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METHODOLOGICAL ISSUES IN EXAMINING EXPORT MARKET PERFORMANCE: THE AUSTRALIAN CASE

by

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METHODOLOGICAL ISSUES IN EXAMINING EXPORT MARKET PERFORMANCE: THE AUSTRALIAN CASE

In recent years, U.S. public policymakers have attempted to redirect the grain exporting network from a quasi market-oriented system toward a more market-managed system (Weaver Bill, 96th Congress, H.R. 4237; Roth-Stevenson Bill, 96th Congress, S. 2773). The economic implications of these proposed actions are unclear. Several studies have commenced examination of this very complex issue (Peltier and Anderson, McCalla and Schmitz, Martin, Thompson and Dahl). The purpose of this paper is to improve our understanding of the subject by describing another major grain export marketing system and to investigate a number of methodological issues with respect to measuring the performance of the Australian export marketing system. This paper is the framework for a proposed study to be completed at Texas A&M University; therefore, it does not present research results or policy conclusions. A brief description of the wheat marketing system is followed by an outline for examining Australian grain export marketing performance.

Description of the Australian Grain Marketing System

The grain marketing system can be defined as the "total system" including all elements that influence movement, transformation, and the price of grain after it leaves the farm (McCalla and Schmitz). The "total system" includes the following levels: a) the physical subsystem of country elevators which receive, grade, and dry grain, b) the transformation industry which mills and processes food and feed products, c) the subsystem of port terminal elevators which receive and load grain for overseas shipment, and d) the transportation

system which is responsible for grain movement from farm to final destination. Marketing institutions such as the Australian Wheat Board (AWB), the Bulk Handling Authority (BHA) and various state grain and elevator boards are also included in the "total system" concept. This total system is encompassed and influenced by the policy environment. The prevailing policy environmment in Australia is the market managed system with the Wheat Board as the coordinating body.

The market managed policy environment in Australia has an interesting historical background. Efforts by Australian grain farmers to organize an orderly grain marketing system occurred many years prior to establishment of the Australian Wheat Board. The first thrust at organized marketing lead to the formation of a Commonwealth Wheat Scheme during World War I. The objective of the scheme was to conduct compulsory wheat pools and give all wheat farmers a share of the proceeds. Though successful, this operation continued only through the 1920/21 season. Thereafter, wheat marketing returned to a more market oriented system involving merchants and voluntary pools.

Beginning in the 1920's and up until 1938, increased pressures to stabilize wheat prices led to proposals for a market-managed system. The efforts during that period were only partially successful, but they finally resulted in the Wheat Industry Assistance Act of 1938 which guaranteed producers a stable price in the domestic market. Farmers continued to voice dissatisfaction over world wheat price uncertainty, and by 1939 were demanding a stabilized price for the entire wheat crop. World War II acted as the final catalyst for the move toward a market-managed system; and as a result, the Australian Wheat Board was established in 1939 to coordinate and supervise orderly wheat marketing. In 1940, the Wheat Industry Stabilization Plan was adopted which established a guaranteed price for all Australian wheat and a

licensing system for production control.

The Australian Wheat Board continued to operate as a government agency until the end of 1948. The attractive level and stability of prices during World War II were perceived by farmers as the result of the establishment of the wheat board; and therefore, wheat growers voiced a desire to maintain a centralized marketing organization. Consequently, a comprehensive Wheat Industry Stabilization Plan was adopted. This legislation also required growers to deliver all of their wheat to the Board and authorized the Board to conduct business within state boundaries. Subsequently, the Board was formed in its own name and authorized to own and market all Australian wheat. The Board became the sole marketing authority for both export and domestic sales. The Wheat Plan also linked the guaranteed price to annual production costs.

The 1948 Wheat Plan evolved into the 1958 Wheat Industry Stabilization Act. This legislation directed that the Australian Wheat Plan be reviewed every five years as had been done since 1948. The current Australian Wheat Board derives its basic authority from the 1979 Wheat Marketing Act.

The A.W.B. is producer controlled and oriented as ten of its fourteen members are grower representatives from each of the five wheat producing states. The other four members include the chairman, an employee representative, a finance member, and a representative of the flour mill owners.

Operating within this market managed policy environment, three levels of the grain marketing system will be discussed: a) production, b) first-handler (country elevator), and c) end use (transformation and port terminal) (Figure 1). The transport linkage is discussed between each level while the pricing and payment linkage is treated in a separate discussion.

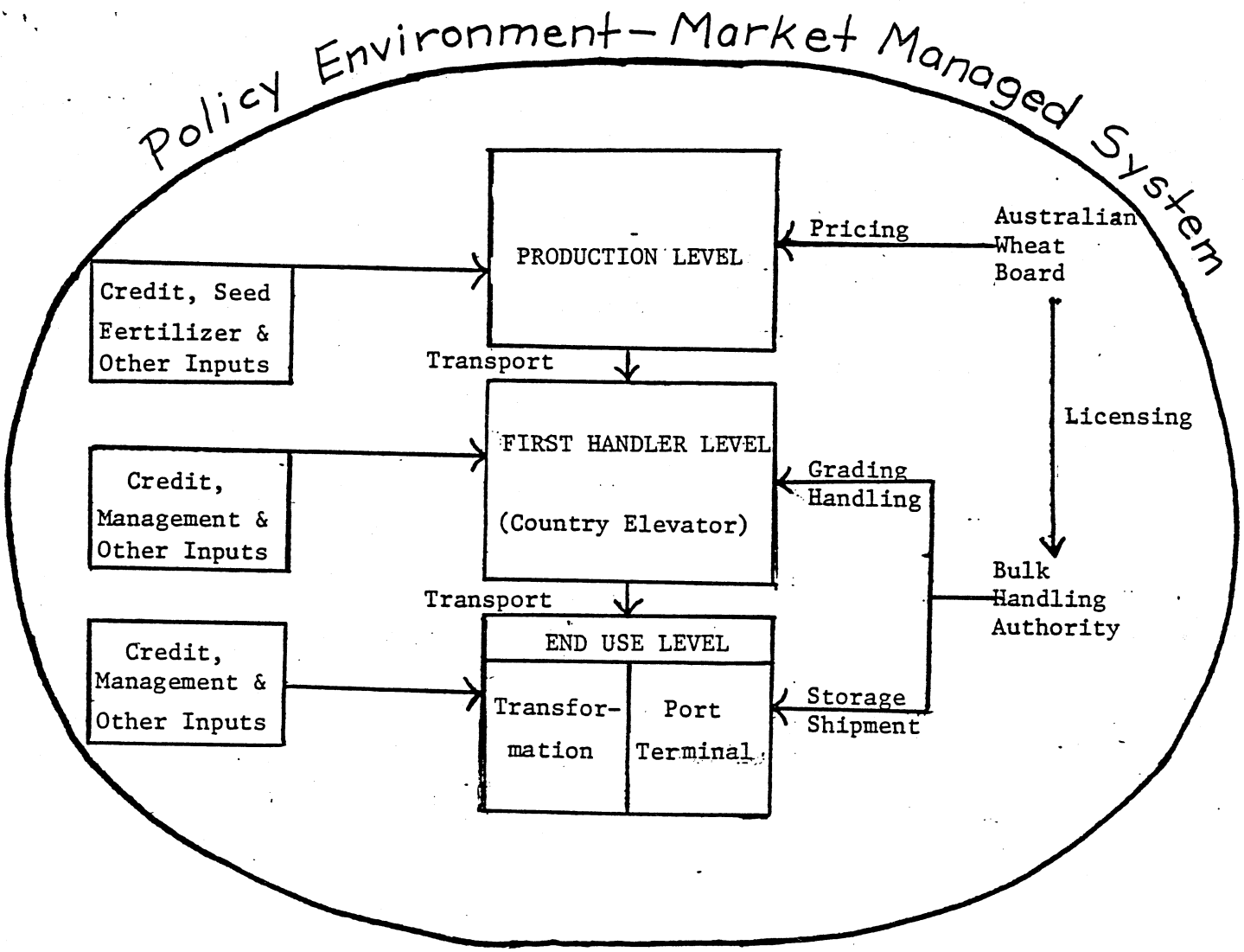


Figure 1. A Schematic Diagram of the Policy Environment and Levels of the Australian Wheat Subsector, 1939-80

A. Production Level

Australia's agricultural sector generated eleven percent of gross national product in 1978, but accounted for one-half of the country's total export value. Australia harvested four percent of the world's wheat production in 1978/79 and will account for nearly that much in 1979/80 if current estimates prove accurate. Usually between two-thirds and three-fourths of the wheat crop is exported. Australia has exported about 12 percent of the world's wheat since 1971 (McCalla et. al., Dec. 1979). Wheat sold domestically is used mainly for flour (65 percent) and stockfeed (32 percent) (AWB).

