THE IDENTIFICATION OF RESEARCH ISSUES IN THE AUSTRALIAN COTTON INDUSTRY

by

Peter Vidler[1] and Brian Davidson[2].

A paper contributed to the 33rd Annual Conference of the Australian Agricultural Economics Society Christchurch New Zealand. 7-9th February 1989

---

1 Department of Transport and Communications, Canberra, A.C.T., 2600

2 Department of Agricultural Economics and Business Management, University of New England, Armidale, N.S.W, 2351.

THE IDENTIFICATION OF RESEARCH ISSUES IN THE AUSTRALIAN COTTON INDUSTRY.

ABSTRACT

In the past 20 years the Australian cotton growing industry has evolved from a small marginal dryland import dependent operation, to a large high quality export orien ed irrigation industry. In 1985-86 the industry's gross value of productic w is $335 m, and export receipts were $380 m, ranking cotton as the 10th l rgest a ultural earner and 6th largest contributor to rural exports. Despite its recent growth and prominence, very little detailed economic analysis has been undertaken on the cotton growing industry. The aim of this paper is to identify areas where the potential exists for economic research to be undertaken. It is concluded that three fields of study warrant closer and more detailed investigation: marketing strategies used by cotton ginners; valley orientated supply equations; and modelling of the demand side of the ma ..

1. Introduction

The purpose of this paper is to identify areas in the cotton industry which may warrant further economic investigation. While no formal ex-ante evaluation of possible research projects is presented herein, an attempt is made to align perceived needs for research with studies that have already been undertaken. Such a method should then reveal areas of deficiency. In achieving this end, the Australian raw cotton market is described in terms of its structure and the uncertainties faced by participants within the industry in an attempt to come to terms with the perceived needs for research by participants. Then a review of previous economic studies in the industry is presented. Finally, the perceived deficiencies in the research effort will be identified. Prior to a more thorough investigation of these issue it is necessary to discuss the growth and importance of the Australian raw cotton industry, in order to come to terms with the rational for directing research effort into this industry.

2. The Justification For Research in the Australian Cotton Industry

Anderson and Parton (1983, p. 185) suggest that one method of guiding the allocation of resources among research projects is to base such allocations on the value and volume of the product in question. This technique, known as the 'congruence

model', lends itself easily to a system of industry levies and matching funds from government, a practice which is used to fund the Cotton Research Council. However, its disadvantages are that emerging areas, such as cotton may potentially be highly productive but small in relation to total rural output and value. Furthermore, the method does not provide an adequate guide on the choice of projects within an industry or on the likely costs and benefits of a particular project. The purpose in this section is to assess the economic significance of the Australian cotton industry and to trace its relatively rapid growth, in order to assess its importance as an area of research.

Cotton has been grown in Australian since the early days of European settlement. For much of the period since then, until the early 1960s, cotton was only a marginal cropping operation conducted in Queensland, as part of dryland mixed farming operations. While the industry was virtually non-existent, it received government assistance, in one form or another from 1860 to 1969. This assistance ensured that production continued in spite of low world prices.

In the late 1950s and early 1960s a number of developments occurred, which provided the stimulus for structural change in the industry. The most important of these developments were the construction of major headwater storage dams on rivers in northern New South Wales and southern and central Queensland. These dams facilitated the establishment of a large intensive irrigation based cotton growing industry in Australia. Furthermore, changes to the Raw Cotton Bounty Act 1963 provided the incentive for the production of high quality cotton containing a high proportion of lint.

As a result of these structural changes the industry entered a period of unparalleled growth. The pace of development eased in the first half of the 1970s as various production problems were overcome, but from then on it entered another growth phase and has emerged as a significant industry in terms of the gross value of production and value of exports. In 1968-69, the cotton-growing industry's share of the gross value of rural production was only 0.5 per cent and its share of the value of rural exports was only 0.1 per cent. By 1986-87 the industry's gross value of production had risen to 2.1 per cent or $373 million, while export receipts rose to 2.8 per cent or $345 million (BAE 1988 and earlier issues). The cotton industry in Australia is now ranked as the tenth largest rural industry in terms of its gross value of production and the sixth largest contributor in terms of export receipts (see Table 1).

