The impact of globalisation on Australian Family Farm Businesses: Survival, adaptation and abandonment of the wool enterprise

Joanne Sneddon[1] and John Stanton[2]

1 Graduate School of Management, University of Western Australia, Crawley, Western Australia

2 WoolDesk, Department of Agriculture Western Australia, South Perth, Western Australia, and Curtin University, Perth, Western Australia

Abstract

What kind of challenge does globalisation pose to family farm businesses producing wool in Australia? Since the collapse of the producer funded Minimum Reserve Price Scheme for wool in 1991, farm family businesses have been fully exposed to global textile markets. Australian wool industry authorities have responded to exposure to global markets by implementing strategies to improve the competitiveness of Australian wool through on and off-farm innovation. In spite of the successful uptake of a range of innovations by farm family businesses, Australian wool production and its market share has fallen significantly over the last decade. Aggregate industry data suggests that farm businesses are simply abandoning wool production, however this view largely ignores the diverse behaviour of individual farm family businesses when exposed to global market pressures. In this study we employ longitudinal micro-economic data to examine the responses of individual farm family businesses to globalisation between 1988 and 2002. We argue that Australian farm family businesses respond to global market pressures by restructuring, diversifying and abandoning non-competitive wool enterprises. We show that the survival strategy employed by the farm family business is influenced by innovation adoption behaviour and enterprise size and structure. We conclude that this heterogeneous nature of the responses of farm family businesses to globalisation should be incorporated into the development and implementation of industry initiatives aimed at promoting competitiveness and sustainability.

1. Motivations for the Study

Agriculture has long been a cornerstone of Australia's economic prosperity. In 2000-01 the farm sector accounted for 3.1% of Gross Domestic Product (GDP) (Economist Intelligence Unit, 2003). The Australian agricultural sector has a strong export focus (Department of Foreign Affairs and Trade, 2002; Penm, 2003), and wool is Australia's third ranking agricultural export commodity with an export value of AUD$3.3billion (approx. USD$2.1billion) in 2001-02 (Australian Bureau of Statistics, 2002). The Australian wool industry was established in the early nineteenth century to supply wool to the European textile markets. Presently, Australia is the largest supplier of raw wool fibre to the global textile industry. Around 40,000, or one third of all farm businesses in Australia produce wool (Australian Bureau of Agricultural and Resource Economics, 2002). The production of wool in Australia is dominated by independent, family owned and operated businesses (Gamble, Blunden et al., 1995; Australian Bureau of Agricultural and Resource Economics, 1996; Lloyd and Malcolm, 1997).

Over the last three decades the Australian wool industry has been in the grip of a severe 'cost-price squeeze' compounded since the 1990's by volatile global markets. Deteriorating consumer demand for wool apparel, strong competition from alternative fibres and economic upheaval in those countries traditionally purchasing large quantities of wool have impacted negatively on the global demand for wool (Australian Bureau of Statistics, 2002). Terms of trade for wool production decreased by 2.4% between 1977 and 1999 and in the same period woolgrowers achieved productivity gains of only 0.6% (Australian Bureau of Statistics, 2002). Poor productivity gains have been blamed on low enterprise profitability, insufficient feedback from the market and low levels of innovation adoption (Wool Industry Future Directions Task Force, 1999). The volume of wool shorn in Australia fell from 1.03 million tonnes in 1990 to 0.55 million tonnes in 2001. Over the same period, the number of farms producing wool in Australia fell by 24% (Australian Bureau of Agricultural and Resource Economics, 2002).

The dramatic drop in wool production during the 1990s coincided with the full exposure of Australian wool producers to global market forces after the collapse of producer funded market price protection, the Minimum Reserve Price Scheme (MRPS) in 1991. Despite bringing the Australian wool industry close to financial ruin, the abandonment of the MRPS marked a critical turning point in terms of industry policy. By the mid 1980s the political and economic climate in Australia had begun to change and significant economic reforms were undertaken in support of trade liberalization and the dismantling of domestic industry protection (Beynon, 1997). The Australian Government encouraged industry level policy initiatives aimed at helping farm businesses become more competitive, self-reliant and responsive to market conditions through investment in innovation programs (Department of Primary Industries and Energy, 1989). Significant changes were made to the funding of research and development to ensure that innovation activities were coordinated at the industry level, driven by market signals and that there was greater urgency in the application or commercialisation of research results (Department of Agriculture Fisheries and Forestry, 2002).

For practitioners and academics alike, innovation is considered to play a pivotal role in defining a sustainable and internationally competitive industry (Schumpeter, 1939; Campbell, 1980). Although innovation had played a major role in wool industry policy prior to the early 1990's, the collapse of the MRPS heightened the need for innovation initiatives to arrest the decline in domestic competitiveness. Primarily the industry sought to increase the competitiveness of the Australian wool clip in the global textile markets through the introduction of marketing innovations including fibre testing technologies.

Over a decade after the collapse of the MRPS, the effectiveness of marketing innovations such as fibre testing technologies in halting the decline of wool production in Australia by making the clip more competitive is uncertain. The question central to this research study is whether those wool enterprises that had rapidly embraced innovations designed to increase the competitiveness of Australian wool maintained their wool enterprise when fully exposed to global market forces and whether those woolgrowers who were slow to embrace innovation initiatives did not? The contribution of enterprise size and commitment to wool production to innovation adoption behaviour is discussed in the context of examining whether individual farm businesses maintain or abandon wool production in response to full exposure to global market forces.

The paper begins with a discussion of the relationships between the response of individual enterprises to full exposure to global market forces and their innovation adoption behaviour, enterprise size and commitment to a farming enterprise. Following consideration of research design, the main findings are presented. The paper concludes by considering the implications for the Australian wool industry and other agricultural industries facing full exposure to global market forces.

