN ECONOMIC ASSESSMENT

Prepared for the Cotton Research and Development Corporation

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Executive summary

In March 1995 the Cotton Research and Development Corporation (CRDC) asked the Centre for International Economics to prepare a report on the cotton industry and its economic impact. This report was to provide a basis for assessment of the key policy, economic, market and environmental issues facing the industry.

Industry development and performance

The modern cotton industry, concentrated in northern New South Wales and southern Queensland, has shown rapid growth over the past 30 years. By 1992, when the industry reached a peak production level of 2.2 million bales, it was Australia's fourth largest rural export earner, with exports valued at around $1 billion. Few other significant rural or manufacturing industries in Australia have achieved such strong export growth over this period.

While government and the industry have worked together effectively in such matters as R&D, the rapid growth of production and exports has been achieved without government assistance and intervention. A federal government bounty on cotton production applied until 1971 but since then the industry has developed despite government taxes on inputs and other imposts. In 1992-93 the effective rate of assistance to the cotton growing and ginning industry was minus two per cent. Furthermore, the industry has had to compete on world markets against heavily subsidised competition. In the US, for example, the cost of the Cotton Program, which supports US cotton growers under the Farm Bill, is equivalent to around US$87 per bale.

The industry's rapid development suggests that cotton growing is more profitable than other alternative enterprises and that it is an efficient way of farming in the irrigation areas of northern NSW and southern Queensland. The net returns from growing cotton have been much higher than for other crops. The levels of investment in cotton growing as well as ginning have also been much higher than for other rural industries in these regions. Cotton farms on average have a net worth of at least twice the average net worth of farms in other rural industries, and in the early 1990s the level of cash operating surplus was several times higher than the average for any other rural industry. The level of inputs, also, has been relatively high as has the level of average debt.

Since 1992 the drought in eastern Australia has taken its toll on the cotton industry. The availability of water for irrigation has been severely depleted in many river valleys, particularly the Gwydir. Growers in this valley have suffered severe losses, with gross industry profits having fallen substantially in 1994-95.

Regional and economic significance

The significance of the cotton industry declines with the level of aggregation. At a regional level the cotton industry tends to be the mainstay of the economies of regions in which cotton is grown. With the expansion of cotton has come a large number of support activities, including labour for cotton growing,machinery suppliers, seed, chemical and fertiliser suppliers, aerial contractors and consulting and management services. Regional economic activity has also been stimulated on the output side as ginning, marketing and byproduct handling activities generally take place in the region. It is estimated that for every one person employed directly in the growing of cotton in the Gwydir Valley, for example, another two people have jobs directly or indirectly associated with cotton in the rest of the region.

At a state level, cotton in NSW accounted for about 8 per cent of the gross value of agricultural production in 1993-94, and 3 per cent in Queensland. At a national level, cotton contributed just over 3 per cent to the gross value of agricultural production in 1993-94 and just over 4 per cent to the value of agricultural exports (nearly 7 per cent in 1991-92). However, developments in the cotton industry have a limited impact on the economy at large (this is true for just about any single industry). For example, estimates from a cotton version of the ORANI general equilibrium model indicate that a 40 per cent reduction in cotton production would reduce real GDP in Australia by 0.09 per cent.

The cotton growing industry has contributed to expansion of the domestic textile industry. Domestic mill cotton consumption has nearly doubled in the last decade with much of the increase destined for export as yarn or textiles.

Industry challenges

The successful development of the cotton industry has also raised a number of problems. After three years of drought, public and private water storage are well depleted and there are increasing claims on the smaller

stock of water. These claims have come from the continuing growth of the cotton industry, the demands from other agricultural users and demands from environmental groups for water for wetlands.

The increased use of chemicals has also meant major challenges for the industry. R&D is still vital to addressing these problems but a challenge here is the allocation of limited funds for R&D to these issues as well as to others to increase the competitive edge of the industry in world markets.

Water

This set of problems is being tackled in a number of ways — for example, the use of shorter season varieties, improved cultural practices, the use of on-farm storage and tailwater recycling, and irrigation methods which conserve water. Cotton is increasingly being produced in a raingrown environment albeit from a small base. However, the problem of water allocations from public storages, access to unregulated water sources, security of supply and price remain pressing matters of the industry.

In the areas where cotton is grown commercially, water regulated by state dams has not been sold by the authorities according to what the market would bear. Rather, there have been block allocations — so much for irrigation, so much for environmental flows and other uses. Water charges have been set to partially reflect costs of regulating supply rather than to reflect demand relative to supply. Access to 'surplus flows' and water on unregulated streams at the cost of pumping has further disguised the strength of demand pressures relative to supply.

Recent changes have seen a tightening of the rationed allocation of water to cotton growing and an increase in the administered charges to include 'water resource management costs' of the Department of Land and Water Conservation, which is seeking greater costs recovery from extractive users.

Higher charges and less water with lower security is not a good outcome. But greater market based access to supply with prices for water reflecting cotton growers' demand for it would also mean paying more for water than through the present water charges. However, provided this was accompanied by increased security of supply there could be gains. Formalisation of a market based access to off-allocation water might be a way forward.

For the cotton industry, security of supply of water is the big issue. While higher prices for water would obviously mean higher costs and lower

incomes, in the long run there would be benefits for the cotton industry in having price play a bigger role in the allocation of water. First, the cotton industry would be the strongest bidder for water and a willingness to pay for water would make clear to governments — local, state and federal — the opportunity costs of meeting demands for water from environmental groups.

Second, higher prices could justify the construction of additional collective water storages. Whether such storages could or would be built is an open question but in principle the economics of constructing them must improve with higher water prices.

Use of chemicals

The other main point of concern for the industry is the reliance on chemicals to protect the crop. The industry is a large user of chemicals. There are concerns that this extensive use of chemicals may have harmful effects which extend beyond the cotton industry. Furthermore, in the past insects have built up resistances to the chemicals which have been used. The further potential build up of resistance remains a serious challenge.

Perhaps the most serious challenge which the industry faces is that of public perception, right or wrong, that the use of chemicals in cotton production is a potential significant source of environmental damage and possibly, through spray drift and other means, a danger to human health.

People in the industry have faced these challenges in several ways. An independent environmental audit has been conducted which found that the industry was responsible in its approach to environmental issues and that no specific community health problems could be linked directly to pesticide use.

Regular water quality monitoring programs are in place, management of tail water is of a high standard and major research efforts are aimed at minimising the use of chemicals.

These challenges remain and, in some cases, may even intensify. But a potential breakthrough is the commercial introduction of transgenic cottons in which resistance to insect attacks has been genetically engineered into the plant. While these cottons offer the potential to significantly reduce the use of chemicals in cotton growing, expectations should not be inflated and their introduction will require a high degree of industry cooperation and self-regulation to ensure that Integrated Pest Management (IPM) programs are effective and that the benefits of

transgenic cottons are not rapidly diluted because of insect resistance build up. These IPM programs will be made all the more difficult as raingrown cotton, in particular, increases.

Research and development

Effective and focused R&D has been a major factor behind the rapid development of the modern cotton industry. A key focus has been the breeding and commercial development of plant varieties suited to Australian conditions. This has led to yield improvements of around 60 per cent since the early 1970s, substantial improvements in the quality of Australian cotton and the use of varieties with greater resistance to insect attack.

Several factors have contributed to the success of R&D and the relatively rapid adoption of research results.

There have been close links between growers, researchers, R&D funders and marketers, facilitated by the geographic compactness of the industry and the location of research facilities in the major growing regions. Growers have been active, through the Australian Cotton Growers' Research Association, in influencing the direction of research and identifying significant areas for research funded by the Cotton Research and Development Corporation. Researchers have had to be accountable to the industry through media such as the biennial Research Conference. There has been substantial private investment in research and, perhaps most important of all, there has been no government involvement in marketing schemes which might otherwise have blurred price signals between customers and growers and also plant breeders.

Given the abovementioned challenges facing the industry, it faces a further continuing challenge of directing R&D funds in areas which will give the best returns to the industry, and community in general, in future years. In this regard, the industry should look carefully at its long term goals.

Cotton growing regions at a glance

Regional and major centres	*Typical production bales*[a]	*Typical value of production*[b]	*Features*
	'000 bales	$ million	
Darling-Riverina (Bourke, Menindee)	70	35	Isolated Darling areas, small areas in the Riverina.
Macquarie Valley (Warren, Trangie, Narromine)	260	130	Relatively stable production but vulnerable to diversion of irrigation water to other uses.
Namoi Valley (Narrabri, Wee Waa, Gunnedah, Walgett)	395	198	Recent expansion of Upper Namoi. Some raingrown production and use of ground water.
Gwydir (Moree, Collarenabri)	490	245	Ideal climate and soils, some raingrown production. Vulnerable to availability of irrigation water.
Macintyre (Goondawindi, Mungindi)	290	145	Similar to the Gwydir.
Darling Downs (Dalby, Cecil Plans)	235	117	Mixed farming and production is sensitive to price variations between crops. Relatively higher proportion of raingrown production.
St George	100	50	Similar to the Gwydir.
Biloela–Theodore	40	20	Production stable at Theodore but shrinking at Biloela.
Emerald	120	60	Relatively stable production. Some raingrown cotton.
AUSTRALIA	**2 000**	**1 000**	

[a] All figures are highly variable depending on seasonal conditions, water availability and so on. In recent years total production has ranged between 1.4 million and 2.2 million bales. Usually over 90% of production comes from irrigated crops and the remainder from raingrown crops. Around 75% of production comes from NSW and 25% from Queensland. [b] Value of production is based on a conservative $500 per bale total for fibre and seed.

Source: Cotton Research & Development Corporation.

1 Introduction

The cotton industry, with an annual production in normal non-drought years worth nearly $1 billion, is one of the success stories of modern Australian agriculture. From being a minor commercial crop until the 1960s, the industry became firmly established through the 1960s and was on a solid growth path until set back by drought after 1992. By 1992 cotton had become Australia's fourth largest rural export earner and Australia was the world's fourth largest cotton exporting nation.

Unlike the more traditional Australian rural industries such as wool or wheat, the cotton industry has not been subject to frequent investigations by the Industry Commission or other such bodies. A possible explanation for this might be that government reviews tend to happen only when industries are in major difficulties or face severe challenges. The cotton industry has been successful without any involvement of government in marketing since a production bounty was removed in 1971. While cotton output prices are not directly affected by (Australian) government policies, input prices are raised by duties on imported inputs such as chemicals, machinery and fertilisers. There is some indirect government involvement in the industry, with government contributions to R&D and through water pricing, water supplies and environmental regulation.

With no balanced accounting of these factors, views about the strengths, weaknesses and emerging policy issues for cotton are not well documented. The purpose of this report is to fill that gap.

The report begins by identifying essential industry characteristics and relating these to both past success and emerging pressures on the industry's capacity to contribute to national and regional economic performance. Subsequent chapters develop this theme — starting off with world markets and working back through processing (chapter 3) and farm production economics (chapter 4) and ending up with key inputs — water, chemicals and R&D effort. The regional and national significance of the industry is addressed in these terms in chapters 5 and 6. Three substantial appendixes provide details on production, markets and marketing.

Cotton's past success has been built around a strong focus on international markets. With small government involvement, the cooperative behaviour and self-regulation which is a significant explanation of past success has evolved from inside the industry and without government controls. The industry's growth, its regional concentration and relatively small size have helped that happen. But with time, expanding size, growing regional dispersion and external community interest in the role of key inputs —

water and chemicals — there are emerging pressures for a growing role for government.

As in the past, pressures on the industry are bound to flow from changes in markets and prices as seasons, fashions and economic fortunes fluctuate. Coping with the rough and tumble of international markets is something that Australian cotton has done very well for over 30 years. But coping with competing domestic demands for resources and influences on resource use from groups outside the industry is relatively new. Whether it be through demands from environmental groups for water for wetlands or for outside imposed regulations governing chemical use, there is significant potential for outside demands (and government responses to them) to impact on the cotton industry and with that its future capacity to contribute to regional and national economies.

Governments are inevitably being involved as a 'player' in the resolution of these competing demands. Thus, an important task for the study is to assess non-market as well as market pressures confronting the industry. Such an assessment will help ensure that the resolution of these demands whether by governments or by consensus is made on the basis of the potential impact on what cotton can do and has been doing for the Australian economy.

2 Background on the Australian cotton industry

Key points

- The Australian cotton industry has grown rapidly over the past 30 years to become a major producer exporting over 90 per cent of output on highly competitive international markets.
- The fact that this strong performance has been achieved with little help from government testifies to the industry's adaptability and suitability to Australian conditions and its efficiency as an employer of labour and other resources.
- Industry development has concentrated in southern and central Queensland and northern New South Wales and cotton makes significant contributions to these regional economies.
- Cotton production expanded rapidly during the 1980s to reach a peak of 2.2 million bales in 1992. Drought has reduced production to 1.48 million bales in 1995.
- Water is a crucial input into cotton production, and low availability of water in public storages will again depress output of the Australian crop for the 1996 season.
- Pressures are emerging to influence the use of key factors in cotton growing — water and chemicals in particular.

With nearly 50 per cent of the world fibre market, cotton is the world's biggest selling fibre. Though relatively small compared with the major cotton producers (China, the US, India and Pakistan), Australia is the world's fourth largest exporter of cotton. The Australian industry has developed in a relatively short time (only 30 years ago it was barely commercial), in a relatively concentrated region of northern New South Wales and southern Queensland and with little direct involvement of government.

Broad market characteristics

Australian producers compete against large and long standing producers which are to be found throughout the world — wherever climate permits commercial production. China, the United States, India, Pakistan, Brazil, Turkey, Australia, Uzbekistan and Turkmenistan dominate world production, producing about 80 per cent of the total world crop. The United States and Uzbekistan are the major exporters with the United States exporting over six and half million bales and Uzbekistan over five and half million (the bulk of which has traditionally gone to Russia).

Over 90 per cent of Australian cotton is exported. Japan, Indonesia, South Korea, and Taiwan are the main destinations taking about 80 per cent of

total exports. The remaining 10 per cent is consumed in Australia and supports a significant cotton textile industry..

A characteristic which seems to have been important in the strong performance of the Australian cotton industry on international markets is its capacity to strike an effective balance between competition and cooperation. While there is strong competition among processors and growers, extensive cooperation is also evident throughout the industry. Unlike many industries this cooperation is market driven and not mandated by government. Codes of conduct about such things as chemical use and water management have emerged cooperatively and have been essential ingredients in industry performance.

More than most other Australian producers cotton growers appear to recognise that action at the farm level to reduce processing costs will have an economic return to them. This attitude has been reinforced by an effective system of penalties and incentives and relevant product description to provide effective signals between processors and growers. These signals appear to have been extended to R&D providers as continued improvement of varieties of cotton has been an important explanation for processing improvements in Australia and marketing success overseas.

Industry development

The modern Australian cotton industry was established around 30 years ago and drew on water from the then newly constructed Keepit Dam on the Namoi River. Industry growth since has been concentrated in the river valleys of northern New South Wales, and southern and central Queensland. Box A1 sets out a chronological outline of industry development.

New South Wales dominates production in non-drought years with over 75 per cent of the crop grown there. Within New South Wales the Namoi, Gwydir, Macintyre and Macquarie regions are the biggest producing regions while the Darling Downs, Emerald and St George regions produce most of Queensland's cotton.

Within cotton growing areas, cotton is a major agricultural crop. In the Moree Plains, Narrabri and Warren areas of New South Wales and the Emerald area of Queensland over 20 per cent of all farms produce cotton (appendix table A2).