The expansion of the industry has seen Australia's transformation from a net cotton importer at the beginning of the 1970s to an important world exporter by the mid-

Table 1

Selected rural Commodities: Percentage Shares of Gross Value of Rural Production (GVP) and Value of Rural Exports (GVRE) (%)

	1968-69		1972-73		1976-77		1980-81		1985-86	
Commodity	GVP	GVRE	GVP	GVRE	GVP	GVRE	GVP	GVRE	GVP	GVRE
Cotton	0.5	0.1	0.7	0.3	0.6	0.1	1.3	1.1	2.1	3.2
Wheat	18.5	15.0	7.7	8.6	16.7	17.1	14.6	21.4	17.5	25.6
Barley	1.8	1.0	2.0	1.2	4.7	4.3	3.3	4.2	3.8	5.2
Sorghum	0.4	0.2	1.3	1.1	1.3	1.5	0.1	0.7	1.2	1.5
Rice	0.4	0.8	0.5	0.6	0.9	1.1	1.2	1.2	0.6	1.6
Wool	21.3	45.5	27.0	38.1	18.6	30.4	14.5	23.6	17.4	36.8
Beef and Veal	14.1	11.3	22.2	19.7	16.0	11.8	17.8	12.6	15.2	14.2
Dairy Products	9.7	4.6	10.1	4.3	8.3	3.9	7.2	3.4	7.6	3.6
Sugar	3.9	6.5	5.0	7.5	7.5	12.2	6.9	5.3	3.2	5.2

Source: BAE (1987 and earlier issues) Quarterly Review of the Rural Economy.

Table 2

World Cotton Exports: Percentage Shares of Exporting Countries: Selected Years

(%)

Country	1970-71	1976-77	1980-81	1985-86
Australia	0.1	0.1	1.5	4.7
U.S.A	21.4	27.2	29.7	26.3
U.S.S.R.	13.9	22.8	21.6	11.4
Pakistan	2.7	0.3	7.6	11.4
Egypt	8.4	5.7	3.8	2.4
Turkey	6.2	3.3	5.0	2.0
Sudan	6.0	3.4	1.7	3.1
Mexico	4.4	2.7	4.1	0.9
Syria	3.6	3.8	1.6	1.1
Brazil	5.8	0.3	0.2	1.7
Iran	2.6	2.0	0.1	0.2
Uganda	1.8	0.3	-	0.2
Tanzania	1.6	1.5	1.0	0.6
India	0.8	0.1	2.2	3.9
Greece	1.9	0.4	0.3	1.4
Argentina	1.2	2.0	0.8	0.2
Paraguay	0.1	1.2	1.7	1.4
Nicaragua	2.0	3.2	1.6	0.7
Guatamala	1.3	3.1	2.6	0.2
China	-	-	-	12.5

Source: USDA (1987 and earlier issues) World Cotton Situation, FC9-87, September. Australia was the fifth largest exporter, surpassing traditional exporters such as Egypt, Mexico, Turkey and Sudan.

1980s. The change in export shares of cotton exporting countries is shown in Table 2. The steady expansion of Australia's share is clearly evident. In 1985-86 and 1986-87

In this section it can be seen that the Australian cotton industry is a significant one both nationally (in terms of the contributions to the gross value of rural production and export receipts) and internationally. Hence, it is an industry which warrants some degree of economic evaluation. Furthermore, as the industry has evolved rapidly any early investigations of the industry, especially prior to 1960 and possibly prior to 1980, will have limited applicability to the current industry. The question must be asked, will the industry continue to grow at its current rate, making any evaluations of the industry in the near future equally inappropriate? Gallagher and Musgrave (1966) suggested that the expansion of the industry is governed by the availability of regulated supplies of water (i.e. irrigation). Over the past decade no new large scale dams, with the exception of Split Rock Dam, have been built. Consequently, the ability for the industry to expand is limited by its ability to use the existing water supplies more effectively or to develop more efficient methods of increasing yields. As these are technological breakthroughs it could be argued that the pace of expansion in the industry will be lower in the coming years, than it has in the past two decades.

3. Risks and Uncertainties faced by Market Participants

The structural changes initiated in the cotton industry by the developments discussed in the previous section have heralded a move towards large scale production under irrigated conditions. The industry of the 1970s and 1980s is vastly different to that which existed earlier. Consequently, the industry post-1970 is of most interest in this assessment. In this section the structure of the raw cotton industry, from the growers to the spinners, will be discussed. Of particular interest in this assessment will be the risks and uncertainties faced by participants in the industry and the strategies pursued in overcoming them, specified. In essence, it can be said that each participant undertakes a specialised task in the market (i.e. growing, processing, marketing, etc.). As such, each participant experiences different problems in completing their individual tasks, resulting in some risk and uncertainty about the outcome of their endeavors.

Cotton in Australia is principally grown in 10 fairly compact regions along river valleys in Northern New South Wales and Southern and Central Queensland. These regions, their relative size, the principal towns in the region and the source of their water supplies are detailed in Table 3.