Wheat is the country's most important cereal crop, accounting for 79 percent of total cereal crop value in 1978/79 (Table 1). Wheat value was one-half of total crop value and 24 percent of total agricultural output in that same year. Total wheat area is estimated at 11.5 million hectares for 1980/81 or 2.5 percent below the record area sown in 1979/80 (FAS).

Only 237 million hectares, or 30 percent of the total land area, receives moisture adequate for agricultural production. Wheat has traditionally been grown in areas with rainfall ranging from 250 mm - 500 mm (10-20 inches) annually. Great expansion of total wheat area seems unlikely because of extremely dry conditions in the country's interior and increased disease and insect problems in the relatively high rainfall areas (Richards).

On-farm storage was almost nonexistent until 1978/79. In response to the large grain crop of 1978/79, temporary on-farm storage was erected and current capacity stands at 7 MMT (IWC Report).

Table 1. Australia: Gross Value of Wheat Production, Cereals, Crops, and Agricultural Output, 1976/77 - 1978/79

	1976/77	1977/78 b/	1978/79 c/
	- - - - - - - -	$ A million	- - - - - - - - -
Wheat	1030	920	2420
Total Cereals a/	1551	1362	3053
Total Crops	3192	2956	4980
Agricultural Output	6312	6384	10010

a/ Wheat, barley, oats, maize, sorghum, rice.

b/ BAE estimate.

c/ Preliminary.

Source: Industries Assistance Commission Report. Wheat Stabilization, No. 175, June 30, 1978; and Bureau of Agricultural Economics. Quarterly Review of the Rural Economy, Canberra, Nov. 1979.

Five of Australia's six states grow wheat, with New South Wales and Western Australia being the two largest producers, each harvesting 6.4 MMT and 4.4 MMT, respectively, in 1978/79 (BAE) (Figure 2). Together they accounted for over half of total wheat production. Victoria, South Australia and Queensland produced 3.4 MMT, 2.1 MMT, and 2.0 MMT , respectively, in the same year.

Dryland wheat is almost always grown on mixed activity farms in rotation with other grains and pasture. Alternative grains reduce the occurrence of wheat disease, while pasture legumes restore nitrogen to the soil thereby complementing wheat and cereal grain production.

Australia's average farm had 1,274 hectares (3,147 acres) in 1975/76 (BAE). Of this total, 251 hectares (620 acres), or 20 percent, were planted to wheat, 108 hectares (267 acres) planted to other field crops, 791 hectares (1,954 acres) under pasture, and the rest fallow or unused. There appears to be a trend of increasing farm size, as the 1,274 hectares was a 10 percent increase over average farm size in 1970/71.

Average value of farms growing wheat was $A 245,000 in 1975/76, with land value being the largest component, averaging $A 145,000 per farm (BAE). Average farm total revenue was $A 55,000 in 1975/76. Increased wheat value was a major contributing factor as wheat receipts increased from 34 percent of total farm receipts in 1973/74 to 61 percent in 1975/76. Total cash costs per farm went from $A 16,000 in 1973/74 to $A 23,500 in 1975/76 or an increase of 47 percent (BAE). Net farm income increased from $A 23,000 to $A 34,000, or 48 percent during this same period.

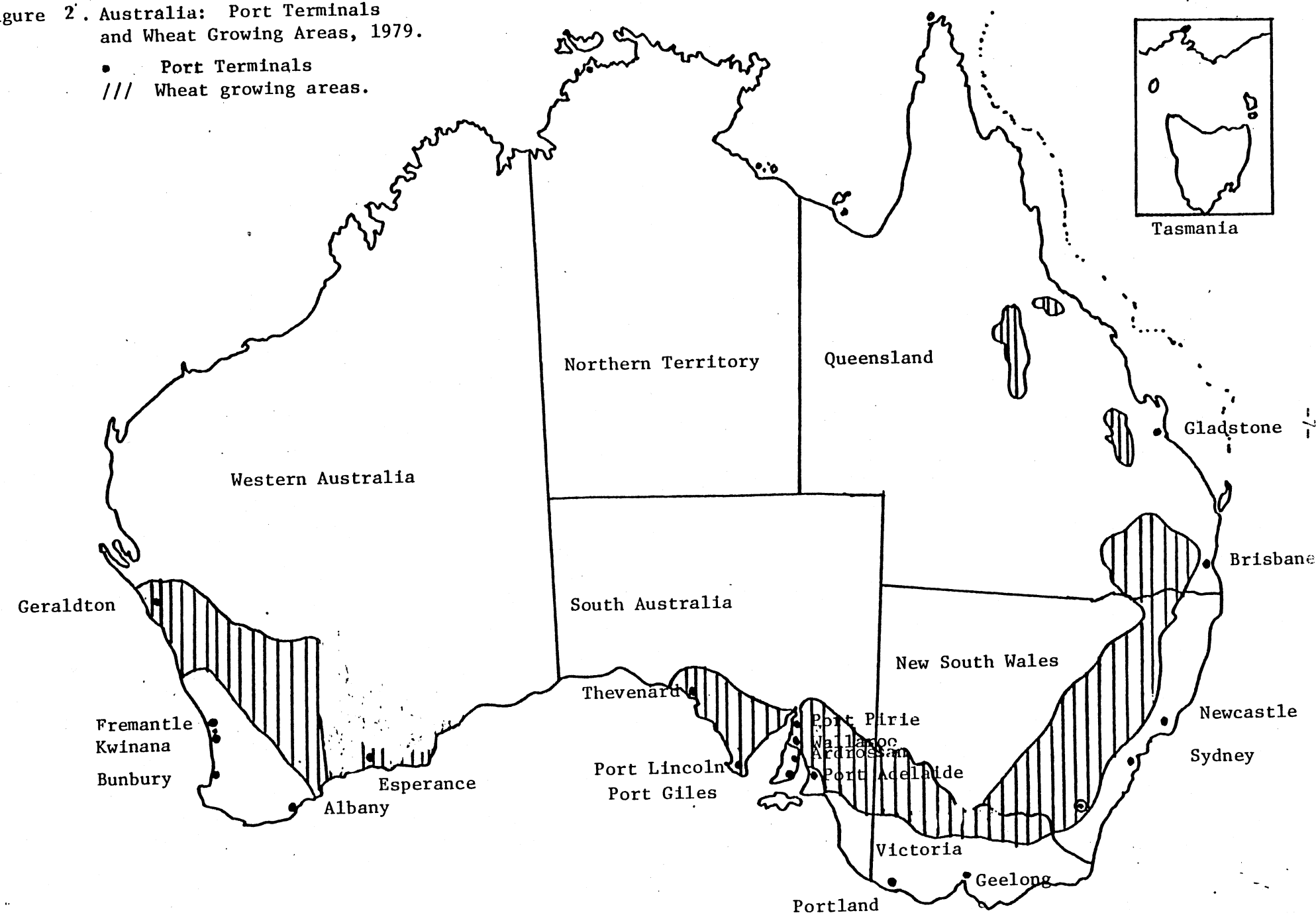
B. First Handler Level (Country Elevator)

In 1978 there were approximately 930 country elevators located in the Australian wheat belt (Green). That represents an increase of 40 percent over

Figure 2. Australia: Port Terminals and Wheat Growing Areas, 1979.