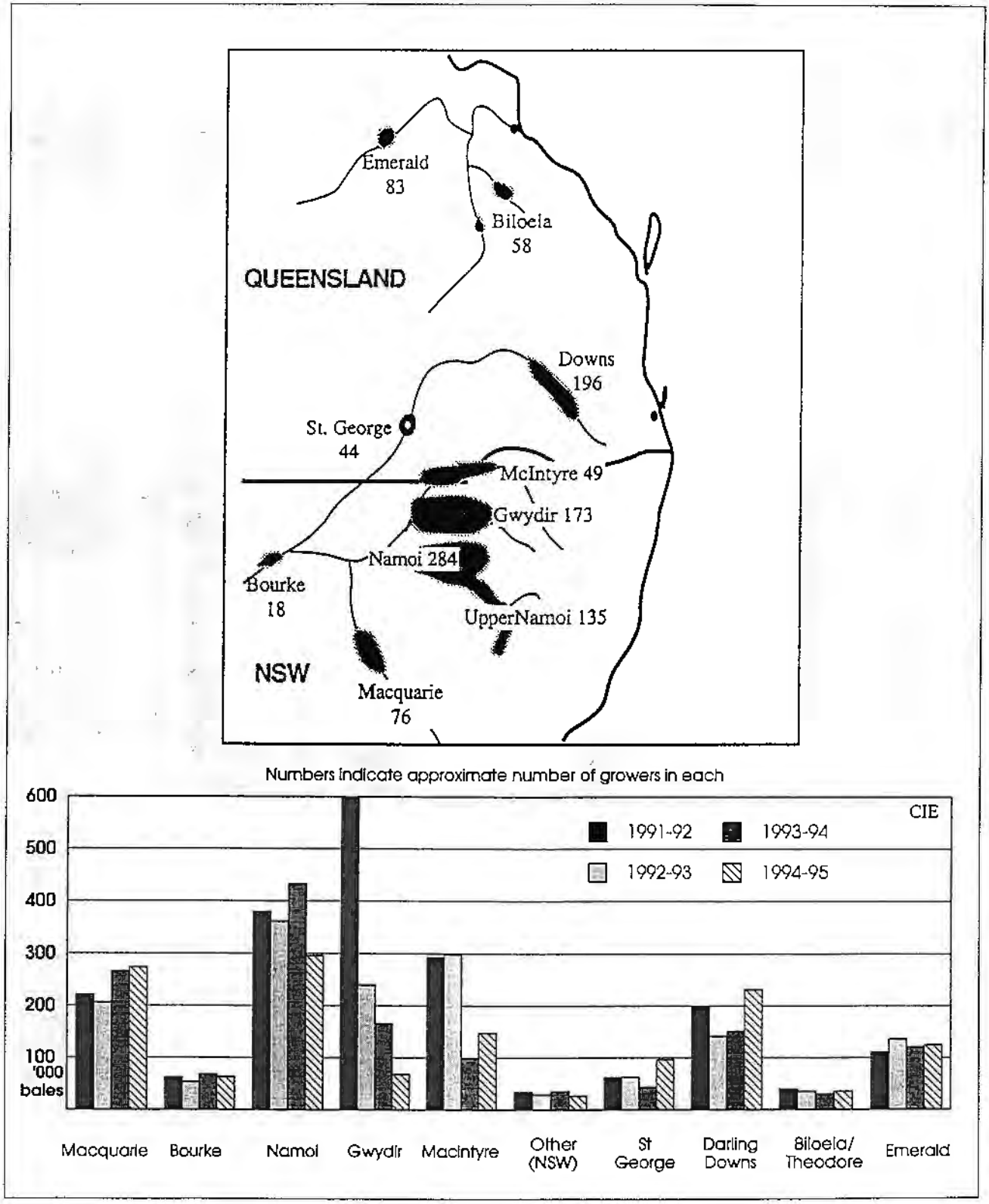
The concentrated nature of the industry mainly reflects past water availability. While temperature and length of growing season set broad parameters, within these the impact of water availability has been critical. And while initially location of gins may have had some impact on development, water supply was the primary determinant and gins were established to meet needs. In the Menindee Lakes area for example, a gin (owned by the operators Tandou) was built following the establishment of cotton production.

Chart 2.1 shows the areas where cotton is grown in Australia. Production is concentrated in a relatively narrow band, from latitude 32 degrees south to 23.5 degrees south (Tropic of Capricorn). This compares with the world's cotton production areas which extend from 46 degrees (in China) to the equator (in Uganda for instance). The latitudinal flexibility of cotton worldwide indicates that potential exists in Australia for expansion subject to the availability of sufficient quantities of water and suitable varieties of cotton.

The map indicates how regionally based the Australian cotton industry is. This concentration has had two important benefits.

- It has assisted self-regulation. This is evidenced in the relatively fast uptake of research results in the cotton industry, and in the voluntary compliance by most growers with insecticide resistance management (IRM) strategies.
- It has fostered the growth of support industries in regional economies. For example, the 32 gins in the cotton regions are industry specific. The growth of agricultural aviation firms, consulting and other service industries (chapter 5) in these regions is strongly related to growth of the cotton industry.

Chart 2.1 Cotton growing regions of Australia and regional production



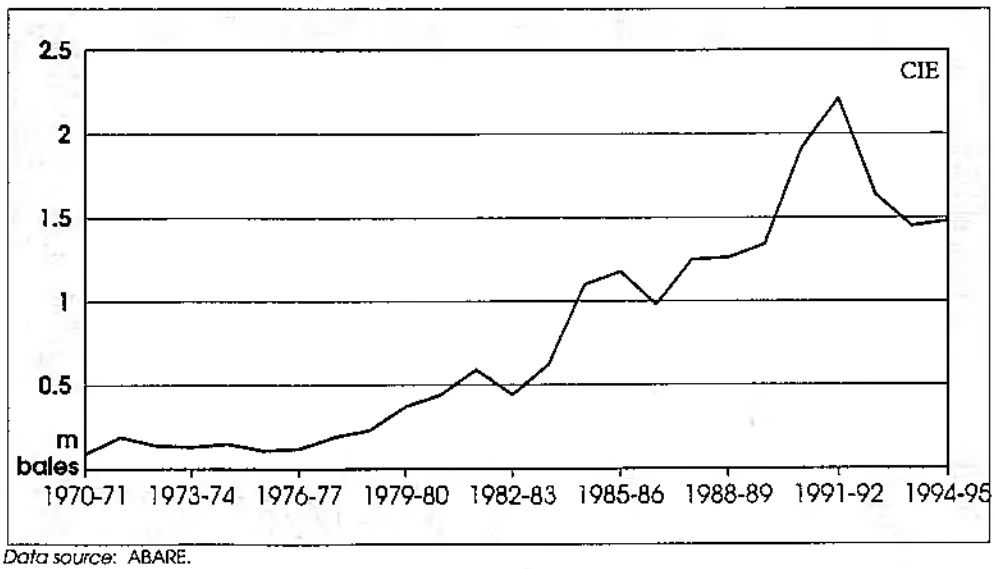
Data source: Cotton yearbooks.

Rapid industry growth

Chart 2.2 shows the expansion of Australian cotton production over the past 25 years. The steep rise in production during the 1980s from about 100 000 bales in the 1970s was a result of improving yields (chart 2.3), the completion of the Copeton, Glen Lyon and Pindari Dams on the Gwydir and Macintyre river systems and the expansion into cotton on the Macquarie River. A lack of water due to drought conditions halted the expansion of production in 1992 following a year of record yields and production. In the two years following the on set of drought, cotton production slipped from a peak of 2.2 million bales in 1992 to just over 1.4 million bales in 1994 and again in 1995.

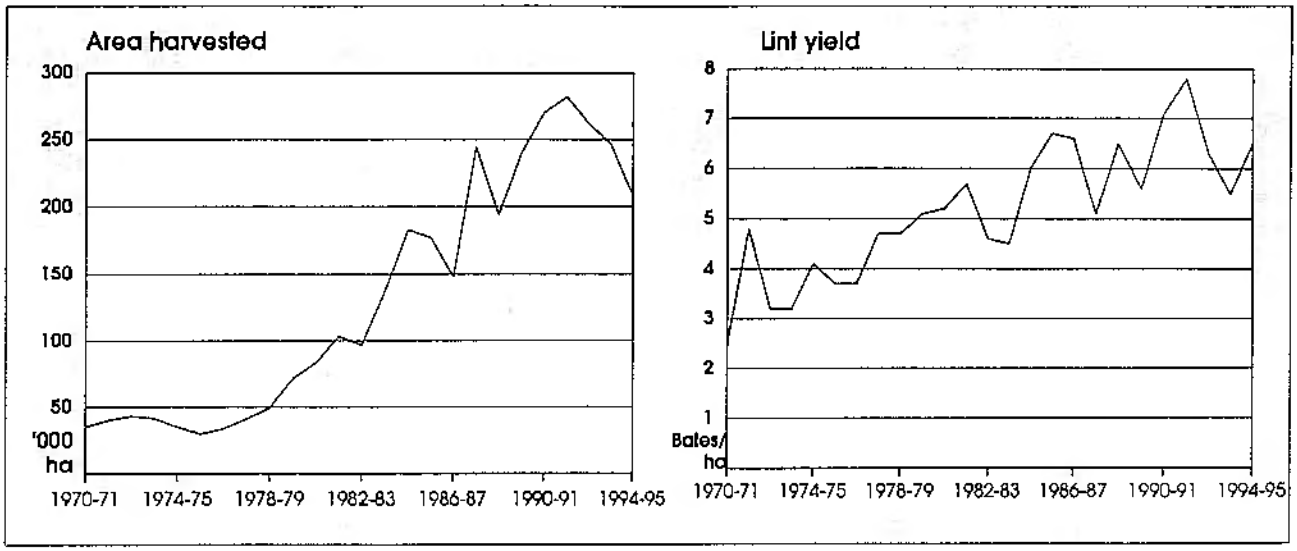
When water availability permits, Australian yields are the highest among major producers. As chart 2.3 shows, yields fluctuate over time but exhibit a significant upward trend. Total cotton area in Australia (chart 2.3) shows a similar trend. The upward trend in yields has been brought about through improved growing techniques and methods of farm management, improved pest control, and superior varieties.

Chart 2.2 **Australian lint production**



Data source: ABARE.

Chart 2.3 **Australian cotton area harvested and lint yield**



Data source: ABARE Commodity Statistical Bulletin 1994; Australian Commodities, June 1995.

Industry institutions

Industry institutions are focused on research and marketing issues rather than agro-political objectives. While growers have formed regional grower associations, national political grower bodies, prevalent in other major rural industries, are absent. Two key organisations, the Cotton Research and Development Corporation (CRDC) and the Australian Cotton Growers' Research Association (ACGRA), drive the research activities of the cotton industry while two others, the Raw Cotton Marketing Advisory Committee (RCMAC) and Australian Cotton Foundation (ACF), are focused on marketing and promotion. The ACF also acts as the peak body for regional grower associations and represents cotton growers on the National Farmers' Federation. The grower controlled Cotton Seed Distributors (CSD) supplies quality cotton seed to the industry and the newly formed Cooperative Research Centre for Sustainable Cotton Production (Cotton CRC) is focused on research strategies addressing key issues of sustainable production systems and adoption of research results.

The importance of water

While the role of government in the marketing of cotton (apart from a cotton bounty which applied in earlier years) is small to non-existent, governments have played an important role in the development of the industry. This role in the first instance was passive — governments built the first dams and cotton production was the most rewarding way of

utilising the water. But as production has expanded and low rainfall seasons have occurred, the government's role as an allocator of scarce water has come to be increasingly tested. Another source of added pressure on the allocation of water is increasing demands for water to meet environmental goals.

In 1994 and 1995 persistent drought conditions prevailed in northern New South Wales and southern Queensland and water supplies in state dams have been inadequate. This has focused attention on the potential for producing cotton in other areas. New cotton areas include Tandou in the Menindee Lakes area of western New South Wales and, more recently, small areas of production on the Lachlan River as well as production trials on the Murrumbidgee River in southern New South Wales and the Ord River in Western Australia.

The persistent drought conditions since 1993 have highlighted the widespread perception that regulators have overallocated river systems, and focused attention on the development of semi-irrigated and raingrown cotton production. Innovative systems of making better use of the available water (for example, skip-row plantings and complete on-farm storm water harvesting) are being implemented.

Increased raingrown production has come from two sources. First, there are those who are already cotton irrigators, and second, those who are exclusively raingrown farmers who grow cotton when seasons permit. The increase in 'opportunity' growers is a trend which the industry recognises it must monitor carefully to ensure that the self-regulating mechanisms mentioned above do not collapse. These issues are taken up in later chapters.

Purchased inputs

Cotton is a summer crop, planted in September or October in most regions, and harvested or picked in March— May. Input costs are high and cotton growers need to be efficient users of resources in order to generate returns high enough to cover these costs. The major inputs to the production of cotton in terms of cost are chemicals and labour, but many other inputs are important to the success of the crop.

A variety of different chemicals is used to control insect pests and weeds and to defoliate the crop prior to harvest. Most chemicals used on cotton are insecticides and of these currently the most heavily used is endosulfan. Weed control is also necessary for successful cotton production as weed populations can reduce yields. Pre-emergence herbicides are the principal

tools used although inter-row cultivation and hand weeding are also important after the emergence of the crop.

In 1983 the industry introduced an integrated resistance management strategy (IRM) to control resistance to pesticides specifying time 'windows' for the use of different classes of chemicals. The strategy relied on the voluntary compliance by growers. Gibb Environmental Sciences and Arbour International (1991) concluded that compliance was virtually total. This is likely the result of peer pressure among growers and grower recognition of their own long term interests. However, even with the strategy in place, resistance continues to develop among cotton pests and is a major problem for the cotton industry.

Community concerns over riverine health as a result of water flows off cotton fields have led to industry developing efficient tailwater and stormwater recycling systems. Tailwater recycling also makes good sense in an environment in which water is the binding constraint on growers. Additionally, monitoring systems have been implemented and funded by growers and government. However, the increase in the production of raingrown cotton without stormwater recycling systems is a concern to be tackled by the industry.

The Cotton Research and Development Corporation (CRDC) has placed the issue of reducing chemical use as its top priority in its five year management plan. The introduction of the Bt gene in (transgenic) cotton within the next few years will reduce dependence on chemicals but this will require greater adherence to a modified IPM strategy to ensure that the benefits of this technology are not lost to the industry through the development of resistance to transgenic cotton.

Strengths and potential points of vulnerability

Strengths

- Demonstrated capacity to compete on international markets free of government involvement and support.
- Scope in production and processing to produce a consistent, contaminant free product.
- Industry institutions built around research and market relevance;.
- An industry culture which exploits cooperation (without government management) and competition to best possible advantage.
- Irrigated assisted yields and capacity of the cotton industry to use water to the best advantage.

Potential points of vulnerability

- The risk that as geographic dispersion and diverging interests break down voluntary cooperation, governments may step in and regulate behaviour which till now has been voluntary and market driven.
- The industry is vulnerable to drought and depletion of public water storages — as seen especially in the Gwydir region.
- The limit on water supply as industry growth starts to stretch available water supplies, compounded by problems of water allocation, drought and demands for surface water from other agricultural and non-agricultural (environmental) users.

3 Markets, marketing and ginning

Key points

- Cotton, with 48 per cent of the world fibre market, is the biggest selling fibre in the world.
- Competition is fierce. Cotton has lost share to synthetic fibre over the past 30 years. There are many efficient producers of cotton.
- Cotton prices have fallen in real terms (that is, relative to prices in general) due to productivity improvements in synthetic substitutes and in cotton.
- These productivity improvements have maintained profitability in the face of falling prices.
- They reflect a focused research effort on developing varieties for Australian conditions and quick adoption of high technology.
- This focused research effort and quick adoption reflects an efficient and competitive marketing system which lets growers know what consumers and textile firms want.
- These achievements also reflect an effective balance struck between unregulated competitive behaviour and self-regulation and cooperation.
- An emerging question is the extent of future cooperative behaviour, especially with respect to market development and cotton promotion.