Table 3

Irrigation Water Sources: Principal Growing Areas

Growing Area Area	Major Storage	Capacity (mL)	Principal Towns	Area Grown (ha)
A. New South Wales				
Macquarie Valley	Burrendong Dam	1,667,000	Warren Narromine Trangie	17 000
Gwydir Valley	Copeton Dam	1,364,000	Moree	54 000
Namoi Valley	Keepit Dam	423,000	Narrabri Wee Waa	40 000
Macintyre (a) Valley	Glenlyon Dam (Qld.)	261,000	Goondiwindi	16 000
	Pindari Dam	37,000		
Bourke	On-farm storage from Darling R.		Bourke	5 000
B. Queensland				
St. George	Beardmore Dam	101,000	St. George	9 000
Darling Downs and Lockyer Valley	Leslie Dam	107,500	Toowoomba Dalby Gatton	12 000
Theodore	Weirs on the Dawson River		Theodore	2 000
Emerald	Fairbairn Dam	1,440,000	Emerald	11 000
Biloela	Underground water		Biloela	3 000

(a) The Macintyre River forms the border between New South Wales and Queensland for much of its length. Most irrigation development has been in New South Wales. Water allocations from the Glenlyon Dam are made independently to Queensland and New South Wales irrigators.

Source: Australian Cotton Foundation (undated), Australian Cotton Profile.

The Bureau of Agricultural Economics (1987) estimated that there are 615 enterprises growing cotton within the regions outlined in Table 3. The results of the survey, while still preliminary, suggest that cotton is produced in conjunction with other cropping and livestock operations (see Table 4). In 1985-86, the area planted to cotton tended to be less that that for other crops. However, in that year, the receipts for cotton accounted for over 65 per cent of total returns. While returns from cotton production are high, so are its costs. Cotton growers face relatively high costs for inputs, particularly for hired labour, fertilisers, fuel and capital. In addition, the amount paid in interest suggests that cotton growers have to borrow heavily in order to produce. From these results it can be hypothesised that cotton production involves high risks and returns great rewards to growers.

As this survey was undertaken on a national level, it tends to obscure trends and differences which may occur in an individual producing region. In the Namoi for instance, cotton producers tend to devote more of their resources towards cotton than the national average. While their farms tend to be smaller, around 1000 hectares in size, more than 80 per cent of their area under cultivation is devoted to cotton production (Gordon Cherry, Grower Services Manager Namoi Cotton Co-operative, personal communication 1988).

Growers face many uncertainties in producing cotton. Not only are there the difficulties associated with the physical production of the crop, such as climatic variations, water availability and the control of pests, but there are also financial concerns as well. It has already been implied that while cotton production has tended in the past to be a highly profitable enterprise for growers, it is also a very uncertain and risky business.

It is not difficult to discern the view that the modern Australian cotton industry is highly dependent on regulated flows of water. In general those valleys with larger storages have the ability to regulate greater flows of water and hence produce more cotton then those with smaller storages. Furthermore, those regions which rely on unregulated flows, such as Bourke, Theodore and Biloela (see Table 3) are relatively small producing regions. As growers receive a volumetric allocation of regulated water supplies, they are faced with the dilemma of how much cotton to produce. They can plant an area which they know they irrigate only from regulated flows, or they can plant a greater area and rely on adequate rainfall and surplus flows down the river in order to water the crop adequately. Growers can reduce this uncertainty in a number of ways, notably by

Table 4

Cotton Farms: Average Characteristics

		1985-86 (P)	1986-87 (S)	1987-88 (S)
Total farm area	ha	1,450	1,445	1,401
Cotton area sown	ha	260	179	202
Cotton harvested	t	400	251	291
Other crops sown	ha	560	564	544
Sheep carried at 30 June	no.	387	522	578
Beef cattle carried at 30 June	no.	170	205	228
Cash receipts				
Sales				
- cotton	$	432,190	223,110	310,280
- other crops	$	116,290	201,710	172,910
- livestock	$	20,020	41,400	61,570
- wool	$	6,760	7,590	8,650
Off-farm sharefarming	$	54,470	19,790	3,690
Total cash receipts	$	656,360	512,520	577,400
Cash costs				
Hired labour	$	51,530	36,080	35,780
Materials				
- fertiliser	$	52,430	36,850	41,460
- fuel, oil, grease	$	59,490	44,620	45,730
- sprays and pesticides	$	94,090	62,250	72,250
Services				
- leasing and plant hire	$	51,320	40,170	29,060
Interest paid	$	58,020	49,150	49,900
Total cash costs	$	567,970	460,630	500,530
Farm cash operating surplus	$	88,390	51,890	76,870

(P) Preliminary
(S) Estimated

Source: Bardsley et al., (1986), Table A.1; BAE (1987), Table A31.

investing in on-farm storages and other capital items which increase the efficiency of water use.

Climatic variability plays an important role in determining the quantity and quality of cotton produced. Possibly the factors which are of most concern with respect to climatic conditions are the quantity and timing of rainfall, the number of cloudless days and extremes of temperatures. While farmers can not influence climatic conditions they can invest in a number of technological innovations, such as soil probes, in order to monitor crop performance, hence governing their response to adverse climatic conditions.

