OBJECTIVE MEASUREMENT IN BEEF MARKETING

INTRODUCTION

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For about 200 years the progressive application of scientific method has led to higher levels of productivity at lower cost and with greater product consistency in all secondary and many primary industries. The cornerstone of this development has been measurement, at all levels. The application of measurement to the world's livestock industries has in general been more recent, led by the more intensively managed sectors. The importance of developing more effective means of communication among Australian beef producers, agents, processors, exporters, importers, wholesalers, retailers and consumers has become widely recognised in recent years.

In 1976 a major symposium on carcase classification was convened by the Australian Meat Board (now AMLC) and a $6 million Commonwealth government development programme was launched. Major principles embodied in the scheme were (a) the maximum use of objective measurement and (b) the maximum incorporation of electronic technology in collecting, processing and communicating the information. Major problems were encountered in the development of suitable electronic equipment, but a manual system was developed in Western Australia and subsequently tested successfully in most States under very diverse conditions.

This contract discusses the rationale, basis, development and applications to date of objective measurement in this industry.

CURRENT PRACTICES AND THE NEED FOR OBJECTIVE MEASUREMENT IN MARKETING BEEF

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The marketing of Australian beef involves many stages between the producer and the end-user. To be most effective, communication of a high order is necessary and unambiguous terminology is an essential component of this. Measurement should play a major role in three of the major components of marketing:

- price setting
- disposition and quality control
- market intelligence

Price setting Livestock products are highly variable in composition and in other characteristics of significance to end-users as a consequence of genetic, nutritional, physiological, pathological and biochemical states. The Australian beef industry provides an extreme example of both product variability and value, as a consequence of the extreme range of production techniques employed and the very wide geographic and economic spread of our markets.

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At the primary level of marketing the weight of the animals is very commonly not measured, fat content, age and other characteristics are visually assessed under difficult conditions and the opportunities for inefficient pricing are many. Even where marketing as carcases occurs it is still legal for "carcase weight" to vary by up to more than 6% according to variation in the parts included, trimming, and the allowance for shrinkage; and other characteristics are most commonly assessed by subjective appraisal by the purchaser only. Although price differentials at the primary level do occur, their relationship to end-use value is often questionable and wide variation in the characteristics of beef at any given wholesale or retail price is common.

Systems of price differentiation based upon more consistent and meaningful criteria could improve pricing efficiency at all levels. Objective measurement would provide the best basis for such systems, owing to its repeatability, and has the added potential benefit of reducing marketing costs by facilitating price negotiation without the need to bring the purchaser and the product together, at all levels.

Disposition and quality control Three aspects of quality control are important in marketing beef:

- the definition of the nature (kind and cuts) of the product
- its hygiene and wholesomeness
- its characteristics and utility

Consistent methods for defining the nature of the product are provided by the Handbook of Australian Meat (HAM) and Standard Description of Meat Cuts, and the hygiene of beef is effectively controlled by State legislation and the Export (Meats) Regulations under the Customs Act 1901, but control of utility definition is much less uniform.

The HAM suggests that quality (grade), sex, weight range of carcases and cuts, selvedge fat thickness or visual or chemical lean content and fat colour should be specified for export packs as indicators of utility, but this information is commonly not recorded. State quality control legislation has in recent years limited branding of carcases to defined age, treatment, and fat measurement categories in Queensland and New South Wales. Local trade descriptions of type vary widely among States, and in some cases (e.g. veal and baby beef) the same term is used for different types. Eating quality is most commonly defined by reference to grade as used and assessed in the E(M)R's. The E(M)R's include a schedule of Trade Descriptions which is extremely subjective, particularly in the case of boneless beef for which the only measurement included is weight. Quality is defined according to a grading system which ascribes first quality to fat carcases and beef, and third quality to lean categories. They are currently being revised. A growing number of importing countries have set specifications following the receipt of shipments of Australian beef of very inconsistent quality and characteristics as a consequence of the inadequacy of our own quality control techniques and procedures. For many years, the U.S.A. has specified the limit of fat content acceptable in Australian beef exports. In very recent years shipments to Japan have been subject to a specified age limit and to Korea limits of selvedge fat thickness have been set, for certain categories. Neither of these two latter standards has been readily complied with by the Australian beef industry. Problems arising from the discrepancy between the characteristics of the Australian beef grades and those of other importing countries, particularly the Middle East, have not yet been resolved.
Extension of the use of unequivocal and universally applicable standards for defining requirement and product characteristics to all markets is essential if we are to command other than minimal market prices and develop more stable trade.