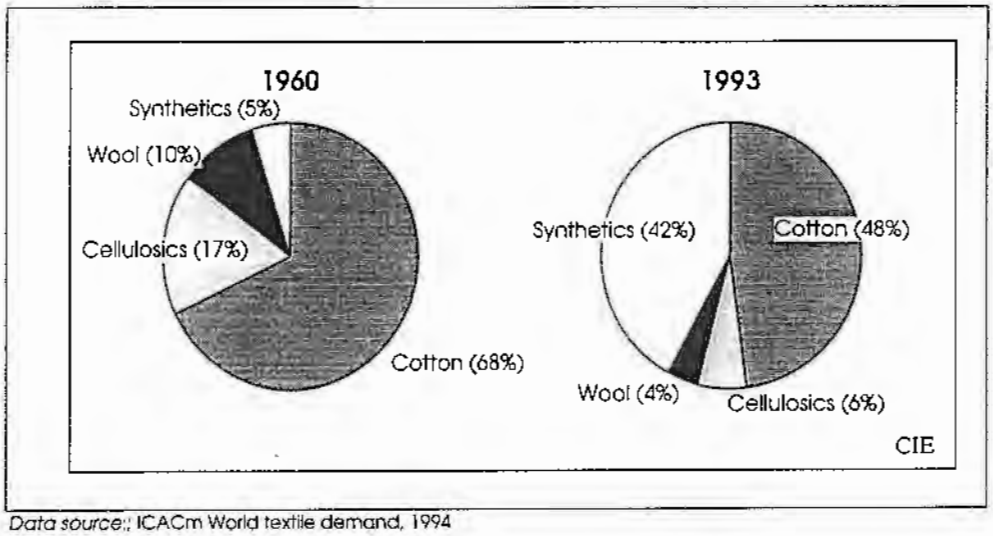
The Australian cotton industry is driven by the international market. This chapter begins at the end point for cotton — world markets — and from there works through the Australian marketing system ending up just before the farm gate with ginning and early stage processing. The economics of growing cotton is the subject of chapter 4 and appendix B.

World market for cotton

Main producers, exporters and importers

Since 1960, *world consumption of cotton* per person has held constant at around 3.4 kg per person. However, with the rapid growth of consumption of synthetic fibres in the 1960s, cotton's share of textile fibre consumption fell from 68 per cent in 1960 to 50 per cent in the mid-1970s and to 48 per cent in 1994 (chart 3.1) (ICAC 1994). Nevertheless, in absolute terms, world cotton consumption has nearly doubled since 1960. World *cotton production* has ranged around 18 million tonnes since the mid-1980s but increased steadily in the two decades before that. This increase was due to higher yields and not to any significant increase in areas sown to cotton. About one-third of cotton production enters world trade. The main cotton producing countries are China (4.5 Mt), USA (4 Mt), India (2 Mt) FSU (Uzbekistan and Turkmenistan 2 Mt) and Pakistan (1.6 Mt) (chart B2). These countries account for nearly 80 per cent of world production. Cotton is grown in over 90 countries, 75 of which are developing countries. The

Chart 3.1 **Cotton's share of the world fibre market**



Data source: ICACm World textile demand, 1994

main *cotton exporters* are the United States and FSU (mainly Uzbekistan). Along with Australia, the Francophone African countries are also important. China's exports have declined rapidly over the past decade. Russia is the world's largest importer of cotton but Japan, northern and south-east Asian countries together with countries of the European Union account for over 60 per cent of world *cotton imports*.

Main determinants of demand and price for cotton

World *cotton prices* (Cotlook A index) rose strongly in the early 1970s but since the mid-1970s the upward trend has been weak. In *real* terms, prices have generally fallen. The long term downward trend in cotton prices in real terms has been accommodated by technological improvements in the growing and processing of cotton. While demand has expanded, productivity improvements have enabled production to meet demand at lower real prices. This has been necessary as there is strong competition between cotton and synthetic fibres and there have also been significant technological advances in the production of synthetic fibres. Nonetheless, cotton still dominates the overall textile fibre market and, like wool, the cotton market is strongly influenced by economic activity (GDP growth) in the main textile consuming countries.

Australia is a relatively small player in the world cotton market, and is largely a price taker. However there is a premium representing the actual cash price for Australian cotton less the futures price in New York. This premium is known as the Australian basis and is affected by many factors including the generally high quality of the Australian crop.

Issues which are common in other Australian export industries such as single desk selling, reserve price schemes and domestic price schemes are absent and are not matters of contention in the cotton industry. This is consistent with a market driven culture.

World market developments

Uruguay Round outcome favourable for cotton

The Uruguay Round was endorsed by member governments in April 1994 in Morocco. The implications for cotton are threefold. First, the overall effects of the Round outcome on stimulating the world economy will increase consumer incomes and enhance demand for cotton textiles and apparel. Second, the Multi Fibre Arrangement (MFA) which placed quota limits on clothing and textile imports in major world markets, will be phased out over ten years and quotas on textiles and apparel imports will be eliminated. Third, the agreement on agriculture should mean some reduction in production and export subsidies and some increases in market access. Of these, the first will be the most important for cotton while the last, the agriculture agreement, will have only a minimal impact.

Shifting pattern of mill consumption

In recent years there has been a trend toward decreasing mill consumption of cotton in some industrialised countries but a strong upward trend in mill consumption in the main NIC countries of East Asia. Since 1987 mill consumption in the EU has declined by 13 per cent, in Japan by 46 per cent and in Korea by 8 per cent, whereas mill consumption in Indonesia and Thailand has increased by 145 per cent and 52 per cent respectively. This may be associated with lower labour costs and higher economic growth rates in Indonesia and Thailand. An exception, however, is the US where mill consumption of cotton has increased by 21 per cent since 1987.

1995 US Farm Bill

The US Farm Bill has had a significant impact on world cotton prices because of the massive subsidies it has injected into the US cotton industry. In recent years payments to cotton producers under US farm programs have exceeded $ 1.4 billion per year. This is equivalent to a direct subsidy of about US$87 per bale per year. Further substantial payments have been made to keep cotton land under the Conservation Reserve Program whereby land at environmental risk is taken out of production. While this program will come under pressure as the US attempts to reduce its budget

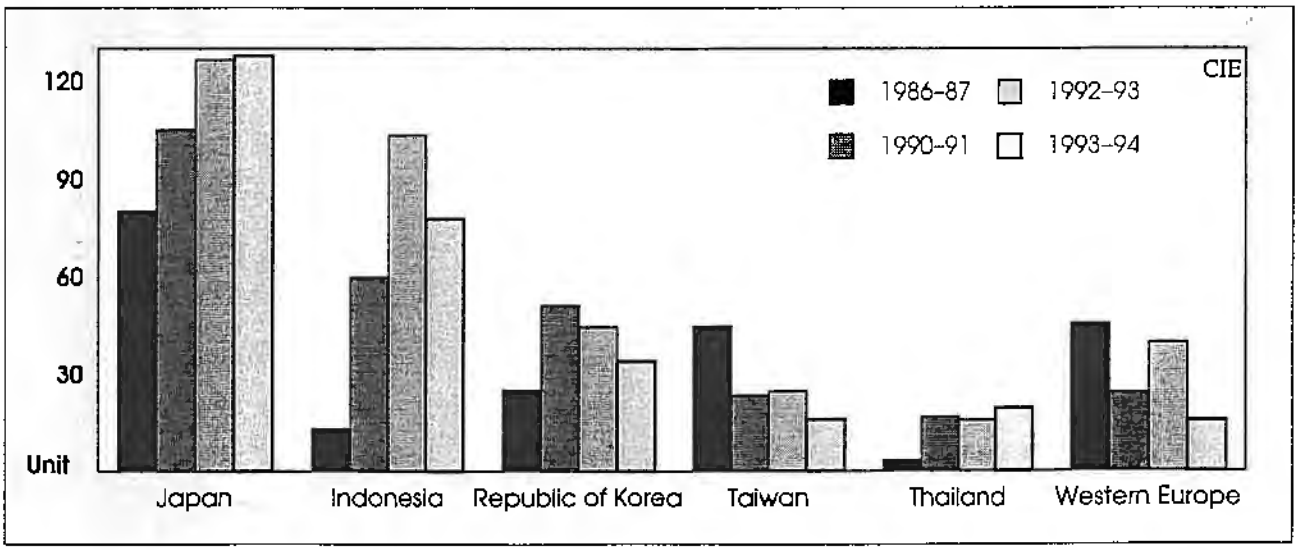
deficit, the same pressures have existed for some years. And even now contracts are being renewed in the US.

Australia's cotton markets

Australia exports cotton lint to around 35 countries but the bulk of exports is shipped to Asian markets, particularly Japan, Indonesia, Korea, Taiwan, Thailand and mainland China (chart 3.2 and table 3.1). Western Europe is still an important market but our exports to that region have declined while markets in Asia have expanded rapidly. Markets in Asia accounted for 86 per cent of Australian cotton exports in 1993-94, and the top five markets, all in the Asian region, accounted for 78 per cent of total exports.

Australia's dependence on the Japanese market has declined substantially since the early-1980s (table 3.1) even though the volume of cotton shipped to Japan has increased. Indonesia is now Australia's second most important market. Volumes shipped to Indonesia rose substantially in 1992-93 but have since fallen back largely because of drought induced falls in Australian output. Korea and Thailand are other markets where export volumes and the proportion of total exports has increased while the Taiwan market, where the textile industry has experienced rapidly increasing wages, has declined in importance.

Chart 3.2 **Asian markets are the main destinations for Australian cotton**



Data source: ABARE, Commodities Statistical Bulletin 1994.

Table 3.1 **Proportion of Australia's total cotton exports shipped to key markets**

Destination	*1980-81*	*1984-85*	*1990-91*	*1992-93*	*1993-94*
	%	%	%	%	%
Japan	68.0	47.8	27.6	32.0	35.5
Indonesia	4.8	3.6	15.7	26.2	21.6
Korea	1.5	2.1	13.4	11.2	9.4
Taiwan	1.0	22.7	6.1	6.2	4.3
Thailand	-	-	4.3	3.9	5.3
China	21.3	-	4.8	-	6.4
Western Europe	-	11.9	6.3	10.0	4.2
Other	3.4	11.9	21.8	10.1	13.3
	100.0	100.0	100.0	100.0	100.0

Source: ABARE, Commodity Statistical Bulletin, 1994.

Marketing in Australia

Australian raw cotton is marketed under a competitive market system with several major international cotton merchants operating in the Australian market.

Compared to many other Australian rural industries — wool, grains and sugar, for example — cotton growers utilise a wide range of sophisticated risk management and price hedging strategies. They started to accept these strategies through the early 1980s. Before then growers had largely relied on their ginner/marketer (principally, Namoi Co-op, Auscott and Queensland Cotton Board) to market their cotton in limited pools.

Cotton growers have a wide range of options for the delivery, processing and sale of their seed cotton. At one level they may sell direct to a merchant or processor. At another level a grower may deliver to a processor under an arrangement whereby the processor retains the cotton seed and the grower sells the lint on international markets. Or a grower may retain ownership of both cotton seed and lint and, after paying a toll processing fee, sell both cotton seed and lint independently.

There is strong competition among purchasers in both domestic and international markets. A large number of Australian sellers, (approximately 900 cotton growers) supply a relatively small number of purchasers, currently operating in Australia (around 13 marketers/merchants). A proposed merger between the two biggest marketers, if successful, would mean that the new marketer formed will account for nearly half of total raw cotton production.

Several large companies offer ginning and marketing services. A trend over the past few years has been the emergence of a number of independent merchants who buy cotton direct from growers and have it ginned or

contracted and then market the cotton themselves. These merchants/ marketers have increased competition within the industry and have introduced a number of benefits including cash offer sales and faster payment for purchased cotton. They also supply a benchmark for growers when comparing daily prices.

Risk management and exchange of ownership

Historically, cotton has seen large fluctuations in its price and, compared with other Australian agricultural industries, individual growers follow a number of sophisticated risk management techniques. This may be explained by such things as the need to manage large production fluctuations and cover for large price variations in a single crop, the absence of any government standard marketing scheme crowding out private actions and the independent culture existing in the industry.

Growers who choose to deliver to seasonal or minimum price pools leave the selling and trading of futures and options to the discretion of professional marketers. These pools effectively transfer the responsibility of managing the risk associated with establishing adequate hedge cover from the grower to the marketing organisation while still allowing the grower the benefit of being able to forward sell. Other alternatives give the growers scope to trade futures and options on their own account.

Marketing efficiency and risk management

Each of these marketing alternatives has different risks which can be minimised by diversification. Apart from cash sales, all the above options require commitment prior to harvest, with different risk characteristics associated with each alternative. The objective is to structure a marketing mix that depends on factors that can differ between growers and between seasons, such as availability of time, risk preferences, expectations of future movements in prices, indebtedness and uncertainty about yields.

When comparing the risk and return characteristics of the different marketing alternatives, on average the net returns for these alternatives are not significantly different (ABARE 1992). However, the price risk at harvest time is smaller with hedging strategies than without. A number of growers employ the services of specialist risk managemetn consultants to assist them in developing their marketing strategies.

Marketing requirements

There are differences among mill buyers about how to decide on the price they offer for cotton, especially as it relates to micronaire (fineness), maturity and freedom from trash. The style now grown in Australia is of a quality that accounts for 85 per cent of all yarns spun in Australia. The longer, stronger, finer fibres which can produce finer yarns for more expensive fabrics can command a premium over shorter, coarser, weaker fibres whose use is restricted to coarser fabrics. Australian cotton that is converted to yarn in Australia is converted into either coarse and medium yarns (especially for denim) or into finer yarns.

There is not strong evidence of willingness to pay high premiums for quality within a broad type. One estimate (Shaw 1994) places a premium of only US$24 per hectare on super colour, strength and fineness.

Cotton promotion

The Australian Cotton Foundation (ACF) provides domestic promotional activities including the sponsorship of fashion shows promoting cotton garments. Two manufacturers, Bonds and Johnson & Johnson, have recently begun high profile cotton promotion with the introduction of the first range of 100 per cent cotton skincare products. Johnson and Johnson have incorporated the Cottonmark, a logo used to promote Australian cotton, in packaging and an accompanying $2 million promotion campaign aimed at women aged 18–39 (ACF).

Currently, Cotton International, based in the US, engages in cotton promotion internationally. The Australian cotton industry benefits from this promotion because of the similarities between cotton from the San Jaoquin Valley (SJV) and Australian cotton. With the further development of Australian cotton, the question arises as to whether differentiating Australian cotton from competing cotton producing countries would attract premium prices and buyer preference in international markets. Whether this is either feasible or cost effective is also an issue for the industry.

Cottonmark

Designers and manufacturers who meet the quality standards of design and manufacture required by the ACF are being actively supported by the cotton industry to display the 'Cottonmark'. The mark is available for use by all sectors of the cotton industry: growers, spinners, weavers, designers,

manufacturers and exporters. No licence fee is required to gain use of the 'Cottonmark'. There is also a 'Cottonblend' mark.

Any assessment of the effectiveness of trade marking of the 'Cottonmark' would need to take account of the fact that while some 90 per cent of the Australian cotton crop is sold overseas to predominantly south-east Asian countries, only a small proportion of this is then used in yarn and fabric for reimportation into the Australian market and that most cotton products sold in Australia are imported. Some Australian textile firms have criticised the current 'cottonmark' claiming the system is confusing. They wish to have a mark to exclusively identify products made in Australia from Australian cotton. This is an issue that the industry as a whole needs to resolve.