• Port Terminals

/// Wheat growing areas.



the 658 available in 1960 (Commonwealth Bureau of Statistics). The Bulk Handling Authority owns or leases most country facilities as the licensed representative of the AWB. The average country elevator, which serves as the first receival point for wheat deliveries, has a storage capacity of 20,000 tons and is located on rail services thus facilitating grain movement to the port terminal (Richards). 1/

Country elevators separate wheat into six major classes: Australian Standard White (ASW), Australian Prime Hard, Australian Hard Wheat, Australian Soft Wheat, General Purpose Wheat, and Feed Wheat. Each class specifies moisture content, test weight, and allowable unmillable material. As many as five separate grades may exist for any one class of wheat, greatly facilitating wheat use by foreign and domestic customers.

Growers who deliver hard, prime hard, soft, and durum wheat usually receive premiums above A.S.W. wheat. These premiums are paid by the flour miller or the AWB directly to the grower. Wheat failing to meet minimum quality standards such as excessive weather damage or unmillable material receives a dockage at the B.H.A. receival point.

Country elevator storage capacities range from 6.024 million metric tons (MMT) in N.S.W. to 1.263 MMT in Queensland, while the whole country system has a capacity of 17.620 MMT (Table 2) or three-fourths of total Australian grain storage capacity. Reports from N.S.W. indicate that inload rates vary from 75 MT per hour at Attunga, Breeza, and West Tamworth to 400 MT per hour at Narrabri. Outload rates vary from a minimum of 40 MT per hour at Baan Baa to a maximum of 240 MT per hour at Banaba, Croppa Creek, Burren Junction, and Moree.

N.S.W. and Western Australia have 34 percent and 31 percent of total country storage, respectively. Victoria and South Australia have 15 percent

1/ Network of subterminal facilities is limited as none are located in South Australia or Queensland due to proximity of farms to ports (Richards).

Table 2. Storage Capacity of Australian Bulk Handling Authorities and Mills by State and Type of Facitity, 1978

State	Country Elevator	Port Terminal	Mill	Total
	----------Million Metric Tons----------			
New South Wales	6.042 (34)[a/]	.375 (7)	.145 (47)	6.562 (28)
Victoria	2.751 (15)	1.070 (20)	.075 (25)	3.896 (17)
South Australia	2.104 (12)	1.471 (28)	.040 (12)	3.615 (16)
Western Australia	5.460 (31)	2.157 (40)	.020 (6)	7.637 (33)
Queensland	1.263 (7)	.107 (2)	.023 (7)	1.393 (6)
Tasmania	-	.031 (1)	.003 (1)	.034 (.1)
Australia	17.620 (76)[b/]	5.211 (23)	.306 (1)	23.137 (100)

a/ Percent of state storage.
b/ Percent of total storage.

Source: 1977/78 AWB Annual Report.

and 12 percent, while Queensland has 7 percent of total country elevator storage capacity(Table 2).

Truck transport is normally used in moving wheat from farms to country elevators. Transport costs are the farmer's responsibility and deducted from the initial payment for his wheat.

Wheat has to travel 40 miles on average to reach a country facility (Richards). Truck transport is also used to move wheat from country points to various end users within each state.

C. End Use Level 1-Port Terminal

Australia has 19 major port terminals, thirteen of which are located in South and Western Australia (Figure 2). The Bulk Handling Authority (BHA) in

each state is the licensed representative of the AWB and receives wheat for storage and shipment domestically and overseas. In New South Wales (NSW), Victoria and Tasmania the Grain Elevators Board is designated as the BHA. In South and Western Australia, the BHA is the Co-operative Bulk Handling Ltd., while in Queensland it is the State Wheat Board.

The AWB is the sole marketing authority for Australian wheat. As such, the Board directs the sale of all wheat domestically and also is responsible for the sale of wheat and wheaten products abroad. To this end, the AWB has four modes of operation for export sale: a) for sales to centrally planned countries, the AWB deals directly with governments or government agents; b) a foreign government may call tenders for wheat purchases; c) in some markets private buyers deal directly with AWB; and d) wheat is sold by the AWB to traders who supply various markets. In all cases, the AWB is directly involved in the sale of wheat to both foreign and domestic customers, and is therefore a trading monopoly with authority over Australian wheat. In recent years government-to-government sales have accounted for 60 percent of annual exports (Richards).

Wheat is normally sold on an f.o.b. basis as the Board's daily asking price. Some countries and private traders arrange their own shipping, while others buy on a (c and f) basis.

Export credit plays an important role in AWB wheat sales to many foreign countries. The country's primary credit customers are Egypt, China, and Pakistan. All credit sales are backed by the Export Finance and Insurance Corporation (EFIC) which guarantees against commercial default, expropriation, and war. Normally, the coverage is extended to 90 percent of the value of outstanding credit and the purchase price. If the EFIC is unwilling to accept the risk, the federal government will usually guarantee the coverage if it is

in the national interest.

Port terminal storage capacity ranges from 107,000 MT in Queensland to 2,157,000 MT in Western Australia (Table 2). Total port storage capacity is estimated at 5,211,000 MT or 23 percent of total capacity. Port storage in Western Australia represents 40 percent of port terminal capacity, while South Australia and Victoria have 28 percent and 20 percent of total port storage capacity, respectively. N.S.W., Queensland, and Tasmania together represent 10 percent of port terminal storage capacity.

Handling and storage facilities have been expanded at several ports in recent years to accommodate larger ships and greater grain volume. However, inload/outload rates vary from 120 tons per hour at Gladstone, Queensland, to 4000 tons per hour at Kwinana, Western Australia, which became operational in 1977. Seven of the ports have outload rates of 400 tons per hour, while Kwinana can ship out 5000 tons per hour. Western Australia has the largest export capability measured at 5.5 million metric tons annually, while N.S.W. and Victoria can each handle five million metric tons (MMT) (International Wheat Council Report). South Australia has an export capacity of 2.5 MMT, while Queensland can ship out 2.0 MMT. Australia's sustainable monthly export capacity is now placed at 1.5 MMT which implies an annual flow of 18 MMT.

Wheat is moved primarily by rail from the country elevator collection point to the port terminal. Australia's railway system developed on a state-by-state basis and had 26,000 miles of track in 1971. Of this about 25,000 miles were state owned, while the remainder was privately owned.

Gradual nationalization of the railway system began in 1975 with the formation of the Australian National Railways Commission. The purpose of ANRC was to accept responsibility for state railways transferred to the

Commonwealth. Transfer agreements were approved in May, 1975, by the Commonwealth and respective State governments and were ratified by state and national Parliaments.

While Australian railway mileage is extensive, three different gauges have developed (Figure 3). Wheat movement for export is not severely hampered by these breaks in gauge because they normally occur at state boundaries and export movement is usually contained within each state. However, Australia's inland transport system is considered a major constraint in the country's ability to expand exports (IWC).