**Market intelligence**  
Major sources of market intelligence in Australia are:

- the Australian Meat and Livestock Corporation (AMLC)
- State Departments of Agriculture
- the Australian Bureau of Statistics (ABS)
- private commercial contacts.

The AMLC reports prices offered for specified categories of Australian beef in the U.S.A., Japan and Korea and the value of the local product in many overseas exporting and importing countries. AMLC also reports values of by-products in Victoria and cattle prices in regional centres of Queensland for certain weight and grade and grain fed categories.

State Departments of Agriculture report prices of standard Livestock Market Reporting Service (LMRS) categories as assessed by visual appraisal of weight, sex and fatness in all States except Northern Territory and Tasmania.

The ABS reports annual tonnages and values of beef exports to each destination according to their chilled or frozen and bone-in or boneless form and type of cut. ABS also reports numbers and value of breeding and other cattle exports on a per head basis only.

The main deficiencies in market intelligence are the very limited reporting of values of sales by direct consignment from producer to abattoir for specified categories and the values of specified categories on many export markets. In particular the extremely limited reporting of prices for specific age categories is a considerable impediment to effective market intelligence in the the Australian beef industry. A major source of market intelligence is market signals, the accurate transmission of which depends very heavily upon the differentiation of price according to product at all levels. When working efficiently this process can be a powerful stimulus to producers to better match supply with consumers' needs, but without a reliable system, confusion and a reputation for inability to consistently supply the required product are more likely.

**TECHNICAL BASIS OF OBJECTIVE MEASUREMENT**

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As outlined in the previous paper, one requirement of an objective carcase classification system is that it must provide an assessment of the commercially valuable properties of the carcase. Specifically these are its composition and yield of saleable meat, likely eating quality (especially tenderness) and its end use suitability. Another basic requirement is that the measurements included must be capable of being made accurately and uniformly under a range of abattoir conditions.

This paper is concerned with, the relationship of the classification measurements to commercial value. Some other measurements which may be

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desirable are also discussed.

**Carcase weight**

There is nothing new about carcase weight. As the basis for trading in carcases and for payment in some live animal marketing methods it is normally measured. Its importance lies in the fact that it determines to a large extent the absolute quantity of saleable meat (i.e. yield in kg) in a carcase. It is also a factor affecting end use suitability and therefore value in cents/kg, since carcases within different weight ranges can vary greatly in price, despite otherwise identical characteristics. In Western Australia the preferred range is 160 - 200 kg with discounts applying outside this range. The reason commonly given for this is that the size of some cuts is too large (or too small) for consumers. T-bones and rumps are often quoted as examples.

A major problem in relation to carcase weight is that the method of measurement is not standard among abattoirs. Firstly, shrinkage allowance can vary from 0 to 4 per cent. Secondly, dressing procedures involving kidneys, kidney and channel fats, cod or udder fats, and tail are not uniform. This problem has been approached by the definition of a "standard carcase" but this has not yet been universally adopted.

**Fat thickness**

The fat thickness measurement is designed primarily to indicate the percentage composition and yield of saleable meat in the carcase. Much research has been done into these relationships and into the development of appropriate measurement sites.

Studies by Butterfield (1965), Charles (1977) and Johnson and Vidyadaran (1981) all showed close relationships between fat thickness measurements and carcase composition. Recently, McIntyre and Ryan (1983) found the hot measurement between the 12 and 13th ribs, currently used in the classification system, to be at least equal to other sites in the prediction of fat percentage. The sacral crest site has also been shown to an accurate predictor of carcase composition (Johnson and Vidyadaran, 1981) and has been used in some abattoirs.