New technology affecting marketing prospects

The latest generation of spinning machinery is putting new evaluation criteria into the textile industry. High Volume Instrument (HVI) systems have been developed into a highly reliable and economical method for testing important properties of cotton fibres.

Most merchants use HVI testing themselves to determine the fair value of cotton in their sales to overseas agents and spinners. These lines provide a print-out of the sample results. Further developments in this technology are needed in the industry based on objectively measured, market driven, fibre characteristics. This will allow spinners to quickly and accurately evaluate fibre qualities necessary to produce yarns to their customers.

The Australian cotton industry is one of the few major agricultural industries with virtually no government involvement in the marketing of its crop. This unregulated or self-regulated environment has provided strong incentives for growers to adopt new technology and allowed strong competition to develop in the provision of marketing services.

The speed of technological changes in the cotton industry depends on the signals sent by the spinner to the ginner and grower. Very sophisticated ginning techniques may be applied only to cottons for certain niche markets. However, today's sophisticated consumer will demand even higher quality cotton goods which will ultimately drive demand for consistently higher qualities of raw cotton.

Ginning

Prior to the 1987-88 ginning season there were only two commercial ginners in NSW (Namoi Co-op and Auscott) and one in Queensland (Queensland Cotton). In addition, Darling River Cotton at Bourke owned and operated a gin for its own crop. Before module technology was developed to handle cotton between the picker and the gin, the ginning season was necessarily short because storage and handling processes were not weatherproof. Module technology made it possible to extend the ginning season because seed cotton could be stored in the field.

During the late 1980s and early 1990s gins worked for five months or more per year as seasons were good and there was little or no excess capacity. This meant that the large fixed costs associated with owning and operating a gin were spread across a big volume of product. In early years, the 1960s and 1970s, there was little competition among ginners. However, the continued construction of more gins by existing and new ginners has led to spare capacity which in recent years has become more apparent with the drought years after 1992.

Ginning efficiency and the portion of lint produced to seed cotton ginned has improved dramatically over the last decade. This is a function of improved varieties and also of improved ginning efficiency. The Australian industry is at the forefront of the world in its capacity to produce varieties with excellent ginning characteristics and in its capacity to gin the product efficiently.

One recent development has been the formation of the Australian Cotton Ginners' Association. This organisation facilitates the exchange of information and facilitates cooperation between competitive ginning firms. In a similar way, the Cotton Classers' Association and a Cotton Shippers' Association facilitate cooperation between industry participants.

Evaluation and issues for the future

With production at low levels over the past three years, Australia's export performance has been constrained more by lack of supplies than any inability to market cotton overseas at reasonable prices.

As cotton production in Australia recovers and expands above the 1992 record crop, the issue of marketing strategies for the industry will become more important.

There seems little doubt that concentration on the fast growing Asian markets is an appropriate strategy. But should the industry coordinate its marketing efforts — by developing an overall industry market development strategy — or should individual marketers continue to 'do their own thing'? One emerging response is the amalgamation of the two major marketers to create an Australian 'market leader'. Such a leader may be able to negotiate premium prices for top quality Australian cotton with the possibility that other Australian marketers would come in under this umbrella. The need for and nature of any industry-wide coordination to assist this process are open questions.

As noted earlier, Australia has done reasonably well in its main Asian markets based on the market driven efforts of individual marketers and agents. Strong competition among them has encouraged marketing excellence. But this excellence has also been facilitated by industry-wide high standards which have been achieved by industry-wide commitment and self-regulation.

On the other hand, self-regulation and commitment have been effective in a concentrated and still relatively small industry in establishing a market niche and premium for Australian cotton. As the industry expands, becomes more dispersed and comprises different growers it is reasonable to ask whether more formal ways of coordination should be adopted in order to exploit an Australian reputation.

This idea raises many questions. Which body should be responsible for or take a lead in greater coordination? Should the Australian Cotton Foundation have an expanded charter to coordinate efforts? Who should pay for coordination activities? How would the money be raised? Should there be promotion of Australian cotton or should promotion be left on a voluntary basis so that individual groups of growers or merchants are free to promote a brand and style?

For many years the Raw Cotton Marketing Advisory Committee (RCMAC) has provided an effective forum for government, marketers and spinners to collaberate on matters of joint interest. However, the industry has possibly reached a stage where it should consider the future role for RCMAC and whether it should continue to be chaired by a government representative if it takes on a more commercial role.

An important issue to be addressed is the extent of international promotion Australia should undertake as production increases. Does Australia need to promote internationally, or will the world market increase its purchases of Australian cotton with the increased supply? Can Australian cotton be differentiated from the cotton of other countries to enable Australian cotton

promotion? If Australian cotton is promoted internationally, should a centralised body coordinate the activity or should it be a collective industry effort? These issues will be of great importance as the cotton industry seeks to expand exports into the future.

Strengths and points of vulnerability

Strengths

Some of the particular strengths underlying Australia's performance in international markets include the following.

- An established reputation for high quality cotton, with 80 per cent of exports equivalent to or better than SJV, superior American cotton.
- Support services including ginning have grown quickly to support the rapidly expanding production.
- An established reputation for supply of cotton free of impurities and consistent in quality.
- A freight advantage to Asian markets, particularly Indonesia, compared with other major suppliers.
- A capacity to supply 'out-of-season' to Asian markets compared with the major northern hemisphere suppliers thus reducing storage costs for mills.
- Strong competition from ginners/marketers for the crop means that Australian ginning services are efficient and good value.
- Cotton can be grown in climatic and soil conditions which exist in many places in Australia and, subject to pest control, there is potential for expansion. (For example, on the Ord River plains.)
- The regional nature of the industry along with common interests and problems has encouraged a culture of self-reliance and self-regulation.
- The relative youth of the industry and the small involvement of government means industry organisation and attitudes are market driven.

Points of vulnerability

Some points of potential vulnerability on international markets include the following.

- Competition from synthetics is likely to continue as manufacturers are becoming increasingly able to 'mimic' the characteristics of natural fibres.
- The significance of former USSR countries in both consumption and production makes the general world market dependent on developments in countries where the direction of performance is very difficult to predict.
- A significant reliance on Japan where the textile industry is cutting back and relocating to low labour cost Asian countries, but this reliance is being reduced.
- The fact that cotton can be grown in a wide range of climatic conditions means that there is large potential competition from many countries in the international market place.
- As production subsidies decline in the US a greater proportion may be used for market development and promotion of US cotton.
- If water allocation problems persist and cotton crop volumes do not recover, excess capacity may remain in ginning for some time.
- Increasing geographic spread of cotton in Australia may diminish the industry's capacity for self-regulation.
- Organisations which have participated in a rapidly growing and 'successful industry' may need to be prepared to accept change.
- In wet seasons Australia has sometimes been criticised for supplying rain discoloured cotton.

4 Economics of cotton growing

Key points

- Cotton farming has high dollar turnover and is very capital intensive compared with other rural industries.
- Cotton farmers have faced a similar cost price squeeze to other rural industries, but on most measures of economic performance they have done better on average. The average cash operating surplus of cotton farms in normal times is nearly six times higher than the average for all agriculture. The average total asset value of cotton farms is over three times higher than the average for all of agriculture.
- On the basis of available economic performance indicators and gross margins data, the cotton industry uses resources efficiently.
- The relative profitability of cotton growing compared with other alternative enterprises underlies the growth of the cotton industry.
- Key factors influencing economic performance in cotton growing include maintaining high yields and productivity growth, high levels of crop management and good marketing, including risk management.

Subject to the availability of key inputs such as water, the economics of cotton growing can be boiled down to product prices, input costs and the difference between the two. It is safe to assume that the difference for cotton over most of the past 30 years has been positive and cotton growing has been privately profitable. If it had not been the industry would not have grown as it has.

It is useful to distinguish between the private and social profitability of cotton growing. Social profitability may be greater or smaller than private profitability depending on such things as taxes and subsidies on output and inputs and unpriced external effects of various activities associated with the industry. Cotton in Australia now gets no assistance on output. Moreover, prices of most inputs are raised to some degree by various government charges — for example, import duties. For irrigated cotton, water is the key input and questions of price, and the impact of government policy on price, are much less clear cut. The impact of policy on water is complicated by such things as recovery of fixed costs of water services, treatment of service costs and proposals to levy resource management charges and security of title to continued supply in the future. Over and above questions of price is the question of water availability for while price is important, availability is crucial.

Another part of the calculation of social returns has to do with any unpriced external effects. In the case of cotton there are two possible sets of external effects. One has to do with the impact of the industry on the

surrounding regions and its contribution to the national economy. The other concerns the perceptions of possible impacts of chemical use and water use which may extend beyond the industry. Chapters 5 and 6 address regional and national effects while chapters 7 and 8 address the role of water and chemicals in cotton production.

Cotton prices

Chapter 3 and appendix B canvass the long term factors likely to affect cotton prices. As with most other agricultural commodities, cotton prices have varied considerably over the years and in real terms have shown a marked downward trend. Since the early 1970s this downward trend has been a little steeper than for wool but polyester prices have declined substantially relative to cotton since 1960 (chart C1).

From 1963 to 1971 a bounty on cotton provided a price raising effect to the Australian industry. Since then cotton prices to growers have been unaffected by (Australian) government policies. The protection for Australia's textile and garment industries is not passed on to the cotton industry which in any event exports 90 per cent of output. Indeed, these exports must compete on markets where opportunities are reduced by other countries' import controls or export subsidies.

Prices of inputs

With the exception of interest rates, which have varied considerably since 1976 and which reached very high levels in the late 1980s, prices for most farm inputs have moved more or less in line with inflation. Given the decline in real cotton prices, farmers have been subject to at least the same cost price squeeze as other rural industries.

Policy impacts on input prices/costs

On the input side, duties on chemicals are generally low — except for antidumping duties which frequently apply in the chemical industry. While the price raising effects are small — in the order of 5 to 10 per cent — even that much of an impost for a major input is not trivial. To take a typical share of costs (as calculated in appendix C) a 10 per cent price increase for chemicals would be equivalent to a 5 per cent reduction in gross margin. Similarly, machinery costs are raised by duties in the order

of 10 per cent. Fertiliser costs are raised by a small amount — 1 per cent according to Industry Commission estimates for 1993.

As noted in chapter 3, ginning services seem to be very competitive and not overly affected by government policy — except to the extent that machinery inputs are raised by tariffs.

Whether or not the costs of capital have been raised by macroeconomic management policies is a complex question — to the extent that the costs have been raised then cotton as a capital intensive industry may have been disadvantaged relative to other industries.

This leaves one other input — water — which for irrigated cotton is a small but vital input. In the case of water, policy can affect conditions of supply in several dimensions — reliability of supply in any one period, security of supply over time and, of course, price. These issues are complex and are tackled in chapter 8. For now the main points to conclude are that cotton production:

- receives no benefit from policy on the output side; and
- is disadvantaged by a small but significant amount by duties on imports of machinery, chemicals and fertiliser.

Economic performance

Productivity

Even though the deflated price of cotton has halved since 1971-72, cotton producers have been able to sustain their businesses because of significant improvements in productivity. In particular, yields of seed cotton have increased through better varieties and management systems, and ginning efficiency and turnout have improved.

Cotton growing requires a high level of technical skill. The rate of technological discovery and adoption has probably been higher over the past two decades in cotton than in any other rural industry. Most cotton farmers employ agronomy consultants to advise on, in particular, chemical spray programs. In the future, effective integrated pest management (IPM) will be critical to success. Irrigation management is another critical success factor not only for individuals but for the industry as a whole. The cotton industry has led the way in water management on farms through the use of neutron probes and other technologies. Management of water tailings and efficiency of water use from public storages, however, will come under increasing scrutiny from public authorities. Uncertainties over public water

supplies have led many farmers to increase on-farm water storages at significant cost.

Financial performance

ABARE has not undertaken a survey of cotton growers for several years. But some indication of the economic performance of cotton growing relative to other rural industries can be obtained from the ABS Farm Financial Survey (ABS 1994).

Cotton farms have a turnover, and show a cash operating surplus, several times that of average broadacre properties. But cotton farms also have debts of over $1 million on average, nearly eight times the level of debt for the average agricultural property.

The lower equity levels and much higher absolute levels of debt on cotton farms compared with the rest of agriculture mean that cotton farm businesses can be vulnerable to market downturns or reduced water supplies.

Cotton farms in Australia are capital intensive. In 1992-93 the average total asset value of cotton farms was $3.9 million, over three times the average of $1.05 million for all agricultural businesses.

Gross margins in cotton

Gross margins for irrigated cotton — in a normal year — are much higher than they are for raingrown cotton. According to results presented in appendix C, 'normal' year gross margins in southern Queensland are around $1000 to $1100 per ha compared with $700 per ha in the Macquarie region and $150 per ha for raingrown cotton.

In comparison with other irrigated summer crops on the north-west slopes and plains, gross margins for cotton are much higher than for other crops which could be grown in place of cotton (chart C6). This further explains the dominance of cotton in the irrigated areas of northern NSW and the growth in raingrown cotton.

Farm debts

Cotton farms have been able to carry much higher debts than other farms in agriculture because of their higher earning capacity — in normal seasons. How well farms can service debts depends on existing equity levels and ability to meet interest payments from profits. Appendix C reports details of indebtedness in table C3. Key features of indebtedness in cotton growing in 1992-93 were:

- an estimated 20 per cent of farms had a farm cash operating surplus insufficient to cover interest payments;
- only 8 per cent of farms had an equity of less than 50 per cent;
- very few cotton farms (5 per cent) carry no debt — in contrast to the position for other broadacre farms where one-quarter of farms carry no debt;
- a very small proportion of cotton farms (4 per cent) are in serious financial difficulty, with equity levels less than 50 per cent, and cash incomes insufficient to cover interest commitments (at least in 1992-93); and
- on the other hand, two-thirds of cotton farms had high asset backing (with an asset to debt ratio greater than 5) and can readily cover interest payments — these farms account for nearly one-third of total debt to the industry.