2. Wool enterprise response to global market forces

This paper explores the underlying premise that the response of farm businesses to industry economic crises, such as full exposure to global market forces, is closely interwoven with their willingness and ability to adopt and employ innovative farming practices. A considerable literature has been written on the adoption of agricultural innovations. Innovation Diffusion Theory (IDT) is widely used in the agricultural sector to study the spread of innovations over time through an agricultural industry or farming community. Rogers' (1995) broad definition of innovation is an idea, practice or object that is perceived as new by an individual or unit of a social system. The adoption of an innovation is conceptualized as the decision by a unit within a social system such as a farm family business to accept and continue full use of the innovation (Rogers, 1995).

Rogers and others have offered theoretically and empirically sound distinctions between two categories of adopters; relatively early and relatively late, based upon the time of adoption within their social system. While relatively early adopters are primarily venturesome, have larger operating units, a commercial rather than a subsistence orientation and are influenced by mass media, relatively late adopters have smaller operating units, traditional values and rely upon interpersonal communication to raise awareness of innovations (Rogers and Shoemaker, 1971). This conceptualization is consistent with the notion of innovativeness put forth by

(Midgley and Dowling, 1978) as "the degree to which an individual is receptive to new ideas and makes innovation decisions independent of the communicated experience of others". Relatively early adopters of innovations have also been found to have superior technological and cognitive skills that enable them to utilize innovations more effectively than relatively late adopters. Relatively late adopters of innovations have been found to generally lack the skills and resources to utilize innovations extensively (Rogers, 1995). Therefore we propose that when fully exposed to global market forces:

> PROPOSITION P1. *Australian wool enterprises that adopt innovations relatively early are more likely to maintain their wool enterprise.*

> PROPOSITION P2. *Australian wool enterprises that are relatively early adopters of innovations are more likely to be relatively large.*

The relationship between farm size and innovation adoption behaviour is underpinned by technical, economic and institutional factors (Guerin and Guerin, 1994). Access to inputs such as capital, labour and information have been found to be positively related to farm size and so form part of the environment that determines innovation adoption behaviour (Hill and Kau, 1973; Itharat, 1980). Therefore, relatively large wool enterprises generally have greater access to the resources needed to adopt innovations relatively early. It is also expected that these enterprises will make extensive use of the innovations whenever the opportunity is available. In the case of raw wool, utilization is measured as the proportion of sale lots from the enterprise in a year that are AM measured. Therefore we propose that:

> PROPOSITION P3. *Australian wool enterprises that are relatively early adopters of innovations are more likely to have relatively high level of innovation utilisation.*

The resources available to relatively large enterprises in terms of capital, labour and information are also likely to impact upon the farm businesses commitment to a particular enterprise type. If substantial investment of resources has been made into an enterprise such as wool, this is likely to be reflected in relatively high levels of commitment to maintaining the enterprise. In a recent study of the motivators and drivers of Western Australian woolgrowers, a number of factors signifying a strong level of commitment to the production of wool were identified. Structural factors in terms of having operations geared to grow wool, being located in a climate suited to wool production and having invested in the development of knowledge and experience of producing wool, created impediments to abandoning wool production as to do so would require significant investment to restructure the farm business. However, of equal importance were intrinsic factors that motivated farm business to produce wool such as a strong preference for wool production over cropping and a fundamental interest in wool as a unique fibre (Quaddus et al., 2003). Commitment is therefore conceptualized in this research study as the motivation to continue to produce wool. The level of commitment demonstrated by a wool producer is underpinned by both structural and intrinsic motivating factors. Therefore we further propose that when fully exposed to global market forces:

PROPOSITION P4. *Australian wool enterprises that are relatively large and are relatively early adopters of innovations are more likely to demonstrate relatively high levels of commitment to wool production.*

The adoption of innovations, enterprise size and commitment to wool production formed key considerations of research into the response of Australian wool producers to full exposure to global market forces after the collapse of the MRPS in 1991-92. The remainder of the paper reports the analysis and the research findings.

3. Research Design

This section describes the data and methods of analysis employed in this research study. It is organized in two parts: data collection and analysis.

3.1 Data collection

Data used to test the research propositions presented in Section 2 of the paper were extracted from the Australian wool auction database. The database records the size, quality and price details of each wool lot sold at auction in Australia; these details are recorded against an individual wool brand. The database has all wool sale lot data for each individual wool brand active in the Australian auction system since 1988. Individual wool brands are associated with individual properties, and so were used to monitor the production behaviour of individual wool enterprises. This data has not previously been applied to the analysis of the response of individual Australian wool enterprises to full exposure to global market forces.

3.2 Data

The marketing innovation central to the research study was Additional Measurements, a raw wool fibre testing innovation introduced by the Australian Wool Corporation (AWC) to improve the competitiveness of Australian wool in global textile markets. Traditionally the attributes of raw wool fibre had been subjectively appraised in the wool industry, constraining the accuracy of predicting the processing potential of raw wool and denying woolgrowers an important source of management information about their clip. Scientific testing of wool fibre attributes began tentatively in Australia in the late 1950's and became a major industry marketing policy from the mid 1960s onwards (Fyfe, 1996). It was anticipated that the scientific testing of raw wool fibre attributes would enable better specification of raw wool, creating market efficiencies for processors and woolgrowers alike.

The introduction of Objective Measurements fibre testing technology in the early 1970s radically changed the way Australian wool was marketed and sold through the domestic auction system. However, the industry recognized that fibre characteristics were not objectively specified in enough detail to permit adequate prediction of its processing potential. Therefore in the late 1970s the Australian Wool Corporation, embarked upon a major innovation initiative to develop scientific testing methods for the length and strength of raw wool fibre (Australian Wool Corporation, 1978). The commercial testing of fibre strength and length, otherwise known as Additional Measurements (AM) became a commercial reality in the late 1980s and by 1990, prior to the collapse of the MRPS, over 40% of Australian wool was provided with AM test

results. Initially, the diffusion of AM was promoted through textile processors to create demand in the Australian wool auction system for wool lots with AM. After the collapse of the MRPS, considerable efforts were made to encourage woolgrowers to adopt AM and to use test results to better manage wool production. Adoption of AM required little effort or outlay on the woolgrower's behalf; they simply had to identify to their broker the wool that was to be tested. The costs of AM were charged per bale and were relatively small, at around 1% of the price received per kilogram of clean wool[i].