Based on dissection data the relationship between fat thickness and percentage yield for meat of a specified composition has been calculated by Charles (1977). This shows a reduction of approximately one per cent in yield for each mm increase in carcase fat thickness. In commercial trials similar trends have been apparent (McIntyre, unpublished data, Phillips, 1981, Ball 1982). One feature of these results is that the relationship between fat thickness and yield is not as close as that between fat thickness and fat percentage. This is undoubtedly due to inconsistency in the degree of fat trim of commercially boned material. It is also important to recognize that yield for any particular carcase will vary depending on the degree of fat trim and the method of breakdown of the carcase.

Fatness may have an influence on tenderness by affecting the rate of chilling of muscle and thereby cold toughening. In studies with beef (Bowling et al. 1978) and lamb (Smith et al. 1976) it was concluded that increased tenderness associated with increased fat cover was a result of prevention of cold toughening. However, we found no difference in tenderness between fat (7mm) and lean (3mm) weaner heifers of 154 kg and 128 kg carcase weight.
respectively. Both groups were cold toughened since they were improved by a slow chilling treatment. It is evident therefore that fatness does not provide a guarantee of quality.

Dentition

Dentition was included as an assessment of age specifically to indicate tenderness of the meat. The relationship between age and tenderness has been the subject of much research, the majority of which has shown that as age increases tenderness decreases (e.g. Tuma et al. 1963, Cormier et al. 1971). This pattern has become widely accepted. However, some studies have shown either no effect of age (Romans et al. 1965) or increases in tenderness with increases in age (Field et al. 1966, Hunsley et al. 1971). These results cast some doubt on the reliability of age as an indicator of tenderness. However it is probable that the effect of age has been confounded with the more powerful effect of cold toughening. Since younger animals are usually lighter and leaner than older ones they are more susceptible. The problem of cold toughening has become increasingly recognized and processes, notably electrical stimulation, have been introduced to overcome the problem. These treatments have been identified in branding systems allied with classification recently introduced in Queensland, New South Wales and Western Australia. In relation to age, studies by CSIRO have shown that provided cold toughening has been prevented tenderness is not a problem in cattle up to at least the 6 tooth stage (V.H. Powell, personal communication).

Sex

Sex is the easiest characteristics to assess and is the least important. Before fat thickness measurements were made it may have been useful as an indicator of composition. This arises from the fact that at the same age and or weight females are fatter than steers which in turn are fatter than bulls.

Sex is a relevant factor in costs since bulls are subject to higher slaughter charges than steers or heifers. It may also be relevant to end use suitability since bulls have a slight tendency towards darker meat than steers and heifers as a result of their greater susceptibility to pre-slaughter stress (Martin and Fredeen 1974).

Other factors

(1) Conformation or shape The absence of an assessment of conformation is commonly cited by some in the meat trade as a deficiency in the classification system. It was included in original proposals but has since been omitted because of doubts about its relationship to commercially important characteristics. Although there have been numerous definitions and methods of assessment probably the underlying aim of most is to provide an estimate of muscling or muscle to bone ratio. Since muscle to bone ratio and fatness are the only properties of the carcass which can influence composition and yield of saleable meat, conformation is potentially important. One problem however is that methods of assessment are complicated by fatness which tends to round the outlines of the carcass and improve conformation. As noted earlier fatness has a very large effect on composition and yield. The relative importance of conformation is illustrated in studies by Kauffman et al. (1970) and Fredeen et al. (1974) who have shown differences in the order of about 2 per cent in yield of saleable meat.
between carcases of similar fatness from the extremes of conformation. Other studies by Kempster and Harrington (1980) and Bass et al. (1981) have shown conformation to be a relatively poor predictor of commercially important characteristics. In view of this the inclusion of conformation would not appear warranted. In future, research into methods of estimating muscle to bone ratio specifically could prove to be more profitable.

(2) Meat colour Meat colour is an important factor influencing consumer acceptability. It is affected by age of the animal and by the ultimate pH of the muscle. At present there is no method of predicting pH or meat colour on the slaughter chain so assessments must be made after quartering. Colour standards have been developed to improve consistency.

(3) Fat colour Fat colour influences consumer acceptability and could be assessed on the slaughter chain. Current practise is to make the assessment at the same time as meat colour, once again using colour standards.