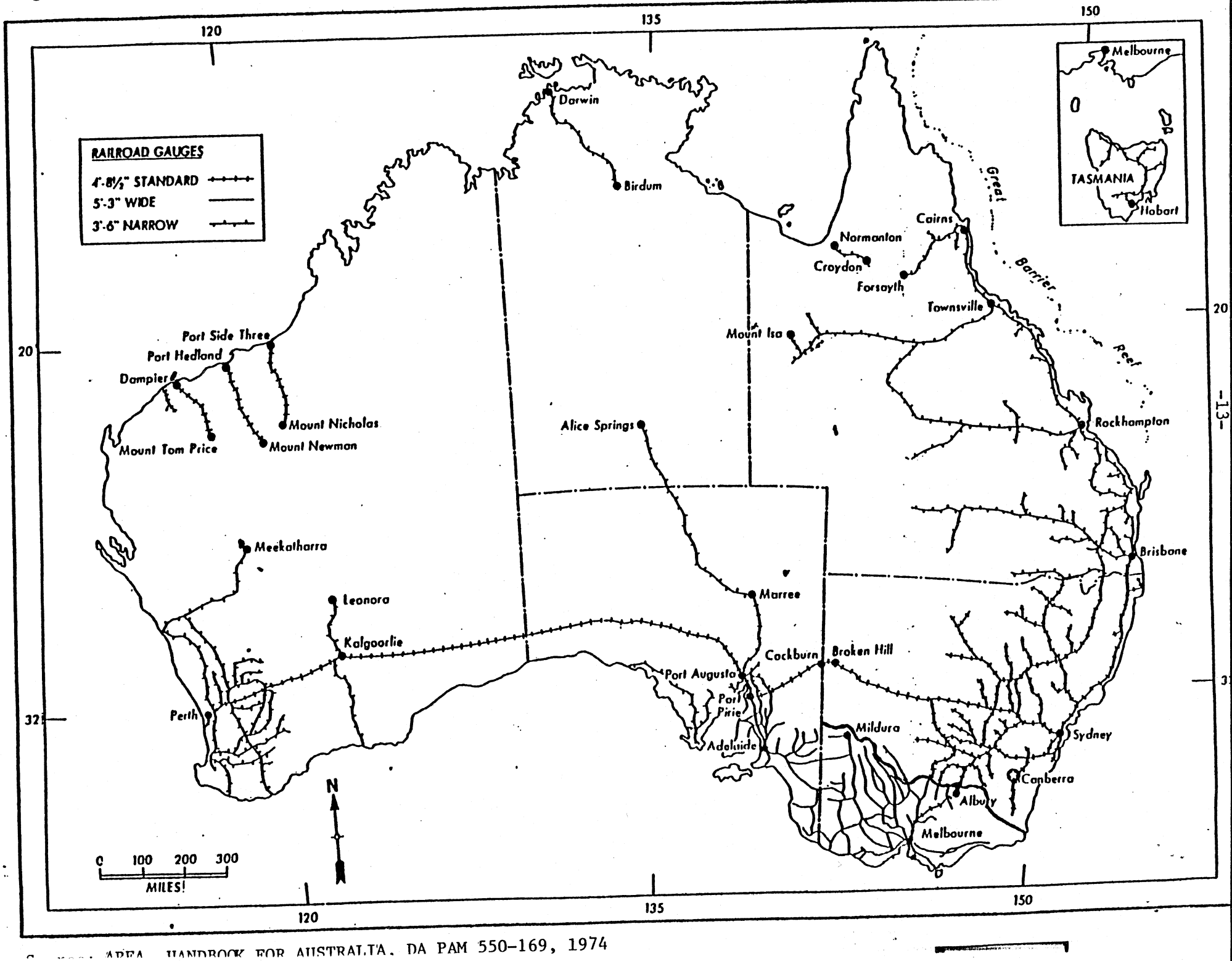
In 1974/75 an acute shortage of freight rolling stock developed. To alleviate the situation the Australian National Railways Commission (ANRC) established a pool of 500 modern freight wagons for hire by the states (D.O.T.). Further needed railway improvements outlined by the International Wheat Council Report in 1980 included larger rail wagons capable of more rapid discharge and better loading equipment.

D. End Use Level 2-Transformation Industry

The second largest use of Australian wheat is the flour industry. The number of Australian flour mills has declined 65 percent since 1948 (Table 3). N.S.W. has seen the greatest decline in mill numbers, going from 58 in 1948 to 23 in 1978 or a decrease of 60 percent, while in South Australia mill numbers fell by 64 percent (Table 3).

This reduction in mill numbers occurred because of technical change, vertical integration of mills with local flour users, and the decrease in demand for export flour (Industries Assistance Commission Report). One third of the mills and one-half of the gristling capacity is now controlled by three groups within the country. These groups also control 40 percent of the flour mill's bulk wheat storage capacity (IACR). Most mills are vertically integrated and

Figure 3. Australia: Principal Railroads, 1973.



SOURCE: AREA HANDBOOK FOR AUSTRALIA, DA PAM 550-169, 1974

Table 3. Number of Flour Mills: Australia, Selected Years, 1948-78

State	1948	1956	1966	1976	1978
New South Wales	58	47	32	25	23
Victoria	38	34	20	9	7
South Australia	31	23	17	13	11
Western Australia	20	19	11	5	5
Queensland	10	11	11	11	7
Tasmania	3	3	5	3	3
Australia	160	137	96	66	56

Sources: Industries Assistance Commission Report, Wheat Stabilization, No. 175, June 30, 1978; AWB Annual Report, 1977/78.

involved in activities such as baking, pastries, stockfeed processing, and livestock fattening and processing. Millers buy wheat from the AWB at the home consumption price. Freight rebates are given to flour mills in country areas to equate their purchase price with that of mills at seaboard terminals (IACR).

In 1976 the flour milling and flour using sector employed 39,000 people. The largest employers were the bread, cake, and biscuit industries which employed 31,000 or 80 percent of total sector employment (IACR). The flour milling subsector employed only 2,663 persons or 7 percent of total sector employment in 1976.

Feed processing has become integrated with the chicken meat industry and flour milling according to the Australian Stock Feed Manufacturer's Federal Council. The AWB controls wheat deliveries to feed millers and processors to insure that regular deliveries and grade standards are met.

In 1976 there were 153 prepared animal and bird feed plants employing 4,100 persons (IACR).

E. Wheat Pricing and Payment Policy

Wheat policy in Australia derives its basic authority from the Wheat Marketing Act of 1979 which was successfully negotiated between the Australian Wheatgrowers' Federation and the Commonwealth and State governments in November 1979. Current wheat pricing policies were the direct result of the Act and will extend through September 1984. This was the seventh five-year wheat scheme since 1948.

Wheat delivered to the AWB in any one season forms a "wheat pool" and growers receive a "pooled" or average price based on export and domestic sales. After wheat is delivered to the AWB, wheat growers receive an initial payment known as the Guaranteed Minimum Delivery Price (GMDP). Under previous wheat plans this initial payment, called the Stabilization Price, represented 80 percent of the total returns available to growers. The remaining 20 percent was paid over a period of two to four years.

The 1979 Act was designed to alleviate this waiting period and give growers a larger initial payment. The GMDP is set at 95 percent of the average of the pool return for the past two seasons and an estimate of the pool return for the current season. Any deficiency between the net pool return and the GMDP is guaranteed by the commonwealth government. The GMDP is limited to a 15 percent movement between seasons.

The former "home consumption price" has been replaced by a two-tier domestic wheat price to more adequately recognize the major components of the domestic market, namely wheat for flour for human consumption and wheat for stockfeed and industrial use. This should make wheat more competitive on the stockfeed market and reward growers of high quality wheat.

The "human consumption price" will be determined by a formula which accounts for export price movements and grower production cost adjustments, while giving farmers a margin above export prices. The formula price is limited to movements of 20 percent from one year to the next.

Under the 1979 Wheat Marketing Act, the Wheat Finance Fund (WFF) was established to replace the old Wheat Stabilization Fund. The primary purpose of the WFF is to hold funds which will be used to refinance the debt incurred from initial grower payments for wheat deliveries and to refinance AWB debts to the Rural Credits Department of the Reserve Bank of Australia. The WFF receives $A 2.50 per ton from all AWB deliveries and can accumulate $A 100 million in grower monies. Any excess in the fund will be returned to growers as pool payments, settling the oldest pool first.

Measuring Export Market System Peformance

After describing the system and the policy environment, the question arises as to how the policy environment has influenced the performance of the export marketing system. In this section, five general performance criteria are examined: a) technical efficiency, b) price efficiency, c) export response, d) progressiveness, and e) equity. A number of conceptual measures [2/] are identified for each performance criteria. And for each conceptual measure, a number of operational methods can be utilized. Time and space preclude an evaluation of all these measures. Since the intention of this paper is to examine some methodological issues, only one conceptual measure under each of the performance criteria will be studied at an in-depth level.

[2/] In the proposed study, the operational method for analyzing each conceptual measure identified in the appendix will be evaluated.