The WoolDesk at the Department of Agriculture Western Australia (DAWA) provided access to the database used in this study. The Australian wool auction database identifies the geographical region (Wool Selling Area, or WSA) where the wool was produced, and covers all regions of Australia. A single Wool Selling Area around Kojonup in the South West of Western Australia was selected as the area of interest for this research study. The Kojonup Wool Selling Area is in the middle of the Western Australian 'wool belt', a climatic zone ideally suited to sheep production and with a long history of wool production. The Kojonup Wool Selling Area produces on average 16% of the Western Australian clip and 4% of the national clip and is home to over 3.5 million sheep. The Kojonup Wool Selling Area is relatively representative, in geophysical terms, of the Mediterranean zone of Australia that produces the majority of the Australian wool clip.

In order to ensure that the data recorded against individual wool brands in the database represented individual wool enterprises the WoolDesk amalgamated miss-spelt and multiple brands into individual enterprise data. A unique property number was assigned to individual wool enterprises and data relating to that enterprise across multiple and miss-spelt brands were then combined into a single enterprise brand.

Of the individual wool enterprises identified in the Kojonup Wool Selling Area, enterprises that had been in operation from 1988 to 2002 were selected for this study to ensure that longitudinal analysis of response behaviour could be undertaken. Further to this, only those enterprises with an estimated value of agricultural operations (EVAO) of AUD$22,500 (approx USD$14,625) gross or more per annum were selected for this research study[ii]. An EVAO of AUD$22,500 gross or more per annum indicates that the enterprise is being run for commercial purposes. A cohort of 334 individual wool brands representing commercial wool enterprises that had operated continuously in the wool industry from 1988 to 2002 were selected as the data sample for this research study.

3.3 Data Analysis

Hierarchical cluster analysis[iii] was employed in this study to identify relatively homogeneous groups of wool enterprises in the Kojonup region in terms of their enterprise size, and changes in enterprise size over time. Individual wool enterprises were clustered using enterprise size in kilograms of clean wool produced per annum for each year between 1988 and 2002. Hierarchical cluster analysis was employed in this research study because it allows the researcher to select an appropriate number and level of cluster groups.

3.4 Concept measurements

Four concepts were examined and compared between the cluster groups identified by the hierarchical cluster analysis: enterprise size, commitment to wool production, the mean time of adoption of AM and the utilization of AM post-adoption. These concepts are described in the following sub-sections.

Enterprise Size. Wool enterprise size was measured in kilograms of clean wool produced per annum from 1988-89 to 2001-02. The average clean weight of wool produced by each cluster per annum was compared with the regional average clean weight of wool produced per annum to determine whether enterprises were relatively large or relatively small. Those cluster groups producing higher average clean weight of wool per annum than the regional average were identified as relatively large enterprises. Those cluster groups producing lower average clean weight of wool per annum than the regional average were identified as relatively small enterprises.

Level of Commitment. The level of commitment to wool production was measured as the change in kilograms of clean wool produced per annum by the cluster groups compared with the regional average change in kilograms of clean wool produced per annum from the collapse of the MRPS in 1991-92 to 2001-02. Those cluster groups with a larger drop in annual wool production than the regional average were identified as having relatively low levels of commitment to wool production. Those cluster groups with a smaller drop in annual wool production than the regional average were identified as having relatively high levels of commitment to wool production.

Innovation Adoption Behaviour. To distinguish relatively early adopters of Additional Measurements (AM) from relatively late adopters the mean year of adoption was calculated across the individual Kojonup wool brands. The mean year of AM adoption by Kojonup wool enterprises was calculated as an average of the number of years from the availability of AM in 1988-89 and first use of the technology. Those wool enterprises that adopted AM prior to the mean time of adoption, year three or 1990-91, were categorized as relatively early adopters and those that adopted after 1990-91 or that had not adopted AM by 2001-02 were categorized as relatively late adopters. This approach to the categorization of adopters is consistent with that proposed by Rogers (1995). In this research study, the mean year of AM adoption of each cluster group was compared with the mean year of AM adoption for the Kojonup region. The proportion of relatively early adopters in each cluster groups, compared with the proportion of relatively early adopters at the regional level was also employed as a measure of the adoption behaviour of wool enterprises in each cluster.

Innovation Utilisation Behaviour. The post-adoption utilization of AM by individual wool enterprises was measured as the proportion of wool subject to AM testing by individual wool enterprises directly after the collapse in the MRPS in 1991-92 compared with the regional average proportion of wool AM tested in that year. The proportion of wool subject to AM testing in 1991-92 was selected as a appropriate measure of innovation utilisation behaviour as it measured whether those enterprises that had adopted AM relatively were committed to extracting benefit from AM testing significant industry upheaval in the guise of full exposure to global market forces.

Table 1: Regional benchmarks for innovation propositions

Measure	Regional result
Average wool production between 1988/89 and 2001/02	19,604 kg clean
Regional fall in wool production between 1991/92 and 2001/02	43%
Mean time of adoption (first AM test after innovation introduced in 1988/89)	2.8 years
Innovation utilization (proportion of wool sale lots tested) in 1991/92	45%

4. Results

Five enterprise clusters were identified in the Kojonup data set; these cluster groups are described in Section 4.1. A summary of the findings and discussion of the research propositions are described in Table 2 and Section 4.2 respectively.