COMMERCIAL TRIALS OF BEEF CARCASE CLASSIFICATION IN WESTERN AUSTRALIA

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The feasibility of introducing an objective system of carcase classification had been discussed by various sectors of the Australian beef industry at least as early as 1964. When the industry experienced a recession in the mid-seventies, the Australian Government allocated $6 million for the development of a beef carcase classification system.

These funds initially were used by the Australian Meat and Livestock Corporation to test semi-automated classification equipment which was meant to record some of the carcase measurements automatically, process the data and disseminate the information. The trials were unsuccessful, due mainly to the failure of the electronic equipment in the inhospitable abattoir environment.

In 1977, the W.A. Department of Agriculture designed a manual system of objective carcase classification. A nine-month trial of this system commenced in April 1978, with a grant of $30,000 provided by the W.A. Government. Following the success of this trial at three abattoirs, the Australian Agricultural Council granted $50,000 to each State, from the original $6 million, to support trials of manual beef classification. W.A. received an additional grant, to extend the manual system throughout the State; the large-scale trials started in June 1979 for an 18-month period.

Objectives

The objectives, determined by the National Carcase Classification Supervisory Committee, for the commercial trials in W.A., covered three broad areas:

Technical: including operational feasibility of classifying 100% of throughput in different abattoirs, changes required to existing abattoir systems, attainment of national standards of accuracy.

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Information flow - including suitability of standard carcase definition, dissemination of carcase information to all sectors of industry and the extension activities required.

Economic - including establishment costs, operating costs for a range of throughputs, and value of any benefits to various sectors of industry.

At the outset, it was recognised that all the potential benefits of a system of objective carcase description would not be demonstrated within an 18-month period. The effective use of classification information for trading purposes greatly depends on the attitude of individuals, and whether they perceive the innovations as a threat or a benefit.

Development of procedures

The introduction of carcase classification at 19 abattoirs followed a standard procedure, which included close consultation with all levels of management and labour, a detailed investigation of each slaughter floor and clerical procedures, preparation of a written proposal and a training programme for abattoir staff.

Four standard measurements were taken for each carcase - age (number of permanent incisor teeth), sex, fat depth, and weight. The measurements were taken and recorded by various combinations of abattoir staff, according to the slaughter-floor layout and the chain speed.

Fat depth was measured by making a small incision over the M.longissimus dorsi, and placing a plastic rule against the cut edge of the fat. To assist speed and accuracy of this procedure, several instruments were developed, which combined scalpel and rule. With the exception of two abattoirs where mechanical downward hide-pullers were used, stripping of fat over the measurement site was not a problem. Both sides of each carcase were measured, thus minimising the problem.

The carcase measurements were recorded on a two-part waterproof ticket, by removing perforated notches along two edges (age, sex), punching a hole in a series of numbered boxes (fat depth) and writing the weight on the two parts. After the weight was recorded, the tickets were separated, and one part applied to each carcase side. When the carcase had dried, the tickets adhered firmly, ensuring that the information was carried with the carcase to the retail butcher.

At the weigh scales, the carcase information also was recorded on multiple copies of a "weight and classification" sheet; the colour-coded copies subsequently were distributed to the producer, wholesale butcher and abattoir.

The W.A. Department of Agriculture was responsible for the training of all classifiers, and for regularly monitoring the levels of accuracy achieved.

In order to allow the producer to receive carcase information related to individual animals, a special blue, numbered tail-tag was designed. In the abattoir, the tail-tag signified that the animal was to be individually identified, and the number was recorded on the weight and classification sheet.

An important aspect of the commercial trials was an extensive educational programme, directed at producers, buyers, stock agent, abattoir
operators; wholesale and retail butchers, consumers, agricultural consultants and Departmental officers. As far as possible, the extension programme was carried out in collaboration with the respective industry organisations. Communication with industry also was facilitated by the establishment of an advisory committee, which regularly reviewed progress.

Evaluation

The large-scale trials demonstrated that manual beef classification could be introduced in a wide range of abattoir situations, with minimal disruption. The simplicity of the manual system allowed considerable flexibility in the establishment in different abattoirs. However, because the effectiveness of the manual system depends to a large extent on human factors, care must be taken in selecting and training classifiers. The classification information was provided to producers who consigned cattle direct to abattoirs, and to processors, wholesalers and retail butchers.