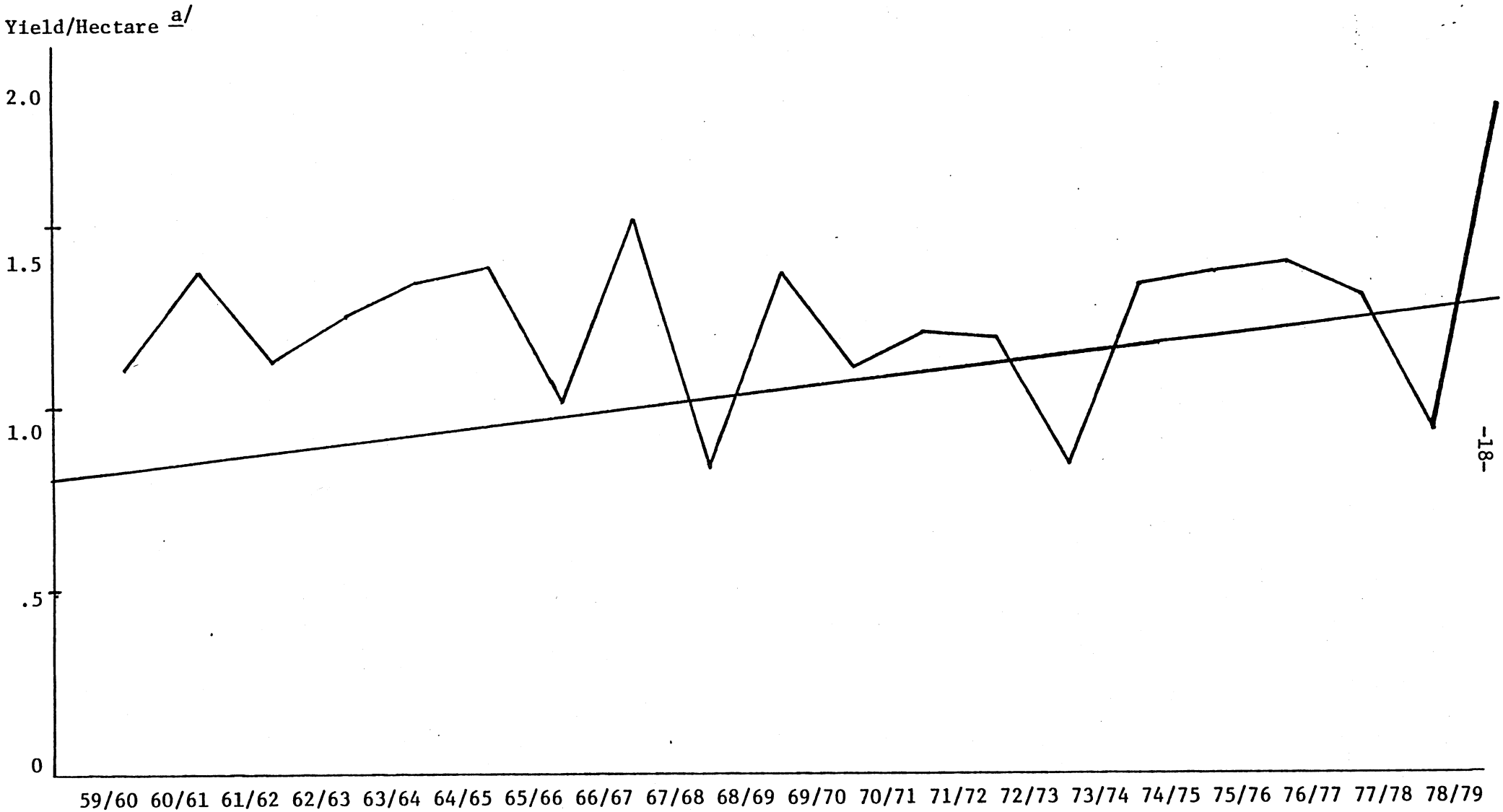
A. Technical Efficiency

Technical efficiency was defined as the input/output ratio (Bressler and King). Ideally, there are a number of ways of conceptualizing technical efficiency as a performance criterion. Those identified in the appendix were a) level of supplies to all users, b) stability of supplies, and c) productivity.

Operational methods of technical efficiency include a) trend in supplies, b) variation around trend in supplies, c) trend in crop yields, d) variation around trend in yields, e) response in grain production to changes in government payments, f) country elevator and port terminal throughput ratios, and g) mill output relative to milling capacity. In this paper, we will evaluate productivity. The operationalized methods chosen for examining this conceptual measure are trend and variation around trend in wheat yields.

Technical efficiency was measured by comparing wheat yield variability in Australia, the U.S., Canada, and Argentina. Between 1959 and 1979, Australian wheat yields were quite variable ranging from a low of .83 tons per hectare in 1967/68 to a high of 1.77 tons per hectare in 1978/79 (Figure 4), the average being 1.2 tons per hectare. The coefficient of variation of Australian wheat yields was 0.19 for this same period (Table 4). The coefficient of variation for Canada was 0.19, for Argentina 0.16, and for the U.S. 0.10. It can be concluded that Australian wheat yields were more variable than wheat yields in the U.S. and Argentina. The high variability in Australia's yields is due mainly to insects, disease, and frequent drought conditions experienced across the wheat growing area (BAE).

Australian wheat yields have trended upward since 1959/60 (Figure 4). The greatest increase (up to 13 percent) occurred during the 1960's from an average of 1.09 tons per hectare (1956-60) to 1.23 tons per hectare (1960-70)



a/ Metric tons.

Figure 4. Season Average Yield and Linear Trend of Australian Wheat, 1959/60 - 1978/79

Table 4. Coefficients of Variation in Wheat Yields: Australia, the United States, Canada, and Argentina, 1959-1979

Country	Wheat
Australia	.19
United States	.10
Canada	.19
Argentina	.16

Source: Prepared for this study.

(Table 7), while the increase during the 1970's was only 3 percent (to be examined in a later section). In 17 of the 20 years analyzed, the actual yield was above the predicted trend line thereby reducing the uncertainty of expected yields. While yields were variable, the variability occurred above, not below the trend. Examination of this phenomenon by use of the semivariance and regression techniques will improve our understanding of the variability exhibited in yields.

The coefficient of variation allowed a comparative analysis of yield stability among countries. The primary advantage of trend analysis was that it permitted an examination of yield level relative to trend and yield variability relative to trend. However, production stability may be a better measure than yield stability because the deviation from trend can be compared to planted area to determine the reason for the deviation.

In conclusion, it does appear that the direct involvement of the AWB in breeding, disease, and variety trial research contributed to an upward trend in yield.

Country elevator and mill productivity may prove difficult to measure in

practice because of problems with data availability. Martin suggests elevator turnover ratios, plant distribution relative to efficient size, and output relative to industry capacity. He also indicates that all are moderately difficult to measure. Port terminal maximum throughput capacity is obtainable from Australian sources and can be compared to actual throughput during a given period. Country elevator inloading and outloading data are available for N.S.W. for the Northern freight zone, but may be difficult to obtain in the other states and freight zones.

B. Price Efficiency

Price efficiency can be defined as the speed and accuracy with which price information flows throughout the pricing system (Sporleder and Chavas). Conceptually, there are many ways of measuring price efficiency: a) level and stability of producer prices, b) changes in marketing costs, c) market signals, d) response to structural changes in demand, e) grower returns, and f) producer market access. For each of these conceptual measures, there exist numerous methods for operationalizing.

In this paper, one minor aspect of price efficiency, the level and stability of producer prices, is partially analyzed. For comparative purposes, the deviations are calculated for year-to-year percentage changes in annual wheat prices for Australia and the U.S. (Martin and Warley). The standard t-test is used to determine differences between means, while the F-test is utilized to examine differences between standard deviations.

U.S. wheat prices have been significantly more variable than Australian prices since 1955/56 (Table 5). Prices received by U.S. farmers were also more variable between 1955 and 1970. Australian wheat prices were more variable between 1970 and 1978. The implications of this variability are not clear. The gains and losses from price stabilization

are dependent on the source and degree of instability (Hueth and Schmitz). The welfare consequences from price stabilization for any country can only be ultimately determined in an empirical framework (Konandreas and Schmitz). However, price stability implies very little about the level of prices in either country.

The level of wheat prices in Australia were significantly less than U.S. wheat prices from 1960/61 to 1969/70. During the other periods, U.S. and Australian prices were not significantly different. However, between 1955 and 1978, U.S. prices were significantly greater. This indicates that although Australian farmers have faced less variability

Table 5. Means ($\bar{x}$) and Standard Deviations (s.d.) of Year-To-Year Percentage Changes in Producer Wheat Prices, Australia and the United States, 1955/56-1977/78.