4.1 Cluster group descriptions

Cluster A: Small scale, diversified enterprises. Cluster A, shown in Figure 1, represented 149 individual wool enterprises and was the largest of the five cluster groups identified. Cluster A produced wool on a relatively small scale with an average annual wool production of 11,633 kilograms clean. For five out of the six production years between 1996-97 and 2001-02 the average wool production volume of this group dropped below 10,000 kilograms of clean wool per annum, establishing the group as borderline commercial wool producers.

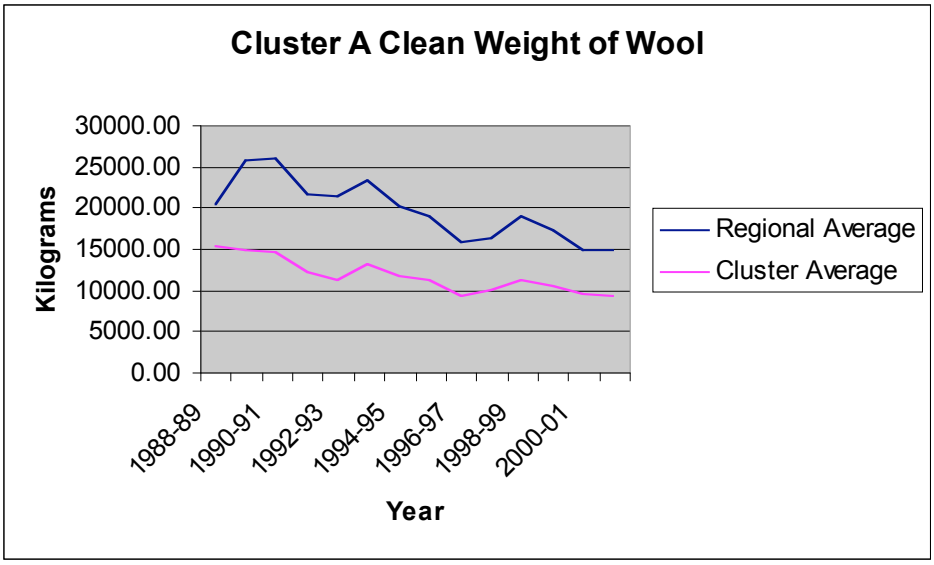


Figure 1: Clean weight of wool produced per annum from 1988-89 to 2001-02

Despite the relatively small scale of wool production, Cluster A maintained relatively high levels of commitment to wool production as volumes dropped by only 37% between 1991-92 and 2001-02. Given the relatively consistent nature of the wool production pattern in this group it is likely that these wool enterprises operated as part of diversified farm businesses.

Cluster A enterprises were relatively late adopters of AM compared with the regional average. The mean time of adoption of AM for this group was 3.6 years. Despite being relatively late adopters of AM, Cluster A enterprises exhibited average utilisation of AM.

Cluster B: Abandoning wool production. Cluster B, shown in Figure 2, was the third largest cluster group, representing 60 rapidly shrinking wool enterprises. On average from 1988-89 to 2001-02, enterprises in Cluster B reduced production by 17% more than the regional average and from 1997-98 operated marginal enterprises, producing less than 10,000 kilograms of wool per annum. As with the enterprises in Cluster A, it is unlikely that a wool enterprise producing less than 10,000 kilograms of wool per annum had a commercial orientation unless it were operated as part of a diversified enterprise in which wool played a marginal role. Therefore it is likely that these enterprises shifted from wool dominant production to diversified enterprises.

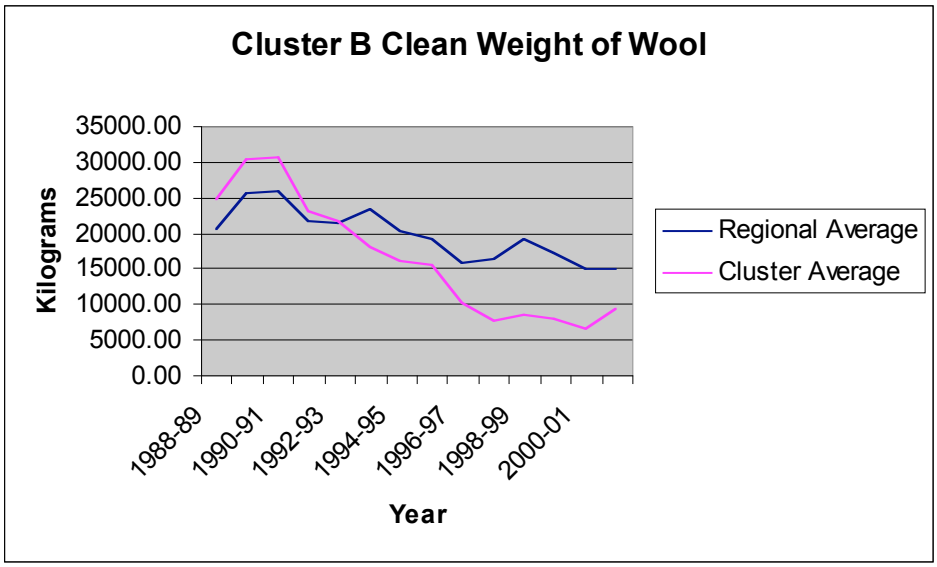


Figure 2: Clean weight of wool produced per annum from 1988-89 to 2001-02

The volume of wool production by Cluster B enterprises dropped by 70% between 1991-92 and 2001-02. This dramatic decline in production suggests low levels of commitment to wool production within the group. Despite small scale production and low levels of commitment to wool production, enterprises in Cluster B were relatively early adopters of AM, with 9% more early adopters in this group than at the regional level. The average time of adoption of AM by Cluster B enterprises was 2.3 years. Cluster B enterprises were however, relatively low utilisers of AM, testing 8% less wool than the regional average in 1991-92.