Crop monitoring has also enabled growers to reduce the risks they face in dealing with pests and in applying fertilizers. Pestilence has always been a problem with cotton production in Australia. In 1972-73 the crop was devastated by an infestation of the Heliothis moth. Computerized crop monitoring programs, such as that developed and run by Sirotec allow growers to monitor infestations and control the timing of spraying such that their actions have a maximum impact.

From the Bureau of Agricultural Economics (1987) survey, it would appear that growers borrow heavily in order to produce the crop and must invest large sums in capital equipment. After purchasing the specialised machinery necessary to produce cotton, growers are effectively locked into the enterprise for a number of seasons. In a world of volatile prices for raw commodities, the decision to produce cotton can be an expensive one if cotton prices fall or the price of alternatives rises. In order to offset [illegible] financial risks, growers can either hedge a proportion of their crop on the New York Cotton Futures Market or forward sell it to a ginner. While these strategies are by no means a perfect guarantee of the returns they will receive, they do provide some measure of financial security to growers.

Cotton growers consign their crop to a gin for processing. This stage in the marketing chain involves separating the cotton lint from the seed and packaging both for sale. An additional and prime responsibility held by ginners is the marketing and sale of cotton production. In Australia there are five principal organisations which gin and market cotton (see Table 5). These organisations; Queensland Cotton, Namoi Cotton Co-operative, Austcott, Colly Farms (who will commence ginning in 1988) and the Darling River Cotton Company; differ in their structure and mode of operation. For instance, Queensland Cotton is a statutory government body which compels growers in Queensland to deliver to their gins (with the exception of growers near Goondiwindi). Alternatively. Namoi Cotton is a co-operative formed and owned by growers. Austcott, Colly Farms

Table 5
Ownership and Location of Cotton Gins

Company	Gin Location
Auscott	Warren Trangie Midkin (double gin) Narrabri (2 gins)
Namoi Co-operative	Ashley Merrywinebone Yarraman (2 gins) Myall Vale Tulladunna Merah North Goondiwindi
Queensland Cotton	St. George Cecil Plains Biloela Emerald
Darling River Cotton	Bourke
Colly Farms	Collarenebri
Tynam	Warren
Dunavant Enterprises	Moree

Source: Australian Cotton Foundation (undated), Australian Cotton Profile, Balmain, N.S.W.

and the Darling River Cotton Company are all privately owned corporations. All three can be termed as integrated, as they not only gin cotton, but are also significant producers of raw cotton as well. While these companies gin their own cotton, they also open up their facilities and marketing services to independent growers. All five ginners tend to offer a wide variety of services to growers in the form of extension services, a system of pool payments and assistance with inputs, along with the normal aspects associated with the marketing and disposal of the crop (Australian Cotton Foundation, undated).

Over the last decade, the traditionally close knit structure of the northern New South Wales cotton industry has broken down to a considerable degree. As the industry developed, outside marketing bodies have moved into the industry. The profitability of irrigated cotton has been at levels which have attracted merchants and commodity traders into the industry.

A recent development of considerable significance for the future development of the industry is the establishment of toll ginning. Dunavant Enterprises, the world's largest cotton merchant, has constructed a cotton gin at Moree which will have a capacity of between 50,000 and 100,000 bales of cotton annually. However, Dunavant Enterprises does not at this stage have its own cotton farms and will need to rely on competitive bidding to maintain the throughput for its new gin. No details of Dunavant's financial operating strategies are available, and it is unlikely that such commercially sensitive material would ever be available.

It is difficult therefore to incorporate the impact of the operations of toll ginners such as Dunavant into a theoretical model of grower risk response. However, the operations of cotton merchants and traders has injected a considerable degree of competitive pressure into the industry, despite the fact that the industry has been particularly innovative both technically and financially. It is not unrealistic, therefore to hypothesise that the introduction of such enterprises into the New South Wales cotton industry will have a significant impact on grower decision making.

The consignment of cotton by a grower to a ginner can generally be viewed as a sale by the producer, who receives payment for the cotton produced. Cotton ginners offer a number of avenues to growers in order to facilitate this transaction. For instance, the Namoi Cotton Co-operative operates a variety of methods by which the growers can dispose of their crop. A Seasonal pool operates, into which growers (who are members of the Co-operative) must lodge the first bale from every acre grown. The remainder can be lodged in a Call pool, which places the responsibility for disposing of cotton

production with the Co-operative. Returns from each pool are equalised across all growers. In addition, the Co-operative will purchase a proportion of the crop outright, at a price determined on a daily basis. Finally, nothing prevents grower's asking the gin to process their cotton, for a set fee and then disposing of the product themselves. All other ginners offer some, if not all the selling options operated by the Namoi group.