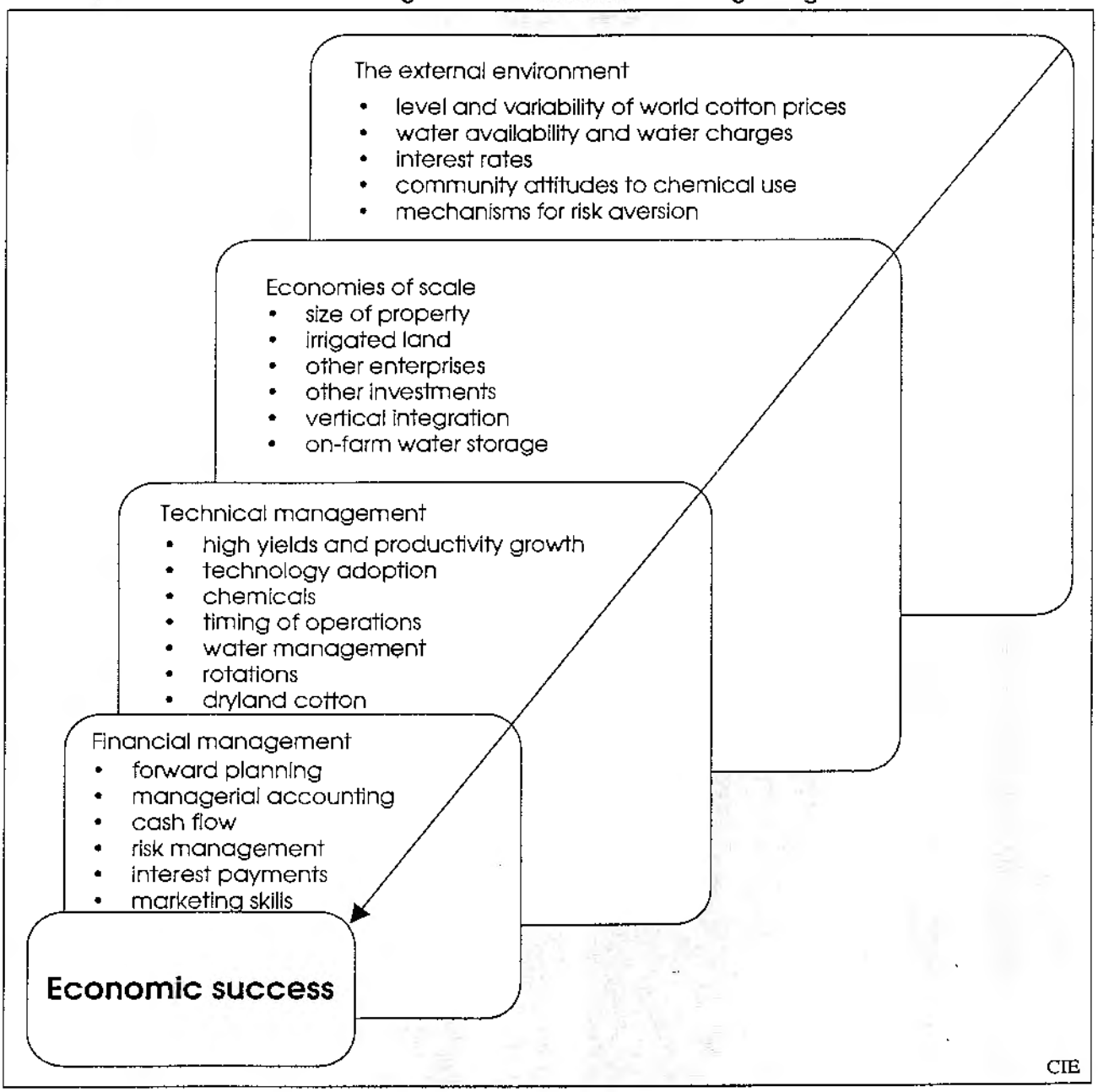
The cotton industry in this respect shows a profile which contrasts with that of broadacre agriculture. For the latter, a high proportion of total industry debt is held by farms with very low levels of equity — characteristics of farms struggling to survive.

The profile for cotton indicates an industry borrowing substantially to invest and move ahead, rather than borrowing to survive as appears to be the case with broadacre agriculture. (Successive years of drought with little or no crop could put this positive profile under some pressure.)

Evaluation and issues for the future

Cotton growing requires high levels of capital and a high degree of technical and financial managerial skill. But in future years success will also be determined by the interplay of many external factors. Some of the main factors underlying economic performance are summarised in chart 4.1.

Chart 4.1 **Critical factors determining economic success in cotton growing**



While prices are obviously important to success, the industry has shown over 30 years that it can cope with the fluctuations of the world market and with steady decline in world prices. But the Australian industry has until recently developed around reliable and cheap water. Since water as a share of total costs is small, security of supply is a crucial issue for the future.

Management of risk is a key factor. Sources of risk include physical factors such as uncertainties of water supplies from publicly owned water storages, risk of crop damage through insects or excessive rainfall at harvest, and marketing risk through uncertainties of world cotton prices

and the value of the Australian dollar. More than most farmers, cotton growers manage price risk by hedging or forward selling or, in some cases, selling to merchants who operate pools. Many cotton farmers also hedge for exchange rate risk. Cotton farmers generally have more experience in private hedging than farmers in industries where statutory marketing has meant that government authorities have rounded out private risk management activities and reduced the total amount of risk management going on.

Large farms, some vertically integrated, have been significant features of the Australian cotton industry. Economies of size are likely to continue to be important with increasing emphasis on on-farm water storages and increased efficiency in water use.

In the future the external environment will play an increasingly crucial part in the success of the industry. Rightly or wrongly, community perceptions that the cotton industry uses excessive amounts of toxic chemicals are hardening and monitoring for chemical presence in public waterways is likely to intensify. Commercial sustainable use of transgenic cotton will be crucial for the industry to lessen its dependence on chemical use. In the meantime, the industry is vulnerable to changes in policy regarding chemical use, especially endosulfan. Widespread adoption of Integrated Pest Management (IPM) will be critical. These issues are taken up in later chapters.

Strengths and points of potential vulnerability

Strengths

- Cotton has emerged in the main growing regions as the most effective user of available water based on economic merit.
- Techniques and on-farm investment have rapidly developed to make best possible use of available water.
- Good varieties and production methods combined with the local environment and, until recently, adequate water supplies have enabled the Australian industry to match the world's best for yield.
- Effective development of raingrown cotton production has evolved, particularly given recent scarcity of irrigated water. But it remains a small component in NSW.
- Input costs are substantial and have warranted strong support services to help growers make the best possible use of chemicals, fertilisers and labour.
- Both the abovementioned pressures, economic and attitudinal, have encouraged the search for low chemical input solutions. Fillage and time of planting, for example, can limit the need for chemicals. The potentially most significant breakthrough is transgenic cotton.

Points of vulnerability

- Rapid growth until 1992 was made possible by adequate water supplies. The drought and subsequent problems of allocation have emphasised the significance of water to the industry as it is now structured.
- The specialised nature of farms makes farming units and regional support services vulnerable to downturns in the cotton industry whether due to shortages of water or downturns in price.
- The commonality of interest and regional forces which has helped self-regulation may come under pressure as the significance of raingrown cotton in other regions and plantings by opportunity growers expand.
- There is a risk that ineffective and unnecessarily costly regulation will be imposed on tasks that could be done cooperatively — to greater effect and at lower cost.
- There are concerns that an expanding industry and the need to protect past investments may break down incentives for continued wise chemical use.
- There is the concern that the costs of such regulation on the industry and on the economy will not be counted properly as new regulations are imposed by governments.

5 The regional significance of cotton

Key points

- Cotton growing is regionally concentrated and where it occurs it is often a leading regional activity. In several cases, this has created a high degree of dependence of local economies on cotton.
- While cotton depends on local regions for much of its labour and services inputs, there are other major requirements such as fertilisers and chemicals which are largely 'imported' and all ginned cotton is exported from the regions where it is grown.
- Regional multipliers, which are often used to illustrate regional impacts of activities such as cotton, must be used cautiously in projecting the likely effects of expanded or contracted cotton activity on regional employment and incomes.
- Cotton is an efficient contributor to the entire Australian economy and not simply to particular regions.

Cotton production has had an enormous impact on the value of agricultural output in the regions where it is grown, particularly as most of the cotton producing land was not developed prior to the introduction of the crop. By way of example, prior to irrigation in the Gwydir Valley, country now irrigated would have carried approximately two dry sheep equivalents (DSEs) per hectare to produce, say, 10 kilograms of wool. In some years, when there was sufficient rainfall, a crop of wheat could be achieved and the yield would probably have averaged in the order of 1.2 tonnes per hectare. This same developed and irrigated hectare, given adequate water, can now produce 1.8 tonnes of lint plus about 2.5 tonnes of cotton seed which is used for the production of vegetable oil and stock feed.

According to the Department of Water Resources (DWR) — now the Department of Land and Water Conservation (DLWC) (Water Resources of the Namoi Valley) — in the first decade of irrigation of one of the two largest cotton growing catchments, the Namoi, populations within and near the development grew substantially — Wee Waa by 68 per cent and Narrabri and Gunnedah by about 30 per cent — at a time when the populations of many towns in the state's rural areas were stagnating or in decline.

Where conditions for growing cotton have been most favourable, cotton has tended to dominate other forms of irrigated agriculture in those regions. Table 5.1 illustrates its relative importance compared to other irrigated crops in the irrigation regions of Queensland and NSW.

Table 5.1 **Area of irrigated cotton compared with other irrigated crops**

Valley	*Cotton*	*Total irrigation*	*Cotton as % of total*
	'000 ha	'000 ha	
Gwydir (90-91)	75	77	97
Namoi	39	56	70
Macquarie	41.5	99	42
Bourke	7	10	70
Macintyre (NSW)	27	29	93
Lachlan (91-92)	1	69	1
Murray (91-92)	-	64.5	-
Murrumbidgee	-	73	-
Lower Darling (91-92)	5	8	63
Irrigation. areas & districts			
Murray	-	720	-
Murrumbidgee	-	564	-
Lachlan	-	88	-
Total NSW	195.5	1857.5	11
Qld North	-	59	-
Qld Central	19	40	48
Qld SE	1	100	1
Qld South	22.5		
Total Qld	42.5	254	17
Total Australia	238	2111.5	1.1

Source: NSW DWR 92-93 year except where otherwise shown and Qld DPI Annual Statistics 1992-93.

The DLWC divides the state of NSW into irrigation regions for administrative purposes. The greater part of the cotton crop is grown in the Barwon Region. In 1993 the agricultural production of the Barwon Region was estimated to be worth $1190 million and accounted for 20.5 per cent of the state's agricultural production. Of that $1190 million, $643.7 million was crops, of which cotton comprised 60.2 per cent by value. Thus cotton contributed approximately 33 per cent of the total agricultural output in this north-western region of NSW that supports such regional centres as Tamworth, Gunnedah, Narrabri and Moree.

In the Macquarie Region, where cotton has been extensively grown, agricultural production in 1993 was estimated to be $520.6 million, of which crops accounted for $242.5 million with cotton's share being 33.2 per cent.

The regional impact of cotton can also be understood through its impact on labour markets. The cotton industry employs labour on several levels, much of it within the cotton growing region itself. At the managerial level, some of the best salary packages available in agriculture are offered by the larger companies, many of which offer career paths particularly from agronomist to manager to general manager level. Attractive salaries are also offered in the ginning industries and here also a career path is offered from a semiskilled level upwards.

Skilled and semiskilled workers are attracted to work for the cotton industry driving farm equipment, irrigating, and working as mechanics because awards are above those in the non-cotton rural industries and because opportunities exist for job rotation and promotion.

Farms having over 500 hectares of cotton usually employ some administrative assistance, sometimes on a part time basis. The cotton industry has been a source of employment for many trained farm secretaries. Smaller farms might use secretarial services provided in the local town. The larger companies use their own accounting staff.

Most of the relatively unskilled work — for example, cotton chipping and aerial marking — is provided by contractors. Chipping can be an important 'second' income for families in regional centres where cotton is grown. Labour requirements for some of this sort of work are likely to drop over the next ten years. In aerial agriculture, many operators are moving to satellite-based GPS systems based in the aeroplane itself. Thus, physical markers may not be required.

Of about 100 aerial agricultural operators in the eastern states it is estimated that 38 depend wholly or partly on the cotton industry for their living. Some of these companies are based in more than one valley, so there is considerable competition. As cotton production has expanded, so have a number of supporting industries including cotton consultants, seed suppliers, oil seed processors, machinery suppliers and repairers, earth moving contractors, harvesting contractors and, of course, ginning providers.

Cotton in the northern statistical division

Table 5.2 shows the increase in the value of agricultural production in each statistical division in NSW. Most of the cotton industry is located in the northern statistical division. In 1991-92 cotton accounted for nearly half of the value of agricultural production in this statistical division, compared with around 40 per cent in 1981-82. The table shows that the value of agricultural production in the northern statistical division as a whole increased over the ten years to 1991-92 at a rate slightly above the average for the state of NSW. In 1991-92, the highest value of agricultural production was in the northern statistical division.

Table 5.2 **Gross value of agricultural commodities produced in statistical divisions in NSW ($'000)**

	1981-82	*1991-92*	*Per cent increase*
Hunter	213 072	377 167	77.0
Illawarra	48 582	80 044	64.6
Richmond-Tweed	111 742	231 502	107.3
Mid North Coast	118 029	209 341	77.4
Northern	**636 190**	**1 133 565**	**65.2**
North West	437 040	668 222	52.9
Central West	491 230	668 236	36.0
South Eastern	232 982	392 522	68.5
Murrumbidgee	528 950	873 432	65.4
Murray	427 046	693 658	62.3
Far West	36 169	62 954	74.7
NSW[a]	**3 590 028**	**5 804 146**	**61.6**

[a] Includes Sydney statistical division.
Source: ABS, Regional Statistics NSW, Catalogue No 1304-1.

Input-output (multiplier) analysis attempts to quantify regional dependence

Several small regional economies greatly depend on cotton. But the task of quantifying the extent of this dependence is quite difficult. For example, there is the problem of defining a 'regional economy' for these purposes.

A method adopted in some regional studies is the calculation of regional multipliers. These are variously expressed in output, employment and income terms. This is done through the construction of regional input–output tables which include cotton growing and processing as individually identified activities. This approach will give a picture of the direct demands on other activities made by cotton growing, processing and marketing within an arbitrarily defined region. It shows how reliant cotton activities are on other activities and how linked these other activities are to cotton. The more dependent is cotton on inputs *from* the region, and the bigger is cotton's share of the output of the region, the more dependent is the region on cotton.

This approach has, as a first step, to quantify the dollar value of input requirements of each type required to grow $1000 worth of cotton. These will include commodity and service inputs, including labour. They will also include all the 'imports' from outside the region. In the case of cotton growing these imports will include the chemicals, fertilisers, vehicles and parts, etc. not manufactured in the region. The task is repeated for cotton ginning and for all other activities of interest in the region. This gives a picture of the input requirements for each of the industries in the region.

Measuring direct effects and linkages to the regional economy

Based on a study of the Macintyre catchment area, Powell (1993) estimated that about 11 per cent of the value of irrigated cotton and 21 per cent of raingrown cotton was attributable to the purchases of 'agricultural services' such as weeding, spraying and harvesting. These outlays find their way back into local communities (table 5.3).

A further 6-7 per cent of the value of cotton output was being directly absorbed by local marketing activities.

The direct labour requirements of cotton within the catchment appeared to be less than 10 per cent of the gross value of output but this ignored the fact that labour is also purchased as 'agricultural services' to cotton and is provided by owner–farmers.

When all types of labour or services were considered, cotton appeared relatively labour intensive compared with most other crops, with labour's share of output typically exceeding 25 per cent.

The effects of cotton growing through direct local demands for other manufacturing inputs to cotton growing were less pronounced than for the other major agricultural activities of the region. As a big user of chemicals, the cotton industry has a significant proportion of its total inputs sourced externally to the region. Fertiliser and insecticides are a major component of the 'imports' items. Only the wholesale and retail activities associated with the supply of these inputs to cotton farming are truly local inputs (recorded again as a component of the 'trade' input).

Table 5.3 **Dollar value of input requirements from other sectors to produce $1000 worth of cotton**

Sector	*Irrigated cotton*	*Raingrown cotton*
	$	$
Agricultural services	107	210
Water, electricity	26	1
Building services	5	1
'Trade' and marketing activities	64	73
Transport	20	20
Finance	23	17
Other services	3	1
Total regional intermediate imports	278	339
Household labour	86	71
Other value added	282	265
'Imports' (eg. fertilisers, chemicals)	353	325

Source: Derived from Powell et al. 1993

The direct 'forward linkages' or 'downstream' effects of cotton in the region are determined by its uses as an input to other industries within the region and so are confined to ginning and oilseed processing in Australia's cotton growing areas since the further processing of cotton lint into yarns and fabrics takes place outside the growing areas.

Regional multipliers try to measure direct plus indirect effects of cotton

Regional multiplier analysis based on estimates of this kind seeks to go further than an appraisal of these direct effects to answer the following sorts of questions.

- What will be the effect of an increase/decrease of $1000 worth of cotton production on the total production of the region?
- What effect will such an increase have on *total* demand for labour in the region?
- What will these answers be if we focus on an increase/decrease in the demand for cotton from its users who are outside the region?
- What effects will there be from such changes for regional incomes?