Season	Australia		United States	
	$\bar{x}$	s.d.	$\bar{x}$	s.d.
	-percent-		-percent-	
1955/56-1960/61	1.68	1.14[a/]	2.72	3.78[a/]
1960/61-1969/70	2.05[a/]	1.80[a/][b/]	12.55[a/]	9.14[a/]
1969/70-1974/75	12.73	23.70[b/]	23.23	31.47
1970/71-1977/78	12.90	21.28	23.11	28.83
1955/56-1977/78	5.28[a/]	12.88[a/]	13.89[a/]	18.71[a/]

[a/] Significant difference between countries with time periods. Means were tested at 90% significance; standard deviations were tested at 95% significance.

[b/] Significant difference within country between time periods.

Source: Prepared for this study.

in prices, the prices they have received have been significantly lower than the prices received by U.S. farmers.

The main advantage in using percentage change among years is the removal of any seasonality in the time series. Another advantage is that it provides a measure of variation resulting from trend and variation around trend (Martin and Warley).

Quality differentials are ignored in this analysis. Therefore, prices are probably even more variable than indicated here. Prices were averaged over all qualities for both countries. This is the most valid comparison possible without examining quality differentials within each country.

The greater stability of Australian wheat prices may be attributable to the actions of the past six wheat stabilization schemes. However, the 1978 Industries Assistance Commission Report disagrees and concludes that price stability was not enhanced due to delayed payments in finalizing wheat pools which disrupted individual grower's cash flows. In the absence of wheat stabilization and pooling, growers would have received higher prices in some years and lower prices in others thereby increasing price variation. The design of the stabilization fund was such that growers paid into the fund when wheat prices rose above a given level and withdrew from the fund when prices fell. Therefore, on the average, the final price received is much less variable than it would have been without stabilization.

C. Export Response

To maintain a viable export program, a country must gain access to foreign markets regardless of the market orientation of its policy environment. Therefore, it is necessary to examine a country's performance with respect to export response. This performance criterion can be evaluated by conceptual measures such as a) growth in sales to alternative countries,

b) response to changes in export demand, c) foreign exchange earnings, d) foreign market development, and e) credit assistance to foreign customers.

Measures to operationalize these conceptual variables include but are not limited to: a) export volume by destination, b) share of major import markets, c) share of world trade relative to annual grain prices, and d) trend in value of grain exports.

The conceptual performance measure examined in this brief paper is response to change in export demand. This is accomplished by comparing Australia's share of world wheat trade relative to average annual Australian f.o.b. export prices (Martin).

During the relatively low export price period of 1970/71-1971/72, Australia exported more wheat and had a greater market share than the average for the 20 year period (Table 6). Australian wheat exports averaged 7.2 MMT between 1960/61 and 1979/80, while its share of the world wheat market averaged 12.5 percent. In 1973/74 export volume was still relatively low (7.1 MMT), even though the export price was $A125.01 per ton; a record high at that time. In spite of the high export prices that occurred between 1974/75-1976/77, Australia's market share did not increase substantially until 1977/78 when it reached 15.2 percent. However, the following year it fell to 9.4 percent when export prices were at another record high of $A136.00 per ton.

This lack of responsiveness may have been due to poor crop conditions as well as industrial disputes and transport problems (Alaouze, et al.). It is known, however, that Australia has made some improvements in its port facilities since 1976. These improvements will lead to a higher volume of exports and will allow Australia to achieve a greater share of the world wheat market. The large world market share associated with high world prices in 1979/80 might indicate an improved export market response.

Table 6. Australian Wheat Exports, Share of the World Wheat Market, Home Consumption Price, and Export Price 1960/61-1979/80

Year	Wheat Exports	Share of World Market	Prices	
			Home Consumption	Export[a/]
	million metric tons	Percent	$A/metric ton	
1960/61	5.5	12.5	56.33	49.20
1961/62	4.2	8.9	58.17	52.51
1962/63	5.5	12.0	58.64	49.86
1963/64	6.0	10.3	53.57	52.51
1964/65	6.6	12.0	53.90	49.16
1965/66	4.3	9.2	56.22	51.77
1966/67	8.0	12.5	57.50	53.17
1967/68	5.1	13.7	60.81	49.75
1968/69	6.1	11.8	62.83	47.95
1969/70	7.7	14.4	63.38	48.55
1970/71	8.6	17.5	63.93	48.00
1971/72	7.4	16.6	65.40	48.17
1972/73	3.9	8.2	67.63	54.35
1973/74	7.1	8.7	71.10	125.01
1974/75	8.3	12.6	83.40	122.33
1975/76	7.9	12.2	99.32	110.13
1976/77	8.5	13.6	105.40	92.30
1977/78	11.1	15.2	111.16	102.90
1978/79	6.7	9.4	116.61	136.00
1979/80	14.5	17.7	127.78	145.00[b/]
Average 1960-1980	7.2	12.5	74.65	74.43

[a/] Excludes Stabilization Fund contributions.

[b/] BAE estimate.

Sources: Bureau of Agricultural Economics, Wheat Situation and Outlook, Canberra, 1980; USDA, Foreign Agriculture Circular, FG-2-80, Jan. 17, 1980; FG 17-80, May 13, 1980; 1977-78 AWB Annual Report; and McCalla et al. AJAE, Dec. 1979.

Comparing market share to export price proved superior to viewing market share alone because it allows one to draw conclusions about the export system's ability to respond to higher relative prices. Trend analysis might more readily identify large changes in export volume to be traced through the system in an attempt to indentify the reasons for the deviations. The apparent lag in responsiveness should also be examined.

An analysis of annual end-of-season carryover relative to market share could also prove useful in viewing export response. McCalla (1966) hypothesized that the elimination of carryover was tantamount to destruction of market power. As end-of-season carryover declined, a similar reduction in market share should be evident.

Australia is wheat-export dependent (Maurer). The examination of this performance criterion suggests that only recently has Australia responded to obvious economic incentives. It is important to note that the lack of responsiveness in 1973/74 may have been caused by labor disputes and transport problems disrupting export shipments.

D. Progressiveness

Conceptually, progressiveness can be measured by a) rate of adoption of productivity increasing technology, b) resource conservation, c) effectiveness of commodity research, d) commodity product image overseas, and e) exploitation of opportunities for new crops.

Operationalization of these conceptual measures is achieved by examining a) fertilizer use relative to yield response, b) rate of development of marginal land, c) water and land conservation programs, d) research expenditures relative to yields, e) adoption of new crops, and f) investment in new technology at country elevator and port terminal facilities relative

to total grain sales.

The scope of this paper permits examination of only one conceptual measure in determining the progressiveness of the Australian wheat export marketing system. The operational method utilized is the comparison of wheat research expenditures relative to wheat yields. Australian wheat research began receiving support from the Commonwealth Government in 1958. Funds came from a tax charged to farmers on deliveries of wheat to the AWB and matching government resources. Until 1973/74 the tax rate had been 9 cents per ton; in that year it increased to 11 cents per ton. Since then two tax increases have occurred: one to 15 cents per ton in 1974/75 and another to 20 cents per ton 1977/78 (Table 7). In past years about one-fifth of the research monies have gone to wheat breeding and storage research while 10 to 15 percent has been spent on soil studies and wheat diseases. The remainder was split among pasture research, varietal trials, and research facilities.[3/]

In order to obtain an indication of whether the research investment has been successful, expenditures are analyzed relative to wheat yields. Total contributions have increased eight and one-half times since government grants to wheat research were instituted in 1958 (Table 7).

Between 1956 and 1960 wheat yields averaged 1.09 tons per hectare (Table 7). During the 1960's yields averaged 1.23 tons per hectare, a 13 percent increase over the decade. Since 1970, yields have ranged from a low of 0.85 tons per hectare in 1972/73 to a high of 1.77 tons per hectare in 1978/79. However, the average yield during the 1970's was 1.27 tons per hectare or an increase of only 3.3 percent over the previous decade.

The last 3 percent increase had a very high cost relative to the increase

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[3/] AWB Annual Report, 1975-76.