Cluster C: Large, committed enterprises. Cluster C, shown in Figure 3, was the smallest of the five clusters, representing only 11 individual wool enterprises. The

enterprises represented by Cluster C were large scale producers and demonstrated a high level of commitment to wool production from 1991-92 to 2001-02. Although the volume of wool produced per annum by this group dropped by 23% from 1991-92 to 2001-02, they remained relatively large enterprises, producing on average 167% more wool per annum than the regional average.

In terms of adoption behaviour, Cluster C enterprises represented relatively early adopters of AM. The average time of adoption of AM by this group was 2.2 years. Despite early acceptance of AM, Cluster C enterprises were relatively low level users of AM in 1991-92, testing 6% less wool than the regional average in 1991-92.

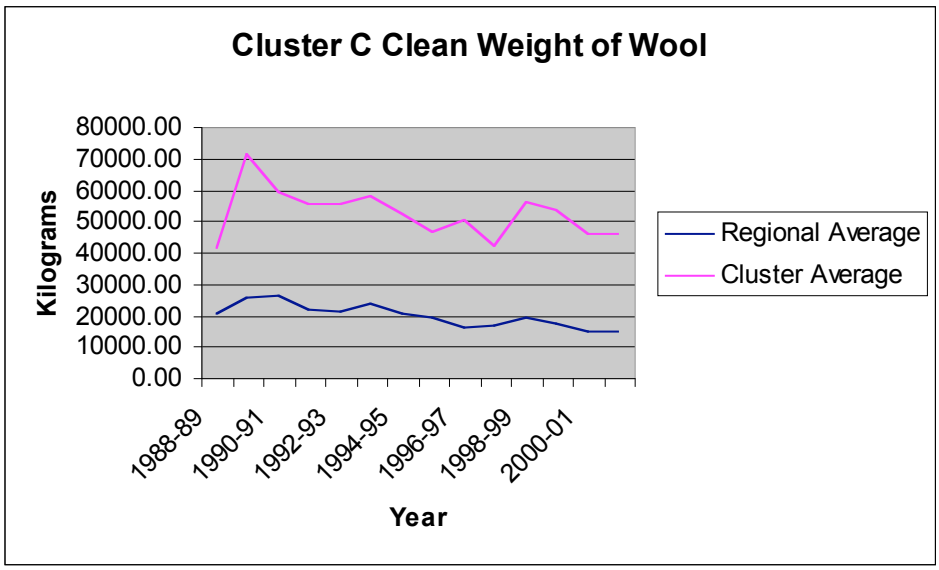


Figure 3: Clean weight of wool produced per annum from 1988-89 to 2001-02

Cluster D: Innovators abandoning wool production. Cluster D, shown in Figure 4, was the second smallest of the five cluster groups, representing 26 individual wool enterprises. Although this group of enterprises produced on average 65% more wool per annum than the regional average their production levels dropped by 73% from 1991-92 to 2001-02. In fact, by 2001-02 production levels of enterprises in Cluster D had dropped to the regional average clean weight of wool for 2001-02. Therefore, despite their relatively large initial size compared with the regional average, enterprises in Cluster D showed low levels of commitment to wool production.

Enterprises in Cluster D were relatively early adopters of AM, with the earliest mean time of adoption of any of the cluster groups, 1.8 years after introduction. However, their utilization of AM in 1991-92 was 17% lower than the regional average.

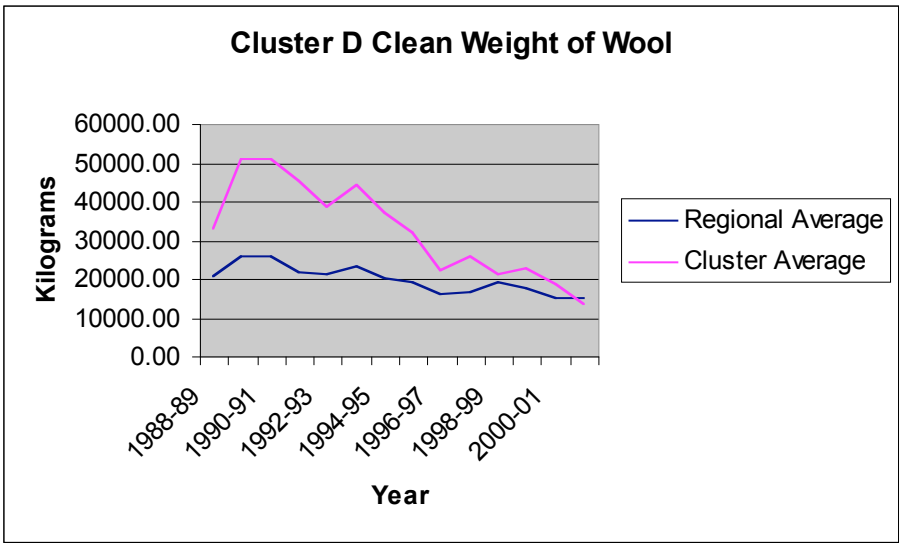


Figure 4: Clean weight of wool produced per annum from 1988-89 to 2001-02

Cluster E: 'Average' wool enterprises. Cluster E, shown in Figure 5, was the second largest cluster group, representing 83 individual wool enterprises. Enterprises in Cluster E produced volumes of wool per annum closest to the regional average over the time period of the analysis.