Effects are often characterised as direct and indirect (or flow on) effects. Indirect effects comprise production induced and consumption induced effects. For each of the local inputs to cotton producing (say, financial services) there will in turn be a set of input requirements required for $1000 worth of *its* output. Cotton growing activity will have local financial services as one of its inputs. But financial services in the Macintyre Valley, for example, will have its own set of input requirements. Any stimulus to cotton production will induce an effect on its direct inputs (seed, chemicals, agricultural and financial services, etc.) which in turn will place demands on other industries. Expansion or contraction of cotton will generate household income changes and expenditure changes by consumers in the region that will in turn induce further output changes in non-cotton activities.

These direct and indirect effects are responsible for the final size of the total effects attributed to cotton output on the regional economy.

Results of a study of the Macintyre catchment

The results in table 5.4 are interpreted as showing, for instance, that for every $1 worth of Macintyre valley irrigated cotton demanded by the world's cotton users, an additional 49 cents worth of flow on effects is created in the catchment as a whole. Multipliers of this type inevitably

increase as the size of the region under consideration increases as more of the larger region's needs are met from within the region and the relative importance of 'imports' diminishes. The effects will also naturally increase if the definition of the industry in focus is enlarged to include growers from outside the region.

In the results provided in table 5.5 Powell et al have calculated the effects of the cotton growing activities of the combined Macintyre and Gwydir valleys on the catchment region. When expressed in output, income and employment shares they create a picture of very great dependence of the regions on the cotton industry. Other regions with more diversified economic activity such as the Darling Downs would show a much lower dependence.

In a more recent study of the economic impact of the Gwydir Valley cotton industry, Powell and Chalmers (1995) constructed input–output tables for the valley to calculate regional multipliers of the cotton industry. Their key conclusions were as follows:

Table 5.4 **Cotton industry multipliers for the Macintyre Valley catchment** 1991-92

	Initial effect	*Production induced*	*Consumption induced*	*Total flow-on*	*Total*	*Type II*
Output ($'000)						
MV Irrigated cotton component	1.0000	0.3684	0.1207	0.4890	1.4890	1.4890
MV Dryland cotton component	1.0000	0.4448	0.1166	0.5614	1.5614	1.5614
MV Ginning component (exc. flow-ons to growers)	1.0000	0.1808	0.1227	0.3035	1.3035	1.3035
MV Ginning (inc. flow-ons to growers)	1.0000	1.2101	0.1207	1.3308	2.3308	2.3308
MV Cotton marketing	1.0000	0.0770	0.0974	0.1744	1.1744	1.1744
Total industry	1.0000	0.3353	0.1196	0.4549	1.4549	1.4549
Income ($'000)						
MV Irrigated cotton component	0.0858	0.1056	0.0467	0.1524	0.2381	2.7765
MV Dryland cotton component	0.0714	0.1135	0.0452	0.1587	0.2301	3.2227
MV Ginning component (exc. flow-ons to growers)	0.1362	0.0583	0.0475	0.1058	0.2420	1.7771
MV Ginning (inc. flow-ons to growers)	0.0188	0.1726	0.0467	0.2193	0.2381	12.6748
MV Cotton marketing	0.1265	0.0280	0.0377	0.0657	0.1922	1.5199
Total industry	0.0923	0.0961	0.0463	0.1425	0.2359	2.5240
Employment (no.)						
MV Irrigated cotton component	0.0025	0.0041	0.0019	0.0061	0.0086	3.4358
MV Dryland cotton component	0.0077	0.0048	0.0019	0.0066	0.0143	1.8644
MV Ginning component (exc. flow-ons to growers)	0.0103	0.0020	0.0020	0.0039	0.0143	1.3810
MV Ginning (inc. flow-ons to growers)	0.0014	0.0064	0.0019	0.0083	0.0098	6.8615
MV Cotton marketing	0.0054	0.0010	0.0016	0.0025	0.0079	1.4741
Total industry	0.0040	0.0038	0.0019	0.0057	0.0097	2.4453

Source: Powell et al 1993.

Table 5.5 **Summary of the combined Macintyre and Gwydir Valleys' cotton industry impacts on the catchment region** 1991-92

Sector	*Component*	*Unit*	*Direct effect*	*Flow-on effect*	*Total effect*	*Share of region*
Cotton production						
	Output	$'000	375 252	184 194	559 446	
	Income	$'000	32 049	57 235	89 285	
	Employment	Number of jobs	985	2 285	3 270	
Ginning (net of purchases from growers)						
	Output	$'000	60 040	18 222	78 262	
	Income	$'000	8 177	6 352	14 530	
	Employment	Number of jobs	618	240	859	
Marketing operations						
	Output	$'000	23 692	4 132	27 824	
	Income	$'000	2 996	1 558	4 554	
	Employment	Number of jobs	127	60	187	
Total industry						
	Output	$'000	458 984	206 548	665 532	37.64
	Income	$'000	43 223	65 145	108 368	29.93
	Employment	Number of jobs	1 730	2 586	4 316	28.10

Source: Powell et al 1993.

- the Gwydir Valley cotton industry represented around 47 per cent of gross regional output in 1990-91 but this fell to 30 per cent in 1992-93 and 1993-94;
- the total contribution of the cotton industry to regional household income fell from 30 per cent in 1990-91 to 20 per cent in 1992-93 and 1993-94;
- the total contribution of the cotton industry to regional employment was around 30 per cent in 1990-91 but this fell to 23 per cent in 1992-93 and 1993-94;
- for every person employed directly in the growing of cotton, another two people have jobs in the region because of cotton activities in the region; and
- the Gwydir Valley has been severely affected by lack of irrigation water because of drought. Industry profits have declined from $70 million in 1990-95 to -$90 million in 1993-94 and an estimated -$30 million in 1994-95.

Caution needs to be exercised when interpreting regional multipliers

An employment multiplier of, say, 3.4 is sometimes interpreted to mean that for every job in a given industry another 2.4 jobs are 'created' elsewhere in the regional economy. Such interpretations are not plausible. It would not be persuasive to conclude that an employment multiplier of,

say, 3.4 means that if cotton growing in the region were cut back then for every cotton job lost a further 2.4 jobs elsewhere in the region would be lost. Such an argument would not hold because there would inevitably be some offsetting effects through, for instance, more water becoming available for other irrigation activities. Such adjustments would substantially dilute the impacts implied by regional multipliers.

The linkages between regional activities that are captured in these input–output multipliers are snapshots of expenditure flows between industries at a point in time. As such they have a limited ability to forecast response to change. They are uninformative as to what would happen in a region in the event of, for instance, a sustained and significant change in relative prices since they do not capture substitution responses by farmers between other inputs (the gradations between irrigated and dryland cotton production) or between cotton and other crops.

Evaluations and issues for the future

There is no doubt that cotton is an important source of income for many people in cotton growing regions in northern NSW and southern Queensland. And from a political economy point of view these people have a strong collective interest in seeing that the industry stays strong. Their coincidence of interests is obvious and the cost of them organising to make a case to government is relatively low.

However, many regional economies in Australia which were once economically healthy due to the presence of a single industry have suffered, and been allowed to suffer abrupt reversals of fortune. Through the 1970s the north coast dairy industry and the Tasmanian apple and pear industry underwent substantial contraction and adjustment. Regional arguments which were used to support requests for protection for the Australian textiles clothing and footwear industries eventually came to be rejected as a basis for continuing protection.

In cotton's case the issue is a matter of balance. Though the regional characteristics of the industry are important, the more important point is that cotton contributes both to the region and the economy at large without help from government. It is an efficient industry.

Strengths and points of potential vulnerability

Strengths

- Cotton dominates irrigated agriculture in cotton regions.
- Cotton production employs labour over a range of skill levels as does processing and distribution.
- Multiplier calculations suggest some regions are very dependent on the cotton industry.

Points of vulnerability

- The strong regional focus of the Australian cotton industry reflects past availability of water in a suitable climatic area. To the extent that water supplies become limiting, any expansion of cotton production will take place outside traditional regions.
- The tendency for regional multipliers to overstate the impact of an expansion or contraction of a particular industry on employment and output in a region is widely known.

6 Economy-wide analysis

Key points

- Cotton growing and ginning is disadvantaged by the structure of industry taxation and assistance policy in Australia.
- This means that the cotton industry has grown over 25 years despite, and not because of, government policies.
- A depiction of the cotton industry in a model of the Australian economy shows cotton to be a relatively small but significant part of Australian agriculture.
- Using this model, results show that an increase of 30 per cent in world cotton price would result in a 7 per cent expansion of cotton production, an 11 per cent expansion of cotton exports and an 80 per cent improvement in incomes of cotton farmers.
- The model also shows that a doubling of irrigation water prices would cause production to contract by about 1.5 per cent and the incomes of growers to fall by 10.6 per cent.
- According to the model, cotton growing is hurt rather than helped by protection to the domestic clothing and textiles industry.

Cotton is a relatively small but significant part of Australian agriculture. In the peak production year of 1991-92 the total value of cotton production and exports was just under $1 billion. This made cotton the fourth largest rural exporting industry in that year. In relative terms, however, cotton makes up less than 5 per cent of rural production exports and value added (table 6.1). In NSW cotton makes a more significant contribution to agriculture — 11 per cent in 1991-92 — but drought has reduced this to 7.6 per cent in 1993-94.

Economic effects of some events and policies of relevance to the cotton industry

The CIE has constructed an economy-wide model to assess the effects on the performance of the cotton industry, other industries and the overall economy of a range of events and policies.

The economy-wide model, known as ORANI-COTTON, is a special purpose version of the ORANI model of the Australian economy. A non-technical description of the ORANI model is given in Industries Assistance Commission (1987).

The cotton growing and ginning industry has a small negative effective rate of assistance (–2 per cent in 1992-93).

Table 6.1 **Contribution of cotton to Australian and state agriculture**

	Unit	*1986-87*	*1991-92*	*1993-94*
Australia				
Value of production				
Cotton[a]	$m	361	972	739
Agriculture	$m	17 302	20 937	23 302
Cotton/agriculture	%	2.1	4.6	3.2
Value of exports (fob)				
Cotton[a]	$m	345	975	767
Agriculture	$m	12 196	14 557	17 683
Cotton/agriculture	%	2.8	6.7	4.3
Adjusted value added				
Cotton[a]	$m	na	363	339
Agriculture	$m	na	6 738	8 941
Cotton/agriculture	%	na	5.4	3.8
New South Wales				
Value of production				
Cotton[a]	$m		652.9	483.3
Agriculture	$m		5851.1	6340.7
Cotton/agriculture	%		11.1	7.6
Queensland				
Value of production				
Cotton[a]	$m		225.9	168.9
Agriculture	$m		4560.4	5206.9
Cotton/agriculture	%		5.0	3.2

[a] Cotton seed and lint.
Source: ABARE, *Australian commodities* (various issues); ABS *Agricultural Finance Statistics*, No. 7503.0.

ORANI-COTTON distinguishes over 100 sectors of production including cotton, wool, other farm based crop and livestock commodities and the downstream processing of cotton into textiles, clothing and other cotton based products.

To help assess cotton's responsiveness to its economic environment and, in turn, its impact on the national economy we use the model to evaluate the effects of the following changes:

- a reduction in domestic cotton production of 40 per cent — through a reduction in irrigation water available for cotton;
- a doubling of irrigation water prices to cotton growers (against 1992-93 price levels);
- a 30 per cent increase in the world price of cotton;
- an expansion in domestic output of cotton yarn of 20 per cent achieved through an improvement in labour productivity in yarn production;
- a 50 per cent reduction in the quantity of chemicals used in cotton growing — through the use of transgenic cotton;

- tariff reductions on clothing and textiles according to the schedule specified in the Prime Minister's March 1991 statement *Building a Competitive Australia* (average nominal rate of protection on textiles falls from 21 to 7 per cent and average nominal rate on clothing falls from 68 to 20 per cent); and
- tariff reductions on clothing and textiles as specified above together with general productivity improvements in these industries sufficient to maintain current output levels in clothing and textiles.

A selection of results is shown in table 6.2.

The results refer to the short term — about two years after the change has occurred. They measure the per centage change in a model variable from the level it would have reached had the change not occurred.

The 40 per cent reduction in cotton production (equivalent to $270 million) has a small impact on real GDP (decline of 0.09 per cent). This reflects the cotton industry's small share of GDP. The adjustment burden is borne by cotton growers and the cotton ginning industry and to some extent by regional economies, as discussed in chapter 5. The decline in cotton production and income causes a small reduction in the economy's overall cost level which improves the international competitiveness of other agricultural industries.

The doubling of irrigation water prices causes cotton production to contract by about 1.5 per cent and the incomes of cotton growers to fall by 10.6 per cent. Effects on other industries and the macroeconomy are negligible.

The increase in world cotton price of 30 per cent results in a 7 per cent expansion in cotton production, an 11 per cent expansion in exports of ginned cotton and an 80 per cent improvement in the real incomes of cotton growers. This simulation assumes that water would be available to accommodate this expansion and to some extent may overstate responses in practice. The expansion in export revenue is sufficient to raise real GDP and real household consumption by 0.02 and 0.06 per cent respectively. Faced with higher cotton input costs the domestic cotton fabric and yarns industry and other textile activities contract. The increase in demand in the economy causes a small increase in the general cost level and hence reduction in the international competitiveness of other agricultural industries. This is the reason behind the small contractions in output and incomes in other agricultural activities.

Table 6.2 **Some economy-wide effects over the short term of selected events and policies of relevance to the cotton industry** Per centage change from base

	Cotton output falls 40% due to drought	*Irrigation prices double against 1992-93 rates*	*World price of cotton increases by 30%*	*Cotton yarn output expands by 20% through labour productivity*	*Crop chemicals used to grow cotton reduced by 50% through transgenic cotton*	*Tariff reductions on textiles & clothing according to March 1991 statement*	*Tariff reductions on textiles & clothing according to March 1991 statement: productivity gains to prevent output in textile & clothing industries from falling*
Real GDP	-0.09	0.00	0.02	0.03	0.00	0.08	0.56
Real household consumption	-0.03	0.00	0.06	0.02	0.00	0.08	0.41
Real incomes							
Pastoral	0.74	0.03	-0.47	0.01	-0.01	1.71	2.32
Wheat-sheep	0.72	0.03	-0.53	0.01	-0.01	2.06	2.82
High rainfall	0.67	0.03	-0.52	0.03	-0.01	2.20	3.10
Northern beef	0.63	0.03	-0.65	0.04	-0.01	2.89	4.03
All agriculture	-0.60	-0.29	1.85	0.04	0.13	2.17	3.13
Cotton growers	-31.07	-10.60	81.08	0.54	4.79	1.36	2.09
Cotton ginning	-80.91	-7.08	45.67	0.36	3.17	0.91	1.39
Output by commodity							
Wool	0.07	0.00	-0.05	0.00	0.00	0.17	0.22
Sheep	0.08	0.00	-0.06	0.00	0.00	0.20	0.26
Wheat	0.08	0.00	-0.05	0.00	0.00	0.13	0.13
Barley	0.06	0.00	-0.04	0.00	0.00	0.17	0.23
Other grains	0.05	0.00	-0.06	0.02	0.00	0.42	0.71
Meat cattle	0.08	0.00	-0.06	0.00	0.00	0.23	0.28
Semi processed wool	0.23	0.01	-0.25	0.03	0.00	0.69	0.83
Raw cotton	-40.00	-1.46	7.33	0.07	0.64	0.19	0.28
Cotton ginning	-40.01	-1.46	7.33	0.07	0.64	0.19	0.28
Cotton fabrics and yarns	-0.89	-0.02	-7.71	20.00	0.01	-18.22	0.00
Other textiles	-0.03	0.00	-0.37	0.30	0.00	-7.81	0.00
Clothing	0.01	0.00	-0.11	0.22	0.00	-7.07	0.00
Output by zone							
Pastoral	0.05	0.00	-0.03	0.00	0.00	0.12	0.17
Wheat-sheep	0.06	0.00	-0.04	0.00	0.00	0.17	0.23
High rainfall	0.10	0.00	-0.08	0.00	0.00	0.34	0.47
Northern beef	0.17	0.01	-0.17	0.01	0.00	0.76	1.05
All agriculture	-0.93	-0.03	0.11	0.00	0.01	0.24	0.31
Exports							
Wool	0.06	0.00	-0.04	0.00	0.00	0.15	0.21
Sheep	0.10	0.00	-0.03	0.00	0.00	0.08	0.16
Wheat	0.13	0.01	-0.05	-0.01	0.00	0.06	-0.01
Other grains							
Meat products	0.30	0.01	-0.25	-0.05	-0.01	0.72	0.56
Semi processed wool	0.25	0.01	-0.22	-0.01	0.00	1.08	1.39
Ginned cotton	-52.93	-1.93	11.28	-3.78	0.85	4.23	3.87

Source: ORANI-COTTON: CIE.