Table 7. Australian Wheat: Research Tax Rates, Research Contributions, and Yields, 1956/57-1978/79

Season	Tax Rate	Grower Contribution	Commonwealth Contribution	Total Contribution[a/]	Yield
	centsA per metric ton		-$A Thousands-		metric tons per hectare
1956/57	9	249.5	-	249.5	1.15
1957/58		169.1	-	169.1	.74
1958/59		414.4	396.4	810.9	1.39
1959/60		373.1	350.0	723.1	1.10
Average 1956-1960		301.5	373.2	488.2	1.09
1960/61	9	523.0	336.0	859.0	1.37
1961/62		466.8	490.0	956.8	1.13
1962/63		594.5	436.0	1030.5	1.25
1963/64		640.6	551.0	1191.6	1.34
1964/65		721.6	574.0	1295.6	1.38
1965/66		585.9	688.0	1273.9	1.00
1966/67		1097.2	816.1	1913.3	1.51
1967/68		617.9	1030.8	1648.7	.83
1968/69		1288.6	835.9	2124.5	1.36
1969/70		778.3	1008.0	1786.2	1.11
Average 1960-1970		731.4	676.6	1408.0	1.23
1970/71	9	713.2	801.8	1515.0	1.22
1971/72		689.4	782.5	1471.9	1.19
1972/73		555.3	800.3	1355.6	.85
1973/74	11	1232.1	852.7	2084.8	1.34
1974/75	15	1177.7	968.2	2145.9	1.37
1975/76		1688.8	1254.7	2943.5	1.40
1976/77		1640.0	3900.0	5540.0	1.32
1977/78	20	1708.2	2800.0	4508.2	.94
1978/79		3467.2	3500.0	6967.2	1.77
Average 1970-1979		1430.2	1740.0	3170.2	1.27

[a/] Totals may not add due to rounding.

Sources: AWB, Annual Report, Melbourne, Selected Issues; John M. Howard, Budget Papers Presentation, Aug., 1978; and BAE, Situation and Outlook 1980, Wheat, Canberra, 1979.

in wheat research dollars. Total contributions to wheat research averaged $A 3,170,200 during the 1970's, an increase of 125 percent over the 1960's. When viewed as the return to dollar invested, a 3.3 percent response to the 125 percent increase was only about a 2.5 percent return. During the 1960's, wheat research dollars increased by 188 percent, while yields responded by increasing 12.8 percent, representing a 6.8 percent return. Although it appears that total dollar contributions have increased greatly during the 1970's, return on investment was lower than in the previous decade when yields increased by almost one-seventh. Perhaps a more equitable analysis may be to examine yields relative to real dollar research investment. More sophisticated techniques in examining research lag impacts, quality differences, and profitability should be explored.

In conclusion, it appears the marketing system has an impact on progressiveness due to the institution of the government grant in 1958. Wheat grower contributions represent funds for research that would not otherwise be available. Together, the AWB and the Commonwealth government have taken initiatives that have had a definite impact on the progressiveness of Australian agriculture.

E. Equity

Many ways exist of conceptualizing equity; those developed for this study include a) level and stability of consumer prices, b) income distribution, c) market access, d) sales restrictions (barriers to entry), e) employment, and f) environmental externalities.

For each conceptual measure there exists a number of operational methods. These include a) percent change in food component of CPI relative to percent change in CPI, b) coefficient of variation in percent change of food CPI, c) farm income relative to non-farm income, d) wheat prices or grower returns

by state or region, e) use of production or delivery quotas, f) unemployment level and coefficient of variation in employment level, g) level of employment in the grains sector, h) percentage of work force in labor or trade unions, i) relative strength of trade unions (seats held in legislature), j) number of elevator explosions per 1,000 tons throughput, and k) number of explosion deaths per 1,000 tons throughput.

Again the scope of this paper limits us to the examination of only one conceptual measure. Grain elevator safety is examined as a measure of environmental quality. At the first and second handler level, the number of grain elevator explosions appears to be a direct measure of quality degradation.

Since the inception of the Bulk Handling Authority in Australia 60 years ago, only one grain dust explosion has occurred (Green). The explosion was minor and no permanent, serious, personal injury resulted. During the last ten years, six minor fires have erupted in elevators, but insurance replacement costs were small. The U.S. recorded 730 explosions after 1900 killing 531 and injuring 1,508 (Table 8). While these data are not entirely comparable, it can be concluded that Australia has had considerable success in limiting adverse environmental externalities. Total grain exports is a common denominator that can be used to improve the comparability of inter-country elevator explosion data. The number of deaths or injuries during a time period can be divided by export volume or total marketings to give a ratio of deaths per 1,000 tons handled. The proposed study will develop this measure further in attempting to answer the question of equity within a given system. Australia's excellent safety record can be attributed to hygiene and safety aspects enforced in all operational and maintenance facilities.

Country elevators in Australia do not have dust extraction facilities,

Table 8. Grain Elevator Explosions in the United States, 1900-1979

	1900-54	1958-77	1979	Total
Number of Explosions	490	220	20	730
People Killed	381	148	2	531
People Injured	991	499	18	1508
Damage $ Million	70	148	N.A.	218

N.A. - Not available.

Sources: Hall, L. J. "Insurance Industry Views," International Symposium on Grain Elevator Explosions, July, 1978, and USDA, Office of the Special Coordinator on Grain Elevator Safety and Security, "1979 Explosion Incidents."

but reduce the danger of secondary explosion through enforcement of rigid safety standards. Regular maintenance schedules are followed to prevent overheating and malfunction of equipment. Building enclosures are constructed of noninflammable material and designed for pressure relief. No smoking rules are rigidly enforced, and stiff penalties are assessed for violation. Elevator surface areas are kept extremely clean throughout the operational period and also during non-operational hours to prevent dust accumulation. Most of these practices evolved because of efforts to eliminate insect infestation.

Australian port terminals have extensive dust control systems. All terminals are shut down daily for a period of routine maintenance, which greatly enhances safety aspects. Port terminals do not usually dry or pelletize grain, therefore, less gas-fired and combustion appliances are required. One interesting aspect of the Australian system is that state agencies, not the Commonwealth, have responsibility for elevator safety standard enforcement.

In answering the question as to whether or not the market managed system has influenced performance, two aspects need to be addressed. First, has the competitive system in the U.S. sacrificed safety for operational expediency? It would seem that 730 explosions since the turn of the century would indicate so. The perceived need for OSHA and EPA, whether justified or not indicates that society felt safety and environmental harmony were in question. Second, what is the relative price of a human life? Since 1900, elevator explosions in the U.S. have killed or injured over 2,000 people, while in Australia, no deaths have occurred. Therefore, it would seem that the market managed policy environment, through its use of a separate Bulk Handling Authority and Grain Elevators Board, has significantly reduced the occurrence of at least one severe environmental externality. It should be noted, however, that Australia's initial efforts at eliminating dust accumulation were to reduce insect infestation, which may not have persisted in the U.S.

Conclusions

The description of the Australian grain marketing system and the brief outline of selected performance criteria surface a number of disconcerting issues. These issues can be categorized into four general areas: a) the scope of economic policy environment, b) methodological issues, c) implications for clientele, and d) implications for the agricultural economics profession.

A. The Scope of Policy Environment

Is the real issue board versus nonboard? We think not. The question is of greater magnitude - what is the economic policy environment, market oriented or market managed and what objective function is the economic policy environment and its related institutions attempting to optimize?

Can it therefore be hypothesized that the adaptation of a board is predetermined by the choice of economic policy environment (Figure 5)?

B. Methodological Issues

No set of well developed testable hypotheses has been found linking policy environment - grain boards - market performance to a commonly accepted body of economic theory. The simultaniety of relationships between performance and its determinants makes conceptualization difficult and empirical measurement even more formidable.

Selection of testable performance criteria can prove very difficult. A certain degree of subjectivity is involved in selecting any criterion. Our five criteria and 26 conceptual measures do not exhaust the list by any means, but we feel that superior results will emit from an initial selection of a broad spectrum of performance criteria. McCalla and Schmitz use eight performance indicators in comparing the performance of the U.S. and Canadian grain export marketing systems. Martin suggests the use of eleven performance objectives and 25 performance indicators. Therefore, we conclude that attempts at an analysis of the entire spectrum of export market performance criteria, though initially superficial, will yield incremental gains to knowledge that may prove invaluable to future endeavors.