The cotton ginners have a number of avenues by which they can dispose of the national crop, depending largely on its destination. Raw cotton is sold to spinners located both domestically and in a variety of export markets. Domestic sales are conducted within the framework of an agreement between spinners and ginners, while export sales are not.

Sales to domestic spinners are undertaken within the framework of a market sharing arrangement introduced in 1969, under the aegis of the Raw Cotton Marketing Advisory Committee. Under the agreement, the estimated quantity of raw cotton required by spinners for the coming season (termed 'quota cotton') is withheld from the export market by ginners. This quota cotton is shared amongst the ginners on the basis of their share of total production. Quota cotton is sold at an import parity price, which is higher than the price received for cotton which is exported. This import parity price, termed the Australian Base Price, is calculated from a Liverpool (U.K.) price, with allowances made for the cost of freight and converted into Australian currency terms. The spinners, while possibly paying a higher price for cotton, participate in the arrangement because the ginners bear the interest and warehousing costs associated with storage of the product. The spinners can request delivery of the cotton at any period during the year (Vidler 1988). Since the proliferation of entrants into the ginning sector the domestic marketing arrangements have, to some degree broken down.

A vast majority of the cotton produced in Australia is sold on the export market, destined principally to spinners in East Asia, but also to Europe and the centrally planned economies. In order to facilitate sales, the ginners retain agents in various East Asian countries. These agents find customers and gain a commission for any sales made. In the European market, ginners trade with merchants who purchase the cotton and resell it to spinners, hoping to return a profit on any transactions. The distinction between these two different methods of disposing of the crop have important implications to the ginners. In the former case, much of the risk associated with selling cotton is carried by the ginning company. However, with merchanting some of this risk (especially associated with product specification and price variability) is passed on to the merchants.

Australia is seen as a price taker on the export market, as the nation accounts for only approximately 5 per cent of world trade in cotton. However, doubt has been cast upon this assumption as Australian cotton is produced out of season, is perceived to be of 'high' quality and of the type particularly demanded by mills in East Asia. Bruce Loder (Auscott Ltd., personal communication, 23/1/1989) has put forward the view that the quality facets of the Australian cotton crop have improved to the extent that domestic varieties are now competing with the best American produced types. He believes that continuity of supply, is vital to maintaining Australia's position in the Asian market. While these propositions requires further analysis, it is fair to say that cotton prices in Australia are determined by the interaction of global supply and demand for raw cotton.

Ginners also face a degree of uncertainty and risk in undertaking their role in the market. Their uncertainties revolve around the issues of the quantity, quality and price of cotton produced and sold. These concerns are directly related to those that are experienced by growers and risk transference does exist between the two segments in the market.

The ginners' prime responsibilities in the market relate to the processing and sale of cotton. In selling the crop, ginners are exposed to the vagaries of price movements. Given that they have to offer the grower a set price, price variability can cause them great consternation. This problem is further enhanced by the fact that contracts for the sale of cotton are sometimes specified in terms of overseas currencies. Their strategy in disposing of the crop is to forward sell and hedge it on the futures market as much as possible, thus locking into a spectrum of prices. The ginners commence these activities up to 2 years prior to the harvest of a particular crop. By planting time up to 40 per cent of the crop is committed and by harvest time a further 30 per cent is disposed of (Ron Swansbra, Namoi Cotton Co-op, personal communication 1988; Bruce Loder, Austcott, personal communication 1988). Furthermore, ginners can offset adverse currency movements by either utilising the services trading banks offer in guaranteeing exchange rate transactions prior to them taking place or by hedging on the exchange rate futures market.

While these activities reduce the degree of price variability faced by ginners, they also expose them to the uncertainties associated with quantity risks. Given that 40 per cent of the crop is committed at planting time, the gins are obligated to deliver. However, if ginners lock into a price which is too low to early, growers may deposit their cotton at another gin offering a higher price, or if the crop is devastated, the ginners may not be able to deliver. These quantity risks are offset in two ways. First, the gins require

growers to lodge their intention to process cotton with them at planting time. Second, they rarely forward sell more then 70 per cent of the estimated crop before its true dimensions are known, thus reducing the risks associated with variable production.

Finally, ginners must guarantee the quality of cotton supplied to spinners. If the cotton supplied does not match the specifications set out in the contract, spinners can return it or renegotiate the sale price. A number of strategies have been and can be employed by ginners to reduce this type of risk. Since the mid-1970s, ginners have been assessing the quality requirements of their main customers in the east Asian market. Research has been directed towards producing cotton varieties which meet the demands of this market. That is, cotton which is of a higher quality, with a longer staple length and displays greater strength characteristics. In addition, ginners can affect the quality of cotton through manipulating the ginning process. Excessive levels of moisture and trash in processed cotton reduce its quality and ginning conditions the lint in respect of these two offsetting factors. For profitable operations, the ginners need to first determine the minimum number of cleaning stages which will result in a trash free output which is fairly dry, such that the return per bale is maximized. Ginners may manipulate the ratio between trash levels and moisture in order to meet the quality requirements specified in their contracts (Mburathi 1971).