The improvement in labour productivity in cotton yarn production causes an increase in domestic demand for cotton. But the expansion in domestic cotton production needed to meet this demand is only 0.07 per cent. This is because of a redirection of cotton from the export market to meet the needs

of domestic processors. Cotton exports fall by nearly 4 per cent. Real incomes of cotton growers expand by only 0.5 per cent. The expansion in labour productivity causes real national income to increase by 0.03 per cent.

A 50 per cent reduction in the quantity of chemicals used in cotton production improves the international competitiveness of the growing industry. Cotton output and exports expand by 0.6 and 0.9 per cent respectively and the real incomes of cotton growers increase by nearly 5 per cent. The effect on overall macroeconomic performance is negligible.

Tariff reductions on textiles and clothing cause a reduction in output of the domestic cotton fabric, textiles and clothing industries as domestic market share is lost to imports. However, the reduction in the economy's overall cost level through lower textile and clothing prices improves the international competitiveness of cotton and other agricultural industries. As a result, domestic cotton production expands through greater cotton exports and real incomes of cotton growers increase by about 1.4 per cent. National income is also improved (increase in GDP of 0.08 per cent) as a result of the expansion in efficient export industries and contraction in the import competing textile and clothing industries.

Tariff reductions on textiles and clothing, together with productivity improvements in these industries, accentuate the gains to the cotton industry, other agricultural industries and the national economy. Real GDP expands by about 0.6 per cent.

Strengths and points of potential vulnerability

Strengths

- For more than 20 years the cotton industry has been grown on economic merit — and not because of assistance from government.
- It does not benefit from or depend on protection to Australia's clothing and textile industries.
- When efficient industries such as cotton expand so does real GDP — though not by much as cotton is small relative to the economy.

Points of vulnerability

- It is estimated that a doubling of irrigation water prices would cause cotton production to contract by about 1.5 per cent and the incomes of cotton growers to fall by 10.6 per cent.
- While an increase in world cotton prices could lead to expanded production and exports, water availability is crucial.
- A large decline in cotton production would have a relatively small impact on GDP. The impact would be borne by growers, processors and by people in the regional economies.

7 Water for cotton

Key points

- Scarce water in key growing areas is imposing constraints on the industry. It is partly the legacy of over-allocation in the past.
- Irrigators who have significant 'sunk' capital are responding by trialing new methods to conserve water and building on-farm storages. New areas for cotton growing are being trialed and some new water infrastructure is proposed in Queensland.
- Increasing claims for water for other uses are increasing growers' doubts about security of water entitlements.
- Reforms in water pricing will increase costs for cotton growers along with other irrigators.
- Prior or simultaneous improvements to security of entitlements are an essential accompaniment to water pricing reform.

Limited water supplies from public water storages are imposing constraints on cotton production. The shortage of water has also led to calls from competing users, including environmental lobby groups representing the environment, for reallocations of the existing supplies of water. Government responses to these calls and other policy directions such as the Hilmer recommendations have the potential to impact heavily on the cotton industry.

This section outlines the characteristics of the supply and use of irrigation water, current direction in government water policy, and the implications for the cotton industry. In doing so it takes up the key characteristics of water that matter to cotton farmers:

- water availability (volume);
- water reliability and water property rights — the key to security;
- water price; and
- sustainability.

Ownership and allocation

In Australia, water rights have been vested in the crown and are under the control of the individual states. Under the NSW Water Administration Act the ultimate rights to the state's water are vested in the Ministerial Corporation, which in turn delegates these powers to the Department of Land and Water Conservation, the state's overall manager of water resources. It operates state-wide systems for allocating rights to the use of

water resources, licenses the use of those resources and monitors the quantity and quality of the resource. In Queensland the Department of Primary Industry – Water Resources (DPI) exercises similar functions.

Water for cotton is supplied under a wide variety of arrangements. Private river pumpers predominate, but cotton is also grown on government owned channel irrigation systems in Queensland and by irrigators participating in private irrigation schemes on the Macquarie River in NSW.

Dividing up the available water — licences and allocations

Water for irrigating cotton and other crops is drawn from both surface water supplies and groundwater aquifers. The surface water from streams may be from 'regulated' or 'unregulated' flows. The term 'regulated' is used for a stream on which a storage dam controls or regulates the flow to a large degree. Of course, the stretches of a river above major storages are essentially unregulated.

The allocation of water from the major storages is determined by the Department of Land and Water Conservation in NSW and DPI – Water in Queensland who apportion water among competing users, including in-stream use and other extractive users. The rights to 'take and use' this water allocation are formalised through licences. Except for minor household and stock use, all use of water from any stream, regulated or unregulated, must be licensed.

On regulated rivers, water use apart from minor stock and household use is subject to annual allocation by *volume*. Each licence specifies a certain allocation of an annual volume of water and all water extractions from the river are metered. The licences may specify that the water entitlement is 'high security' — a typical condition for country towns and permanent plantings such as vines, citrus, etc. — in which case the licence holder may expect to receive 100 per cent of the specified allocation except in years of extreme drought.

Cotton growers and other annual crops do not have high security licences. In any one year the water managers, having determined the likely availability of water in major storages and likely inflows to regulated stretches of rivers, will divide up the available water in proportion to licensed entitlements. This can be described as 'release sharing' among the users. A cotton grower may therefore receive, say, 60 per cent of her/his nominal entitlement. In extreme years there may be no water allocated other than high security water.

How much is there to share?

The supply of water in cotton growing areas of NSW is characterised by a low average run off from catchments into river systems and a high variation in river flows. Major storages have been introduced to capture water and deal with variability. But low average run off remains a problem. Table 7.1 outlines the characteristics of the major storages servicing the principal cotton growing areas of NSW.

The availability of water for cotton irrigation is dependent on the following.

- In regulated river valleys availability depends on:
  - the capacity for water capture and storage through on-stream dams and weirs and off-stream capture and storage of pumped water and run off water on farms where cotton is grown or growable;

Table 7.1 **Cotton valleys and their water supply (Gigalitres)**

	Average annual discharge	*Main dam capacity*	*On-farm storage*	*Licensed diversion 1990*
Lachlan (minor for cotton)	1.270	1.22	0	0.249
Barwon/Darling	na	0	0.105	na
Macquarie	1.350	Burrendong 1.190 Windamere 0.368	0.042	0.419
Namoi	4.000	Keepit 0.426 Split Rock 0.397	0.080	0.265
Gwydir	0.860	Copeton 1.364	0.300	0.316
Border rivers (NSW)	0.800	Pindari 0.312 (enlarged)	0.120	0.142
Emerald I A		Fairbairn 1.440		0.155
Dawson		Theodore & Glebe Weirs 0.022	0.100	0.031
Callide		Callide & Kroombit D's 0.140		0.013
St George		Beardmore 0.101		0.083
Border rivers		Glenlyon 0.254	0.100	0.065
Macintyre Brook (minor for cotton)		Coolmunda 0.075		0.011
Upper Condamine		Leslie 0.108		0.025
Chinchilla Weir		0.009		0.002
Private Water Harvesting		0.320		0.002

Source: State Water Conservation Strategy, a discussion paper prepared by the Water Resources group of the Queensland DPI September 1993 and NSW Water Resources Council, June 1991.

- the availability of suitable groundwater reserves on or close to cotton growing land;
- inflows into the storages and aquifers; and
- surplus or unregulated flows — water available to be pumped over and above these allocations, again under licences which set out the terms and conditions governing this extraction activity.

- In unregulated valleys the on-stream storages are absent. All flows are unregulated. Access to the resource by river pumpers is governed by the pumper's licence which typically specifies critical river flow conditions, measured at different locations, under which pumping is permissible. In the important Barwon region, however, volumetric quotas have been imposed on licence holders pumping from unregulated streams.

Commitments, allocations and reliability

Hydrological features combine with the water managers' responses to political pressures to issue irrigator licences and to allocate water to other uses, to determine the critical factor — reliability of water — to the grower.

The DWR (1994, p 22) has made the following points about the relationship between commitments, allocations and reliability.

> 'Generally the greater the *maximum* [our italics] water extraction commitment in a system relative to the system flow, the more unreliable the supply will be. This will be made worse if the maximum commitment is not balanced by a storage which controls an adequate proportion of the average system flow or provides an adequate storage. The combined effect of these will be reflected in the average proportion of the commitment available each year.'

Table 7.2 illustrates the results of putting these factors together for the major western river systems of NSW. The unfortunate result for the Gwydir, which until the recent drought has supported Australia's second largest plantings of irrigated cotton, was a 65 per cent average of nominal allocations being delivered. This is because although the potential storage volume to river flow ratio is highest for this river, so are the commitments and the proportion of flow controlled by storage is low relative to these. As a result, a low level of commitment is met. This percentage of allocations met will be revised downwards as the impact of the recent drought affects the figures. Irrigators also report that since transferability of entitlements has been introduced, average allocations have declined. More recently, the ratios shown have fallen dramatically in all the northern rivers.

Table 7.2 **Control, allocation and commitment of regulated river systems in New South Wales**

River system	*Control by dams*		*Maximum commitment as % of average flow*	*Average allocation as % of max allocation*		*% flow extracted*	
	% flows controlled	Years of average yearly system flow that can be stored		Present development	Full development	Present development	Full development
Hunter	20	0.6	15	95	85	11	20
Murray	na	na	na	90	90	na	na
Murrumbidgee	80	0.7	50	100	100	34	34
Lachlan	30	0.9	50	85	70	24	28
Macquarie							
No flood storage	70	0.9					
Flood storage	70	1.2	50	85	80	27	33
Namoi	45	0.8	30	95	95	28	28
Gwydir	50	1.6	70	65	65	31	31
Border rivers							
Existing Pindari	25	0.3	30	35	na	26	na
Enlarged Pindari	25	0.5	30	na	80	na	34

Note : The complexity of the Murray system and the commitment to supply South Australia means that comparison with other valleys is misleading.

Source: DWR *Our Water*, 2nd ed., 1994.

The concept of reliability of irrigation water helps to focus on the tensions in irrigation water management — on the one hand, managing the system to provide maximum reliability and, on the other, maximising the area to be irrigated, and hence total cotton farm incomes. It is widely accepted that maximising reliability does not maximise farm incomes. This applies to the system as a whole or to an individual farm determining the optimal amount of on-farm storage to provide. Accepting this trade off also means 'accepting that water shortages must be accepted as a normal part of life' (CWPR 1989, p 13).

The extent of reliance on regulated flow allocations on regulated rivers varies across valleys and among irrigators. Bryant (1994) points out that because of low supply reliabilities in the Gwydir and Macintyre rivers, and because of the greater natural availability of 'off-allocation' flows in those systems, operators in those valleys have structured their operations to receive a greater proportion of their supplies from unregulated flows, incurring higher capital costs of harvesting and storing this water.

The water managers (DLWC and DPI Water) have the ability to influence reliability through licensing and through releases from storages. The creation of additional licences to irrigate from any given source attenuates the property rights of those already holding an allocation. The value of each existing allocation is reduced through reduced reliability.

A simulation study conducted using Namoi Valley data as a basis (CWPR 1989) suggested that the direct effect of licensing extra allocations would be to reduce the buffering capacity of the dams against dry years, and as a result an increased severity of water shortages in those years and, importantly, an increase in the *sequence* of dry years.

Embargoes on further irrigation licences except for research purposes have been a fact of life on all of the major cotton valleys in NSW for some years. Embargoes were in place on the lower Namoi by 1976, the Gwydir by 1979 and on the Border rivers by 1982 in recognition of what has been termed 'full commitment'. Upgraded licences were issued on the upper Namoi, however, with the completion of the Split Rock Dam in 1988. There is widespread agreement that for most of the northern inland rivers of NSW there is over commitment of the resource.

Individual cotton growers have reacted to these developments in a variety of ways, the most obvious of which is through increased capital expenditure in providing on-farm storage and reticulation to capture surplus flows. (The provision of on-farm storage capacity in some of the major cotton growing locations is illustrated in table 7.2.) This in turn has created tensions with competing users — both non-cotton irrigators and other users.

In the face of the continued rise in extractive uses of the Murray–Darling system as a whole, the Murray–Darling Basin Ministerial Council has recently announced an immediate interim cap on diversions from the system. Recently announced NSW restrictions (August 1995) on access to off-water allocation have further reduced cotton growers' supplies .

Infrastructure developments to raise availability

Where water scarcity problems have demonstrated themselves most dramatically — in the northern NSW valleys — the DLWC sees limited opportunities for augmentation. Others disagree. Loder (1994) has said 'There are still opportunities to build good yielding storages in some of the catchment headwaters and possibly substantial on-route storage sites on the Western Divide on the northern end of the Murray Darling Basin'. Large scale, innovative, off-river storage schemes to capture flood flows await further research.

That such opportunities exist is a matter of dispute. What is very clear is that any such infrastructure developments will have to be financed in a different way from the past and will need to be based on realistic demand

studies for the water and charged for in a way that makes provision for capital cost recovery.

The raising of the height of the Pindari Dam with funds partly cooperatively contributed by irrigators in the Border rivers has raised eightfold the initial storage capacity of the dam built in 1969 and increased streamflow capture by a further 6 percentage points.

In Queensland the government announced a series of infrastructure initiatives as part of its *From Strength to Strength* document (1995), with implications for the cotton industry in that state. These included, as part of a $600 million overall Water Infrastructure package:

- approval in principle of a $235 million 1.3 million ML dam on the Comet River near Emerald;
- the raising of the heights of the Bedford and Bingegang weirs on the Nogoa/Mackenzie River to address the immediate needs of cotton growers in the region, subject to economic, financial and environmental evaluations, at an estimated cost of $9 million. Contributions from industry and the federal government are being sought by the Central Queensland Economic Development Association;
- a new $180 million Dawson River Valley Dam (1 million ML capacity) which will impact on cotton growing capacity in the Theodore area; and
- an $11 million off-stream storage near St. George.

The Comet River dam, if built, is estimated to yield an additional 55 000 ML annually at high levels of security or 90 000 ML at current levels of security. It is estimated that a further 20 000 hectares of irrigated agriculture will be possible as a result. The Queensland government has stated that cotton growing in the region is presently constrained through lack of further reliable water supplies.

Tenders for shares in the additional water are being sought as a means of establishing the willingness of users to pay before commencement of the scheme. The method for allocation of the additional supplies is yet to be determined but an auction system has not emerged as a preferred method. This leaves open the question of how the willingness of potential users to pay is to be captured by the state. It is also intended to pre-sell the Dawson River Dam water to pay for the project. The method of sale is yet to be resolved.

The proposed off-stream storage near St George is designed to increase reliability of water to cotton growers in that area by harvesting flood flows.

These components of the water infrastructure initiatives also form part of what the Queensland government has announced as a Cotton Infrastructure package.