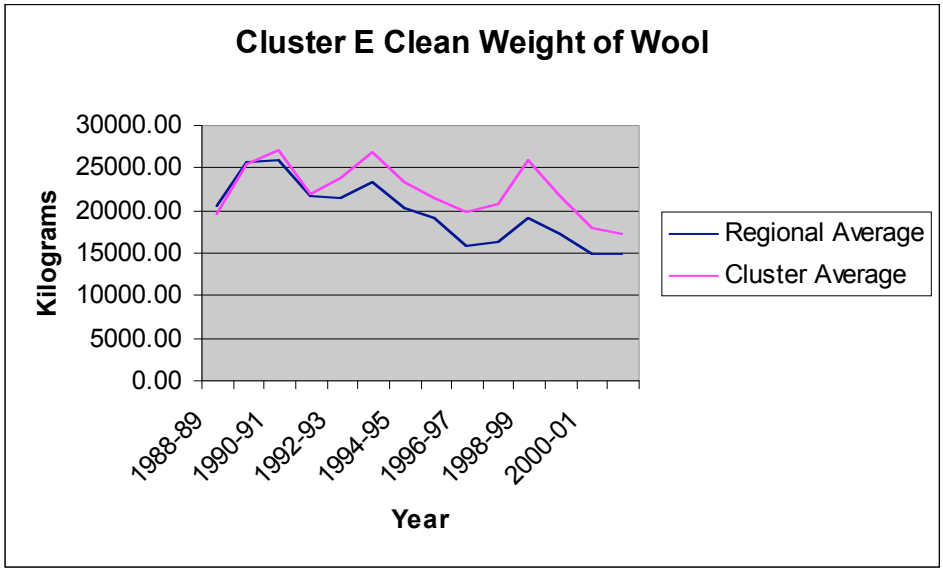


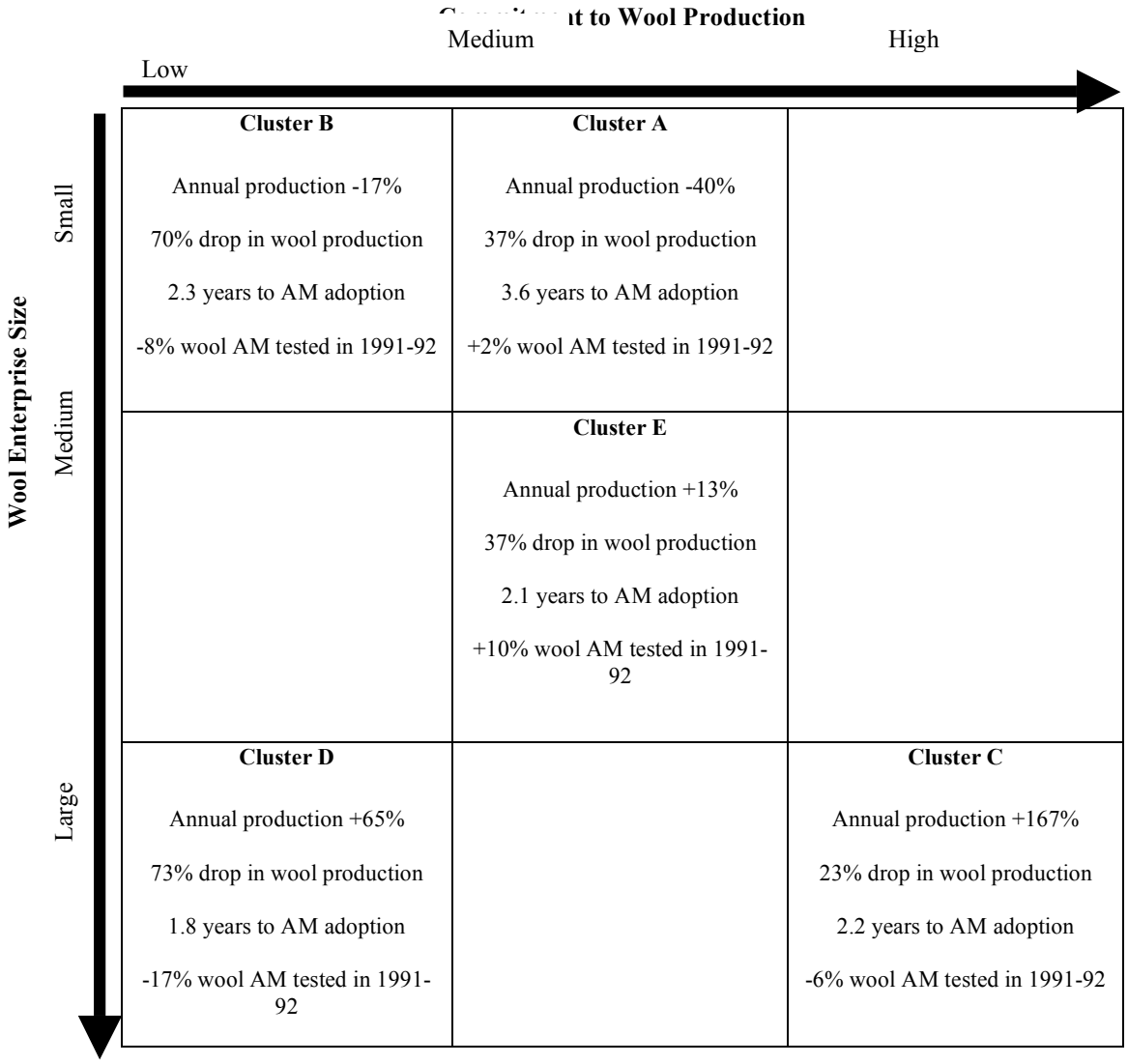
Figure 5: Clean weight of wool produced per annum from 1988-89 to 2001-02

The enterprises in Cluster E experienced the same drop in production as Cluster A, 37% from 1991-92 to 2001-02 which was relatively low compared with the regional average decline in production of 43% over this period. Cluster E represented relatively early adopters of AM with a mean time of adoption of 2.1 years. In terms of AM utilization, enterprises in Cluster E demonstrated relatively high levels of utilization in 1991-92, testing on average 10% more wool than the regional average.