In this section, the structure of the Australian cotton industry was detailed and issues of importance to participants reviewed. These issues were discussed in terms of the risks and uncertainties they confront in performing their tasks within the marketing chain and the strategies they employ in overcoming these problems. All the uncertainties in the market tend to be interrelated. For instance, if some factor alters the quantity of cotton produced by a grower, his returns are altered. In addition the ginners are faced with a different quantity of cotton to sell. Another dimension to this problem is encountered when the quality of the grower's cotton, which is influenced by the physical conditions experienced during its growth, is taken into account.

4. Previous Studies on the Australian Cotton Industry

The purpose of this section is to review the economic research that has been undertaken on the production and marketing of raw cotton in Australia. This review will encompass only that research that has occurred since the industry was transformed in the early 1960s.

The Bureau of Agricultural Economics undertook two surveys of the industry prior to 1970. The first was in the early 1960s (BAE 1963) and related to the industry in

the 1950s while the second (BAE 1970) covered the mid-1960s. Basinski (1965) also surveyed the industry and examined all aspects including agronomic factors such as climate, soil and biotic limitations as well as economic aspects such as marketing. He concluded that 'the scope for expansion of irrigated cotton - the obvious type of development in the foreseeable future - is considerable' (p. 221).

A number of farm management studies relating to the profitability of cotton growing in different parts of New South Wales appeared in the second half of the 1960s, stimulated no doubt by the resurgence which had recently commenced. After examining cost, size and revenue relationships for cotton growing in the Murrumbidgee and Coleambally Irrigation Areas of New South Wales, Ryan (1965) concluded that cotton growing would not be profitable in south-western New South Wales without a Commonwealth Government bounty. However, using a linear programming model to examine the relative profitability of dryland and irrigated farm enterprises in the Namoi region of New South Wales, Dudley and McConnell (1967) found that cotton at that time was clearly the most profitable enterprise to the extent that its price could decline by about 34 per cent before the next most profitable activity would become predominant.

The expansion of cotton growing quite obviously stirred academic interest in the industry and the implications for the economy of its continued expansion. Gallagher and Musgrave (1966) noted that a lot of the comment on the rapid growth of the cotton industry in the mid-1960s concerned initially the level of protection afforded the industry and later the prospect of cotton production on the Ord River. They therefore examined the prospects for the industry and the implications for policy with particular emphasis on the likely location of the industry under zero protection.

After examining the economics of production in three regions (northern N.S.W. and southern Qld., the M.I.A. and the Ord river), Gallagher and Musgrave concluded that a rational cotton policy precluded further expenditure on the Ord River and it was unlikely that there would be any unsubsidised cotton production in the M.I.A. Their overall conclusion was that the limit to Australian cotton growing would be '... set by the availability of 'white elephant' water storages which can provide water at low (real) cost and that expansion beyond this level may be hard to justify on economic grounds' (p. 29).

Despite the fact that in the subsequent years production increased far beyond Gallagher and Musgrave's expectations, their concerns regarding the implicit subsidy of less than full economic costing of irrigation water were well founded because

policymakers are still trying to resolve the issue today. Possibly if there had been a full economic cost of irrigation water, the industry would not have expanded to the extent that it has.

There was interest during the late 1960s in the impact of the phasing out of the bounty paid under the Raw Cotton Bounty Act 1963 on producer returns. Kerridge (1966) examined likely production trends in the Australian cotton industry in the second half of the 1960s and the effect these would have on the unit rate of bounty and on producer returns. He was probably the first to consider the implications of United States policy in the Australian industry when he examined the impact of the US cotton program for 1966-67 to 1969-70 on world prices and incorporated these into various scenarios of changes in the Australian producer price. Sault (1969) and the BAE (1970) also reviewed developments in the world cotton economy and the impact these would have on the market for Australian raw cotton.

The focus of these three studies was the implications for producer returns of what the BAE termed 'the pronounced change in the marketing environment ...'; that is, the change in the industry from supplying the domestic market to being a substantial exporter. There was a general awareness that, as output expanded, market prices would be the main determinant of producers' returns. The BAE (1970) noted that 'developments in the international raw cotton situation will be the principal influence on the prices received on both the domestic and export markets' (p. 100).

During the 1970s there was a considerable volume of research undertaken related to the agronomic and biological aspects of cotton production. The establishment in 1982 of the Cotton Research Committee (reconstituted as the Cotton Research Council in 1986) and its associated Trust Fund has ensured that there will be a continuation of this type of research into cotton growing.