Marion and Hardy point out it is difficult to combine performance objectives into a comprehensive index. Martin further emphasizes this point and adds that performance criteria may attempt to achieve conflicting goals. Therefore, we recommend a three step examination of export market performance. First, a disaggregated performance analysis is used to lay the groundwork for comparative studies and objective function measurement. This disaggregated analysis would examine each performance criterion in depth, similar to the Thompson and Dahl study. Assuming society is attempting to

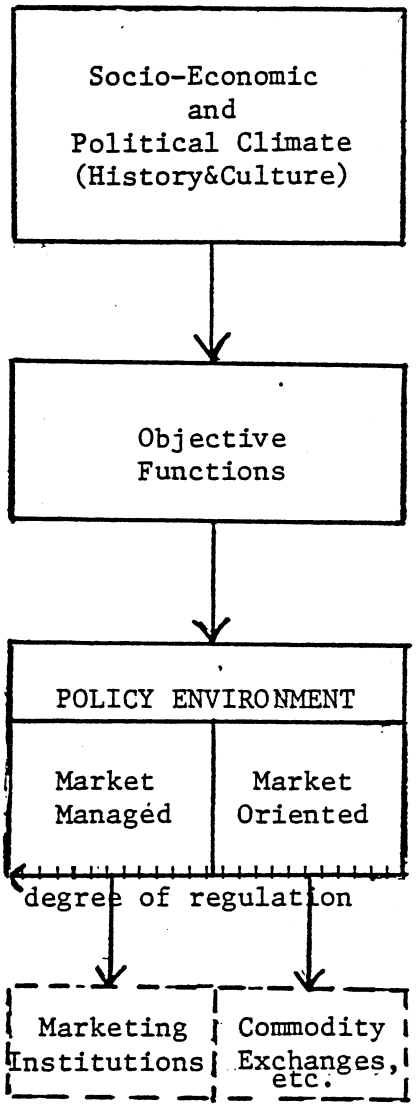

Figure 5. Conceptual Development of a Marketing System

optimize some objective function, a norm is specified and attempts made to achieve it. Comparative studies can then be viewed as a tool or a benchmark in measuring how well a system is accomplishing its own objective functions.

Very few market managed or market oriented systems have developed exogenous to the policy environment and political and economic history. Therefore, we feel it extremely important to develop a thorough historical description of agriculture and food policy, general economic development, and evaluation of the grain marketing network. This description will aid in developing a concensus concerning the objective function of the grain marketing system and its encompassing policy environment.

From this brief exercise, we conclude that the ability to use rigorous descriptive techniques may prove as valuable as the use of sophisticated inferential statistics.

With respect to its end use, export market performance research has implications at two levels: macro and micro. The implications on the macro level involve public policy decision making and the benefits of welfare analysis. When viewing contemporary policy issues such as the Weaver Bill and Roth-Stevenson Bill, welfare analysis takes on added importance (Table 9).

On the micro level, the efficiency and quality of economic decisions within a firm may be improved by the disaggregated performance analysis described in this paper. The firm level decision maker could use this analysis in enhancing the competitive position of the firm through improved long range planning and development of short run marketing strategies. Investment decisions, inventory control, pricing, and marketing arrangements can also be enhanced through this analysis.

Because of training in theoretical and welfare analysis and familiarity with marketing institutions, agricultural economists are uniquely qualified

to objectively explore and evaluate the advantages and disadvantages of such an important public policy issue.

Table 9. Disaggregated Welfare Analysis of Export Market Performance

Performance Criteria	Taxpayer Surplus	AgBus/Empl Welfare	Producer Surplus	Consumer Surplus	Sum of Prod & Con Sur	Net Gains
Pricing Efficiency	(+) (-) Comments:					
Technical Efficiency						
Export Response						
Progres-siveness						
Equity						

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Appendix 1. Classification of Export Market Performance Criteria, Conceptual Performance Measures, and Operational Performance Methods

Performance Criteria	Conceptual Performance Measure	Operational Performance Method
I. Technical Efficiency	A. Level of supplies to all users (domestic and foreign)	1. Trend in supply. Domestic flour mill output: % change relative to population growth.
	B. Stability of supplies	1. Variation around trend: % change among years and C.V. among % changes.
	C. Productivity	1. Yield per hectare-change over time. 2. Grain production compared to government payments--change over time. 3. Inload/Outload/Storage/Channeldepth, other use of new technology. Maximum port elevator throughput capacity relative to actual throughput. 4. Flour mill output relative to number of mills. 5. Wheat production relative to government payments to wheat farmers.
II. Price Efficiency	A. Level of nominal producer prices	1. Trend around prices: % change among years.
	B. Stability of nominal producer prices.	1. Variation around trend: % change each year and C.V. 2. % change in commodity price relative to % change in CPI or WPI.
	C. Level of price spreads.	1. Trucking rates. 2. Inland rail rates. 3. Ocean freight rates 4. Commodity prices at various levels relative to freight rates.

App. 1 Continued.

Performance Criteria	Conceptual Performance Measure	Operational Performance Method
	D. Market signals	1. Number of grades and product forms. Farris measure. 2. Quality of market information-O.L.S.-Cox measure. 3. New grades introduced in response to consumer preferences. 4. Correlation between world and domestic price--simple correlation.
	E. Response to structural changes in demand.	1. Acreage and production trends relative to world share of wheat and coarse grains-% change in acreage and production and % change in world market share.
	F. Income distribution.	1. Grower returns and marketing margins relative to production and marketing costs. % change in grower returns relative to % change production costs.
	G. Producer market access	1. Aggregate sales restriction: carry-over as proportion of production.
III. Export Response	A. Growth in sales to alternative countries.	1. Percentage change in exports by destination. 2. Exporter share of major import markets.
	B. Response to export demand changes.	1. Exporter share of world trade and export volume relative to annual world grain prices.

App. 1 Continued.

Performance Criteria	Conceptual Performance Measure	Operational Performance Method
	C. Foreign exchange earnings	1. Percentage change in value of grain exports adjusted for price inflation. 2. Percentage change in value of livestock exports. 3. Rate of growth in grain and livestock export volume-percent change over time.
	E. Credit assistance to foreign customers.	
	F. Blending Ability	
IV. Progressiveness	A. Rate of adoption of productivity increasing technology	1. Compare level of fertilizer use to yield increases during same period. 2. Rate of development of marginal land for crop use-irrigation development and use. 3. Port terminal $/sales $. 4. Country elevator technology improvements. 5. Transport hopper car technology improvements.
	B. Resource conservation	1. Water and land conservation programs--when developed and how quickly complied with.
	C. Commodity research programs	1. Producer $ contributions to wheat research. 2. Wheat research expenditures by government and producers relative to wheat yields. 3. Unexcessive promotional expenses.
	D. Commodity product image overseas	1. Determine how importers view Australian grain and livestock--general quality.

App. 1 Continued.

Performance Criteria	Conceptual Performance Measure	Operational Performance Method
	E. Exploitation of opportunities for new crops	1. How quickly have new crops been adopted. 2. New crop production and acreage.
V. Equity	A. Level of consumer prices	1. Percentage change in food component CPI relative to percentage change in CPI.
	B. Stability of consumer prices.	1. Percentage change in food CPI or CPI each year converted to C.V.
	C. Income distribution	1. Ag vs. non-ag income distribution.
	D. Market access	1. Compare grain prices or grower returns by states: absolute difference.
	E. Sales restrictions	1. Use of quotas on production or delivery.
	F. Employment	1. Stability of employment (C.V.) 2. Level of unemployment. 3. Employment in grains sector--job distribution. 4. Percentage of work force in labor or trade union. 5. Relative strength of labor and trade unions-total membership and governmental lobby.
	G. Environmental externalities	1. Number of elevator explosions from grain dust relative to total volume handled. 2. Enforcement of safety requirements in and around elevator facilities. 3. Number of deaths and injuries per 1,000 tons throughput.