5. Discussion

The wool enterprise size, commitment and innovation adoption behaviour data relating to the cluster groups described in Section 4 is summarized in a wool enterprise size-commitment matrix (Table 2). The findings are discussed below in relation to the research propositions presented in Section 2.

Table 2: Kojonup Wool Enterprise Size-Commitment Matrix



5.1 Response of wool enterprises to full exposure to global market forces

Individual enterprises operating in the Kojonup region between 1988-89 and 2001-02 responded to full exposure to global market forces in 1991-92 in various ways. The volume of clean wool produced per annum at the individual enterprise level declined between 1991-92 and 2001-02 as per the industry average, reflecting a significant period of adjustment in the Australian wool industry.

The industry anticipated that the introduction of AM testing in the late 1980s would increase the competitiveness of Australian wool in the global textile market and provide important market feedback to producers that would enable them to produce wool better suited to meet market needs. Although the majority of individual

enterprises in Clusters B, C, D and E adopted AM relatively early only enterprises in Clusters C and E maintained production levels above the regional average between 1991-92 and 2001-02. Enterprises in Cluster B had virtually abandoned wool production by 2001-02 and enterprises in Cluster D had reduced production substantially to regional average levels by 2001-02. Due to the small volumes of wool produced by Clusters B and D in 2001-02, it is likely that these farm businesses had rapidly diversified business away from wool production. Therefore, relatively early adoption of AM did not guarantee the sustainability of the wool industry at the enterprise level. Proposition P1 was not supported.

5.2 Time of adoption and enterprise size

The mean time of adoption of AM across the Kojonup region was 2.8 years after the technologies initial introduction in 1988-89, therefore on average wool producers in this region adopted AM in 1990-91. Four of the five clusters groups described in Section 4, Clusters B, C, D and E, had a mean time of adoption relatively earlier than the regional mean time of AM adoption. Of these groups, Clusters C, D and E operated relatively large wool enterprises. Relatively early adopters of AM in Cluster B, produced on average 17% less wool than the regional average per annum. Therefore, Proposition P2, wool enterprises that are relatively early adopters of innovations are more likely to be relatively large, was supported.

5.3 Time of adoption and innovation utilisation

The regional average proportion of wool subject to AM testing at the time of the collapse of the MRPS in 1991-92 was 45%, dropping from 51% in the previous year. At this industry crisis point, Clusters A and E AM tested relatively high proportions of wool, 2% and 10% more respectively. Although Cluster E represented relatively early adopters of AM, enterprises in Cluster A were relatively late adopters of AM, with a mean time of adoption of 3.6 years. Enterprises in Clusters B, D and C had relatively low levels of AM utilisation in 1991-92, AM testing 8%, 6% and 17% less wool respectively. However Clusters B, D and C were relatively early adopters of AM as described in Section 5.2. Therefore, Proposition P3 was not supported.

5.4 Time of adoption and commitment to wool production

Between 1991-92 and 2001-02 the average clean weight of wool produced at the regional level decreased by around 43%. This proportional decline in wool production at the regional level reflects the decline in the volume of wool shorn in Australia during this period. Cluster C enterprises demonstrated a relatively high level of commitment to wool production compared with the regional average, dropping production by only 23% from 1991-92 to 2001-02. Clusters A and E also demonstrated relatively high levels of commitment to wool production, dropping only production by 37% between 1991-92 and 2001-02. Cluster C and E enterprises were relatively early adopters of AM when measured against the regional mean time of adoption. However, despite their relatively high levels of commitment to wool production, enterprises in Cluster A were relatively late adopters of AM. Clusters B and D, which were relatively early adopters of AM, represented enterprises with relatively low levels of commitment to wool production. Therefore Proposition P4 was not supported.

6. Conclusion

The collapse of the MRPS in Australia in 1991-92 and the resultant exposure of Australian wool producers to global market forces drew attention to the fundamental challenges facing the industry and revealed much about the responses of individual farm businesses to globalisation. It has been shown in the paper how the impact of full exposure to global market forces resulted in a range of responses at the individual farm business level.

In the late 1980s in Australia, industry level innovation initiatives were supported by the Australian Government to aid the adjustment of individual farm businesses to more liberal markets and to cope with the removal of market price protection. In the Australian wool industry, the Australian Wool Corporation introduced AM testing as a means of increasing the competitiveness of Australian wool in the global textile market. The effectiveness of AM in increasing the competitiveness of Australian wool was put to the test in 1991-92 when the MRPS collapsed and producers were fully exposed for the first time in twenty years to free market forces. Although AM testing was embraced by the majority of individual wool enterprises, wool production in Australia declined by over 50% between 1991-92 and 2001-02 raising a question mark over the future sustainability of the industry.

The response of individual farm businesses to full exposure to global market forces revealed the diverse nature of Australian wool enterprises and the difficulties associated with the development and dissemination of industry wide innovation initiatives. The responses of individual farm businesses were typically complex. The most common response at the enterprise level was to reduce the volume of wool produced. However, the extent of volume reduction varied greatly across different enterprises and was not predicted by enterprise size prior to exposure to global market forces or adoption or utilisation of AM. Wool enterprises that were relatively large prior to the collapse of the MRPS both maintained and abandoned wool production, as did those enterprises that were relatively small. Therefore the relative size of wool enterprises did not provide sufficient means to profile wool producers for their future involvement in wool production, or future investment in innovation.

The majority of enterprises in the Kojonup region embraced AM, but the time of AM adoption did not provide an appropriate indicator of whether the farm business would maintain or abandon wool production. Although the industry strategy to increase the competitiveness of Australian wool was embraced by individual farm businesses, it was not successful at the enterprise level as many adopters abandoned or reduced wool production soon after initial adoption.