In 1986 the Bureau of Agricultural Economics undertook another survey of the industry, in response to a concern that prices would remain low. This survey reveals detailed information on the costs of inputs and the returns from cotton and alternative crops. However, the survey is highly aggregated and, as a consequence is not as useful as it could be. The Center for Water Policy Research (1987) analysed the costs of growing cotton in the Namoi Valley. Their study was motivated by changes in water reliability wrought by the construction of Split Rock Dam. This study not only analyses the changes at the farm level, but also assesses the impacts of changes at the regional and

national levels. While this study is highly detailed, it examines only the Namoi Valley segment of the industry.

In the 1980s a number of economic assessments of aspects of the cotton industry have been undertaken. Monke and Petzel (1983) addressed the question of whether cotton processors differentiated between the international source of supply. Boman (1986) assessed the forecasting accuracy and market efficiency of the New York Cotton Futures Market. Both Boman and Monke and Petzel regressed one price against another and suggested that if the intercept was not significantly different from zero and the slope coefficient was not significantly different to one, then the two variables were compatible under Hick's composite commodity theorem. This rather simple approach dependents upon the choice of the dependent and independent variables. Regressing P_A on P_B may suggest acceptance of the hypothesis, while regressing P_B on P_A may suggest rejection. Consequently, the test used by Boman and Monke and Petzel is inconsistent and may lead to incorrect solutions.

Orman (1983) analysed the domestic demand for raw cotton with reference to the voluntary market sharing agreement between processors and spinners. Given that this arrangement is breaking down, the study may no longer be relevant.

More recently, two studies Mues and Simmons (1988) and Vidler (1988) have attempted to analyse the national cotton industry. They estimated fairly aggregated supply, demand and stockholding functions. Both studies suffer from misspecification problems and low explanatory ability. For instance, as Vidler modelled supply on a state basis a number of potentially relevant variables had to be excluded on the grounds of not being significant. Furthermore, Mues and Simmons' demand equations have the price of cotton expressed as a ratio of the price of substitute fibres. Invoking the homogeneity assumption, such a specification would imply that the own-price and cross-price elasticities of demand are equal in magnitude, but opposite in sign, and that the income elasticity of demand for cotton is equal to zero.

Given that the cotton industry has grown phenomenally in the past two decades and received a number of adverse shocks, the number of recent economic evaluations of the industry would appear to be few. The view of the BAE (1983, p. 58) that there remains '... limited public literature on management and other economic issues of importance in such a capital intensive industry ...' would appear to be still valid today.

5. The Identification of Researchable Areas

The belief that has been pursued in this paper is that by examining the uncertainties faced by participants in the cotton market and by reviewing the previous studies of the industry, it would be possible to elicit areas which warrant further economic evaluation. Given the fact that few economic studies of this highly changeable industry have been undertaken recently, it would appear that all concerns along the marketing chain would require investigation. However, a few broad areas stand out. These are; (i) the marketing strategies employed by cotton ginners; (ii) the estimation of individual valley supply equations; and (iii) modelling of the demand side of the market. These issues and the rational for their choice will be discussed in this section.

On the supply side of the market there is a lack of detailed knowledge on the impact factors such as climate, water availability, new technologies, alternative enterprises and capital investment have on the industry. It must be asked are these factors important constraints and are the current strategies used to overcome these uncertainties the most optimal. The only method of assessing these questions is to model the production of cotton in Australia. While this has been attempted in an aggregate fashion, i.e. on a national or state basis, it was noted earlier that significant differences tend to occur between growing regions. Consequently, the supply modelling effort should be directed at obtaining estimates on an regional valley basis. Only then can the questions raised earlier, be addressed adequately. Such an approach would also allow for the aggregation of individual valley models into a national model, which could then be used for forecasting and policy evaluation purposes.

There are a number of unknowns on the demand side of the market, especially in regard to export demand, that warrant further investigation. For instance, no evaluation has yet been undertaken on whether Australia specifically produces a unique type of cotton that consumers demand in some different fashion to other countries production. The truth most possibly lies somewhere between these two extremes. Yet the research effort to date, on the export demand for Australian cotton has assumed that all cotton produced is a homogeneous product. While Monke and Petzel (1983) suggested that this assumption may be valid, some doubt has been cast on their findings. Furthermore, questions of the impact price variability and the price of substitute and compliment fibres have on the demand for cotton have not properly been addressed. By undertaking a comprehensive empirical study of the export demand for Australian raw cotton, these questions may be answered. Given that the domestic market, which was recently investigated by Orman (1983), is relatively small and and that reasonable domestic demand functions for Australian cotton have been estimated by Vidler (1988), payoffs to

further research in this area are limited. However, countering this view, is the fact that domestic marketing arrangements are changing.