Making the water go further — irrigators' responses

More than any other irrigation group, cotton growers have committed their own resources to the provision of water storage facilities, with their extensive on-farm developments. However, there are limits to the effectiveness of this approach. These limits are created by decreasing access to stream flows which feed the storages and the problem of evaporation, which is much more acute in the wide shallow on-farm storages than in the deeper storages of the state dams.

The present predominance of furrow irrigation is a rational response by growers to their economic environment and to soil types in major growing areas. Evidence suggests that maximum savings from other methods such as drip irrigation would be in the order of 1.2 ML per hectare on more permeable soils. The additional costs of installation of a drip system would be approximately $5000 per hectare. In reality, most cotton is grown on self cracking clay soils which are less suited to the use of drip irrigation.

Other responses developed in recent dry years include:

- trials reducing plant population;
- skip row planting;
- fallow management and soil conditioning;
- delaying irrigations;
- research into evaporative losses; and
- breeding and growing short season varieties or managerially reducing the plant's growth period.

A great deal of cooperative work occurs between CSIRO, the various Departments of Agriculture and growers in these efforts.

In these respects cotton provides a cooperative model for other irrigators.

Growers are also experimenting with methods of capturing flood flows across the flood plains. If successful this could provide some offset to the harsher restrictions and on access to river water, discussed later.

Reform directions for prices and property rights — government policy

In response to calls from water users to address problems with the water industry, the federal government and the states are working toward reform of the water industry through the Council of Australian Governments (COAG) forum.

In February 1994 COAG recommended its members implement a strategic framework for the water industry that is intended to generate improved outcomes in terms of the sustainability of natural resources and of the environment in general.

Included in these requirements were broad directions for pricing and property rights reforms which will have great impact on the cotton industry in Australia — in particular, any development of proposals to make formal allocations of water to 'the environment'.

In June 1995 the Murray–Darling Basin Ministerial Council agreed that diversions from the Basin must be capped, and an interim cap has been introduced with immediate effect. A working group will report to the Council by November 1995.

Pricing water — how cotton growers pay

Price has been allowed to play only a limited role in allocating water both among cotton growers, among irrigators generally and between irrigation and non-irrigation uses.

Quantitative allocations have been the basis of access to water in the regulated catchments of both NSW and Queensland, rather than volumes of water freely purchased on a spot market or at auction. This has meant that 'the price of water' paid by cotton irrigators on regulated catchments has had three aspects. The first two are administered prices. The third is a market price. They are:

- the price per megalitre charged by the department. On regulated rivers, this will comprise a service delivery charge and a metering charge (a minimum charge, proportional to the normal allocation, is levied in NSW even if no water is taken). The government of NSW has recently announced that a $1.35 per ML 'water management' charge will also be imposed;
- the price charged by the department for the licence and its renewal, which can be regarded as an access/allocation charge component and distinct from these administered prices; and

- the market price of water entitlements which reflects water value of the allocations to growers and which is revealed only when entitlements to allocations are traded.

Because the actual allocation of water to each grower varies from the nominal entitlements in any one year, as does the demand for irrigation water, the value of these water entitlements, and the implicit price of water that they embody, will also vary. The price per megalitre of water transferred on temporary entitlement may differ markedly from the price embodied in permanent entitlements. The price that an individual cotton grower is willing to pay for a temporary transfer from another licence holder with temporary 'spare capacity' to finish the crop may be very high and well above the equivalent annualised value of a similar volume available through permanent transfer.

The price charged to licence holders per ML on NSW rivers contains an element which is supposed to capture 70 per cent of the cost of 'running the rivers' by the state's water managers, the general taxpayer picking up the rest of this cost in return for difficult-to-quantify environmental and other benefits. This charge applies to country town users as well as irrigators.

This charge is calculated on a costing basis that, unlike Victoria, presently excludes all the operating, maintenance and refurbishment costs of the headworks (dams, spillways, weirs, etc.) with the exception of a small component attributable to the cost of making water releases from the storages.

In 1995 a 'water management charge' of $1.35 per ML has been imposed on users as the DLWC seeks to cover some of the costs associated with its broader role in measuring, monitoring and modelling the state's water resources.

In Queensland, water is allocated via a licensing system similar to that in NSW with the licence determining the holder's entitlement to the access and use of a quantity of water. Licences are valid for a specified period of time but renewal occurs as a matter of routine (DPI 1993).

Licences in Queensland specify a nominal allocation and licence holders generally pay a minimum charge equivalent to the cost of 75 per cent of the allocation regardless of use. An announced allocation of a fixed proportion of a licence holder's nominal allocation is determined on the basis of available supplies. Excess charges apply for volumes in excess of the announced allocation.

Queensland, where a larger proportion of the state's cotton crop is grown in areas served by state owned channel systems, has been aiming to recover operating costs with 'some contribution' to capital costs and refurbishment provisions through the application of a 'capital charge' on the grant of a water allocation for new supplies to irrigators. However, like NSW, current charges still fall short of covering even operating and refurbishment costs for most existing supplies. Private diverters in Queensland have in the past paid minimal charges set at 25 per cent of the normal volumetric charge for the first 500 ML with no charge after that. This has been set to cover metering and monitoring costs (DPI 1993).

The actual per ML charge in NSW varies from region to region reflecting the differing costs of running the rivers. However, uniform prices are charged across wide areas — all irrigators pay the same price for normal security water in the Barwon region despite the fact that three different river systems are involved. This means that an element of cross-subsidisation is present.

Both cotton growing states are now locked in to the reform path mapped out by COAG. The Queensland government is involved in rounds of public meetings concerned with bulk water pricing principles following up the release of its *What Price Water?* discussion paper and NSW is formulating the terms of reference for its price regulator, the Government Pricing Tribunal, to inquire into bulk water pricing. However, in NSW the government has moved to put up prices on an interim basis before the Tribunal commences its process.

Efficient pricing of water to irrigators

The COAG reform process and the various water specific inquiries that have preceded it all point to the inevitability of rising prices for irrigation water in many of Australia's catchments. The present pricing practices in NSW, for instance, mean that water has been available on a state-wide basis for, on average, $2 per ML for irrigation This administered price may have as much as $20 in pumping and storage costs incurred on-farm added to it. This demonstrates that as a percentage of total water *costs* the per ML charge is presently a minor component.

The application of efficient pricing principles to irrigation will in future require consideration of capital contributions. Past irrigation investments were made by state governments with other than commercial goals in mind. There is widespread acknowledgment that charging irrigators to capture a commercial rate of return on these investments would be inappropriate. However, there is a strong likelihood that some contribution

to assets renewal will be required, (see, for example, *Industry Commission Report 1992).*

Maintenance and renewals costs associated with rural water headworks are lumpy expenditures, hard to predict in terms of timing and with uneven occurrence across the state. Cotton growers along with other irrigators may be faced with attempts to price these maintenance and renewals expenditures into water charges. The renewals component is a source of problems. Which assets should be funded as though they will certainly be renewed? What will the renewals costs be, given changing technology? Should these charges be levied on a state-wide basis? Should sinking funds be established from such charges? Sinking funds prove vulnerable to future governments faced with funding difficulties looking for 'hollow logs'.

As a result of Treasury induced pressure on the DLWC to recover higher proportions of operating costs, there is likely to be a push to broaden the base of the categories of operating costs recovered from irrigators. In particular, the wider 'resource management' component of the department's activities may be seen by the DLWC to deliver benefits to irrigators which the latter are reluctant to acknowledge but nevertheless should pay for. The new charge of $1.35 is targeted at these costs.

There must be a full documentation of how any such expenditures convert into benefits to irrigators as opposed to other water users. There is a danger that the costs of providing wider community benefits will be inappropriately met by irrigators.

Cost reflective pricing is a principle that is increasingly being built into water pricing in Australia wherever the problem is being tackled. This is usually interpreted to include a return on the capital outlayed in any *new* investment and as a result cotton growers and other irrigators are likely to face increased charges wherever augmentations of supply are occurring.

In the Queensland cotton growing areas only the Emerald irrigation area and Callide Valley are returning a positive rate of return on water infrastructure.

Other steps to improve efficiency could also mitigate the effects of price reform. The latest report of the Working Group on Water Resources Policy to COAG (1995) noted that losses through seepage in one system alone in the southern Murray–Darling irrigation area equalled the entire annual diversion by Gwydir cotton farmers. This suggests that any attempt to achieve returns on assets on a state-wide basis could unfairly penalise some users.

Property rights and transferability of allocations

Water managers have made some progress in assisting cotton growers and other irrigators toward greater flexibility in farm management through permitting the temporary and, more recently, permanent transfer of licences between irrigators. Temporary transfer on an annual basis was introduced in NSW in 1983-84 and permanent transfers followed in 1989.

Allocations are transferable in Queensland but temporary transfer dominates. The most recently available statistics (1992-93) show that no permanent transfers took place in the cotton growing areas of that state in that year.

Because trading in water allocation entitlements has been a relatively recent phenomenon, and because it has been dominated by temporary transfers rather than permanent sale, the implicit or 'shadow' price of water to cotton growers is difficult to estimate with any confidence. Influenced by the drought phenomenon of the first half of the 1990s, entitlements have been traded for $50 per ML and upwards in northern NSW, on a temporary basis. Permanent transfers in the Macquarie Valley in 1992-93 brought between $130–$145 per ML.

In recent years, irrigators have had to pay full market price for allocations purchased from other irrigators. The allocation of entitlements to cotton growers in past decades was not done through an auction system or any other competitive allocation system. The expected future values of these entitlements was not therefore captured by the crown. They were captured by the grower receiving the original water allocations. Where allocated water has become less reliable through over allocation, the erosion of security of supply is a factor working to undermine the value for these 'property rights'.

Formerly, without the ability to trade water entitlements separately from the land to which they applied, much of the value of these property rights was embedded in the price of 'irrigated land'. The rights become more valuable with the ability to trade them separately. These trades, where permitted by the water managers, are subject to the hydrological constraints of the whole system involved.

The bulk of Australia's cotton is being grown in catchments in NSW, where increased investment in water harvesting via enlargement or addition to the numbers of existing on-stream storages may yield low returns in water for cotton. The DLWC suggests that, with respect to NSW, the ability to expand water use in all valleys is now limited. 'No matter what

development route or commitment level has been taken, the proportion of flows which can be extracted is similar' (DWR 1994, p. 22).

Table 7.2 illustrates the very high level of commitment compared to average flow in the Gwydir in particular, and shows the percentage flow extracted at present is close to the maximum sustainable for a fully developed system. In this respect the Namoi and Gwydir systems can be characterised as fully developed with 31 per cent and 33 per cent of flows already committed.

In these circumstances water trading will become the main means of addressing individual growers' supply needs and the only means of permitting entry into the irrigated part of the industry.

The present system of water rights in NSW and Queensland does not provide the kind of secure property right enjoyed by holders of land title. Because of the highly regulated nature of allocations where 'the state giveth and the state taketh away' these 'rights' have a dubious legal status that acts as an impediment to developing a market for them. In New Zealand formal leasehold title is being accorded to water allocations, while perpetual freehold is favoured in Victoria.

Transferability and security are two sides of the one coin. The improved legal status that would come with, say, formal leasehold title to a water allocation, would add value to the entitlement and enhance transferability. Improved markets in allocations through tradeability reduce the uncertainty of the holder.

Property rights for unregulated flows?

The limits to profitable further investment by individual growers in on-farm storage will be brought nearer by perceptions that any increased capture by cotton growers will be at the expense of the availability of water for in-stream and other uses. If further limits are imposed in volumetric terms in the capture of off-allocation flows then the returns to investment in these storages will be affected.

Cotton growers on river systems with regulated but highly unreliable flows and those on unregulated rivers are highly vulnerable to moves to redefine their entitlements to access surplus flows. They are the ones who have invested most in this and are now faced with moves to convert an access previously limited only by pump and storage capacity to an access capped in volume. An urgent need for the industry is for well defined entitlements provided with the pumping licence that recognise the big

variations across catchments in the dependence of growers on access to surplus and unregulated flows.

Improving security of water entitlements — capacity sharing

Capacity sharing has its strong advocates as a means of improving the security of existing entitlement holders.

In converting from the present volumetric entitlements, irrigators and other water users would be allocated shares of storage capacity and tributary inflows that would give them access to an equivalent volume of water to that received under the current volumetric allocation system, but entitlements would be specified as *shares*.

One obvious advantage is that where 100 per cent of available water is already fully committed, there would be no prospect of further shares at the expense of present entitlement holders' reliability. In such cases the present embargoes would become a permanent feature.

Problems would remain in the cotton growing valleys acknowledged to be overcommitted. Conservation groups such as the Australian Conservation Foundation are opposed to both permanent property rights for water users with enhanced legal status and to capacity sharing as described here. They are understood to oppose any entitlement of irrigators to water other than that held in *storages*. In some instances this would have the effect of halving the present availability to irrigators.

The practical implications of capacity sharing and an evaluation of any possible advantages of this system over, say, extending 'carry over' provisions — whereby growers could choose to take less or more than their allocation in one season and more or less the next — into a full continuous water accounting system for irrigators is still under debate. A study for the Namoi conducted by the CWPR and partly funded by the CRDC is under way.

Implications for the cotton industry of 'more water for the environment'

Cotton growers have a strong interest in the ongoing health of the river systems on which the majority depend for their livelihood. Sustainability of those systems is a common objective with other users and environmentalists. Growers have been active in Total Catchment Management

Committees. In the Namoi, cotton growers voluntarily constructed a floodway restoration scheme.

But water requirements of cotton, which is seen to be depriving such areas as the Gwydir Wetlands and the Macquarie Marshes, are providing a focal point for opposition to maintaining existing allocations to irrigators. Environmental Contingency Allowances (ECAs) have been increased in the Namoi over the past five years reserving more water for instream use during low flows. Moves to cap access to unregulated flows in volumetric terms can also be seen as a reaction to guarantee minimum flows in recognition of the benefits to the riverine environment of high flows and flushing of the rivers. These have been accompanied by environmental contingency allowances in the operations of the storages.

The DWR has said:

> A simple way to provide more water for the environment would be to apply an across the board reduction in the amount users can take. However this would be a very blunt tool to use in improving river system health. An across the board reduction would also involve high, and probably unnecessary economic costs because of lost production. A more effective and efficient technique is to provide water at times of maximum environmental benefit (DWR 1994, p. 53).

The 1995 measures announced by the NSW government to provide increased environmental flows have been most severe in the north of the state. For the Gwydir valley, for example, off-allocation extractions have been banned totally in certain months and volumetric limits to off-allocation pumping have been imposed in the critical planting months. Elsewhere, on the Macquarie, off-allocation restrictions have been tightened and security and volume of the environmental entitlement for the Macquarie Marshes has been upgraded. 'Interim' volumetric caps on the Border rivers and the Namoi have been extended and freshly imposed on the Lachlan. Permanent transfer of unused entitlements has been 'temporarily' banned.

These moves will have the effect of halving the effective supply of some growers. While promulgated as a temporary response to a drought situation, they appear to herald a future in which the critical off-allocation component of cotton growers' water supplies is significantly reduced.

Strengths and points of potential vulnerability

Strengths

- Cotton emerged through the 1970s ond 1980s as the most efficient/highest retum use of available water.
- As pressure on water supplies have increased growers have invested in private water supply and methods of using water to best possible advantage.
- Cotton growers have demonstrated strong interest in the ongoing health of river systems.

Points of vulnerability

- Competing demands from cotton producers, other extractive users and from environmental groups are putting pressure on the DLWR to revise ways of allocating scarce water.
- Water allocators are seeking to broaden the categories of costs which will be passed on to irrigators as charges.
- The rules under which scarce water will be allocated in the future are still being resolved.