The level of commitment that a farm business had to wool production after the collapse of the MRPS provided a more useful dimension along which to segment the market for innovation initiatives. Although enterprises with relatively high levels of commitment to wool production did not necessarily represent relatively early adopters of AM, they did represent an attractive target market for innovation initiatives as they continued to produce wool at relatively high levels compared to the regional average after the collapse of the MRPS. However, in order to make effective use of ‘commitment’ in profiling wool enterprises further work is required to develop

appropriate conceptual and operational definitions of this dimension underpinned by social and physiological factors.

In summary this paper examines the way in which Australian wool enterprises responded to full exposure to global market forces. The paper has shown that some enterprises displayed resilience to full exposure to global market forces whilst some did not, and that enterprise size and the adoption and utilisation of industry innovation initiatives did not guarantee survival through a period of significant industry level economic crisis. The paper suggests that in developing industry level innovation initiatives, industry bodies and Government agencies need to consider profiling individual farm businesses according to their level of commitment to the production enterprise rather than their size or willingness and ability to adopt innovations relatively early.

References

Australian Bureau of Agricultural and Resource Economics (1996). Australian Commodity Statistics. Canberra, Australian Bureau of Agriculture and Resource Economics (ABARE).

Australian Bureau of Agricultural and Resource Economics (2002). Profile of Australian Wool Producers 1997-8 to 2000-01. Canberra, ABARE**:** 101.

Australian Bureau of Statistics (2002). AusStats: The Wool Industry, Australian Bureau of Statistics. 2002**:** AusStats Report.

Australian Wool Corporation (1978). Sale by Description. Melbourne, VIC, Australian Wool Corporation**:** 30.

Beynon, N. (1997). Alternative Arrangements for Financing Agriculture: the market approach of Australia. Seminar on Agricultural Finances, APEC ATC Experts Group on Agricultural Finance, Taiwan, Department of Primary Industries and Energy.

Campbell, K. O. (1980). Australian Agriculture: Reconciling change and tradition. Melbourne, Longman Cheshire.

Department of Agriculture Fisheries and Forestry (2002). Output 3 - Industry Development and Adjustment. Output Reports. Canberra, Department of Agriculture, Fisheries and Forestry**:** 14.

Department of Foreign Affairs and Trade (2002). Trade Policy Review: Australia. Canberra, ACT, Department of Foreign Affairs and Trade**:** 14.

Department of Primary Industries and Energy (1989). Research, Innovation and Competitiveness: Policies for reshaping Australia's Primary Industries and Energy Portfolio Research and Development. Canberra, ACT, Department of Primary Industries and Energy.

Economist Intelligence Unit (2003). Economic Structure. Country Briefings, Economist.com. 2003**:** Economic Country Briefing Australia.

Fyfe, C. (1996). Gentlemen's Agreements: Australia wartime wool appraisements. Dalkeith, Western Australia, Lana Press.

Gamble, D., S. Blunden, et al. (1995). Transfer of the family farm business. Kingston ACT, RIRDC.

Gleeson, T., M. Lubulwa, et al. (1993). Price premiums for staple measurement of wool. Canberra, ACT, Australian Bureau of Agricultural and Resource Economics**:** 53.

Guerin, L. J. and T. F. Guerin (1994). "Constraints to the Adoption of Innovations in Agricultural Research and Environmental Management: A Review." Australian Journal of Experimental Agriculture **34**: 549-571.

Hill, L. D. and P. Kau (1973). "Application of multivariate probit to a threshold model of grain dryer purchasing decisions." American Journal of Agricultural Economics 55: 19-25.

Itharat, C. (1980). "Adoption of agricultural innovations: an analysis of socioeconomic characteristics, personality variables, and communications behaviour in the northeastern region of Thailand." Dissertation Abstracts 42/01A: 507.

Lloyd, A. and W. Malcolm (1997). Agriculture and the family farm in the economy. A legacy under threat? Family farming in Australia. J. Lees. Armidale, NSW, University of New England Press**:** 59-80.

Midgley, D. F. and G. R. Dowling (1978). "Innovativeness: The concept and its measurement." Journal of Consumer Research **9**(December): 301-310.

Penm, J. (2003). "Commodity Outlook." Australian Commodities 10(3): 340-341.

Quaddus, M. et al. (2003). Driving and Motivational Factors for Producing Wool: Views from Selected WA Wool Producers. Sheep Updates, Perth, Western Australia, Department of Agriculture, Western Australia.

Rogers, E. M. (1995). Diffusion of Innovations. New York, The Free Press.

Rogers, E. M. and F. F. Shoemaker (1971). Communication of Innovations: A cross-cultural approach. London, Collier-MacMillan.

Schumpeter, J. A. (1939). Business Cycles: A Theoretical, Historical and Statistical Analysis of the Capitalist Process. London, MacGraw-Hill.

Wool Industry Future Directions Task Force (1999). Diversity and Innovation for Australian Wool: Report of the Wool Industry Future Directions Task Force.

---

[i] AM test cost as a proportion of the price received for one kilogram of clean wool calculated using the Australian Wool Exchange Eastern Market Indicator and Gleeson, T., M. Lubulwa, et al. (1993). Price premiums for staple measurement of wool. Canberra, ACT, Australian Bureau of Agricultural and Resource Economics**:** 53.

[ii] Using price data from the Western Market Indicator (WMI) for wool, the EVAO of AUS$22,500 gross p.a. was calculated to represent approximately 10,000 kilograms of clean wool for a commercial enterprise. The Kojonup Wool Selling Area wool enterprises were sorted according to total weight of wool offered and sold at auction in 1988. Those brands that had sold or offered less than 10,000 kilograms clean weight of wool in 1988 were removed from the analysis.

[iii] Hierarchical cluster analysis uses an algorithm that begins with each individual wool brand in a separate cluster then combines similar individuals or clusters of individuals until all individuals are combined into a single cluster.