Finally, no analysts have to date attempted to investigate the modelling strategies employed by ginners. It must be asked, are the ginners selling the crop in the most efficient manner and are they truly competitive and hence sending back to growers the correct price signals? Furthermore, are their strategies in opening up new markets, as opposed to supplying more to their traditional ones, the most optimal? In addition, should ginners attempt to become year round suppliers or continue on as seasonal suppliers of raw cotton? All these questions, and many more, have not been addressed. Yet it is this area where the possibility for change in the industry is most likely, as there are less factors which constrain change.

In this section three broad areas that warrant further investigation were presented. These areas tended to be all encompassing. This is perhaps the best strategy to take as there have been limited economic studies of the industry. Once these broad issues have been analysed, particular issues can be addressed in a more competent manner.

6. Conclusions

The aim of this paper was to identify areas where the potential for economic analysis of the Australian cotton industry exist. In undertaking this task needs and uncertainties experienced by industry participants were compared with previous studies on the industry. It was concluded that the research effort has not been great in this relatively large and dynamic market. As a consequence broad analysis should be undertaken in the areas of the production of cotton, export demand and the marketing strategies pursued by cotton ginners.

REFERENCES

Anderson, J.R. and Parton, K.A. (1983), 'Techniques for guiding the allocation of resources among rural research projects: State of the Art', Prometheius 1(1), 180-201.

Bardsley, P., Flavel, N., Mues, C., Sergeantson, J. and Thelander, T. (1986), An assessment of the economic position of the cotton growing industry, Paper presented to the Australian Cotton Conference, Surfers Paradise, August 20-21.

Basinski, J.J. (1965), 'The cotton growing industry in Australia', Journal of the Australian Institute of Agricultural Science, 31(3), 206-22.

Boman, L. (1986), An Assessment of Forecasting Accuracy and Market Efficiency in the Cotton Futures Market: 1975-86, B.Ag.Ec. dissertation, University of New England, Armidale.

Bureau of Agricultural Economics (1963), Cotton Growing in Australia: An Economic Survey, BAE, Canberra.

_____ (1970), The Australian Cotton Growing Industry: An Economic Survey 1964-65 to 1966-67, AGPS, Canberra.

_____ (1984 and earlier issues), Cotton: Situation and Outlook 1984, AGPS, Canberra.

_____ (1986), Commodity Statistical Bulletin, AGPS, Canberra.

_____ (1987), Farm Surveys Report, AGPS, Canberra.

Centre for Water Policy Research (1987) 'A study of reliability of water supply for irrigated cotton in the Namoi valley'. University of New England, Armidale N.S.W.

Chapman, J. and Whiteway, R. (1982), Cotton Growing in Australia, Working Paper 82-34, BAE, Canberra.

Dudley, N.J. and McConnell, D.J. (1967), 'An economic evaluation of cotton and alternative farm enterprises under irrigation in the Namoi Region', Review of Marketing and Agricultural Economics, 35(2), 69-93.

Gallagher, D.R. and Musgrave, W.F. (1966), Location and the Australia Cotton Industry, University of New England, Armidale.

Jack, P.D. (1987), 'Colly cotton comes good', Australian Business, June, 27-28.

Kerridge, W.J. (1966), 'Cotton: The effect of current trends on producer prices', Quarterly Review of Agricultural Economics 19(2), 57-72.

Merrill, P.J. (1977), American Involvement and the Resurgence of the Australian Cotton Growing Industry, PH.D. thesis, University of California, Berkeley.

Mourathi, G.K. (1971), Some Aspects of Cotton Marketing in Australia, M.Ec. thesis, University of New England, Armidale.

Monke, E. and Petzel, T. (1984) 'Market intergration: an application to the international trade in cotton.' American Journal of Agricultural Economics, 66(4), 481-7.

Mues, C. and Simmons, P. (1988) 'The effects of US farm policy on Australian cotton' A paper contributed to the 32nd annual conference of the Australian Agricultural Economics Society, LaTrobe University, Melbourne, 9-11th Feburary.

Corman, K.M. (1983), An Analysis of Domestic Demand for Raw Cotton in Australia with Reference to the Voluntary Agreement Between Processors and Spinners, B.Ag.Sc. dissertation, University of New England, Armidale.

Ryan, J.G. (1965), 'Cost-size and revenue relationships in the cotton growing industry of south-western New South Wales', Review of Marketing and Agricultural Economics, 32(2), 53-97.

Sault, J.L. (1969), 'Recent developments affecting the market outlook for Australian raw cotton', Quarterly Review of Agricultural Economics, 22(3), 123-39.

Tomek, W.G. and Robinson, K.L. (1981), Agricultural Product Prices, 2nd edn, Cornell University Press, Ithaca.

Vidler, P. (1987) 'A model of the Australian raw cotton market'. A M. Ec. thesis, University of New England.