The average cost of establishing the beef classification system was $1,200 (range $425-$1,700). The average cost per carcase was 40 cents during the trials and 31 cents if classification had been introduced on a permanent basis (1980 costs).

At the conclusion of the trials, five surveys were commissioned, to provide information about perceived advantages and disadvantages of beef classification. The surveys covered producers, abattoir operators, wholesale butchers, supermarket chains and retail butchers. All industry groups were, on average, in favour classification and saw more advantages than disadvantages with the system (Anon. 1981).

COMMERCIAL USE OF CLASSIFICATION INFORMATION

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Direct consignment for slaughter

Abattoir managements were surveyed to determine their normal methods of purchasing livestock. On average, approximately 35 per cent of cattle were traded weight and grade or classification. Of the 10 abattoirs which purchased by this method, 7 specified fat limits in mm and 5 specified weight limits. Price schedules based on weight and fatness were offered in these abattoirs. Comments on classification included, "provides an accurate record of buying performance", and "provides better communication with producers".

In February 1982 the United Beef Breeders Association launched a system of forward selling lot fed beef based on age, weight and fatness. Price schedules with premiums and discounts were agreed to by buyers and sellers and it was proposed to brand 0 and 2 tooth cattle with 5 - 10 mm of fat as a marketing initiative. Overall, 3500 cattle were traded through the system.

Westralian Farmers' Co-operative Ltd have established a marketing system called Telstock by means of which producers can consign their stock direct to an abattoir and still have del credere risk covered.

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Wesfarmers obtain quotes from a number of buyers based on the classification description and charge 1% commission instead of 5%, in recognition of reduced selling costs. Four thousand cattle were sold through the system in 1981/82 and it was expected the number would increase to 6000 in 1982/83.

Classification in live animal assessment

Information on age, sex, weight and fatness is returned to all producers who consign cattle directly to any classifying abattoir. This information can form the basis of future management decisions by producers. In a survey of producers conducted in February 1981, 52% identified the provision of this information as a significant advantage of a classification system.

An additional blue classification tail tag was also introduced to allow producers to relate classification information to each individual animal. This allows a producer to quickly improve his skills in live animal assessment, by comparing the actual carcase description with his on-farm assessment. To date 25000 tags have been issued.

Carcase branding

Carcase Classification data is transmitted forward to the retail trade by use of the carcase ticket. A carcase branding system carries this information one step further, to the consumer. The branding system in operation in Western Australia, identifies meat as to age and post-slaughter treatment. Limits are also set on minimum fatness and acceptable meat and fat colour. The system was launched on August 16, 1983 and early indications are that it will be widely accepted. One hundred and fifty retail butchers attended an evening seminar to discuss the concept and their reactions were very favourable.

Export regulations

As a result of concern at the inadequacy of descriptions in the Exports (meat) Regulations, the Federal Government in conjunction with the states, has produced new trade descriptions based largely on carcase classification criteria. In keeping with the principle of classification, meat is specified objectively rather than subjectively and is described rather than graded. The importer determines which specification best suits his requirements.

The specification for beef carcases (sides, quarters or crops) includes mandatory description of -

- Sex - Ox beef (as steer and heifer) - cow beef and bull beef
- Weight - Net weight in kg
- Fatness - Surface fat depth in mm over 7 primal cuts
- Cut - According to approved definitions.

Descriptions of age (by dentition), sex and original 12th/13th rib fat depth (mm or class) are included as options for the importer.

Specification by retail traders and caterers

The use of classification information in carcase specification by the local industry is also increasing. A survey of 100 retail butchers in November 1982 showed 43% saw it as useful when specifying their requirements to suppliers. Eighty two per cent specified weight, 41% specified sex and 36% objectively specified fatness.
All supermarket chains, which account for at least 50% of retail meat sales, objectively specified age, sex, fatness and weight.

Objective specification is also being used increasingly by restaurants, hotels, hospitals and institutions as the basis of tenders for meat. It is expected that the carcase branding system will be used extensively by these organisations as the majority buy selected primal cuts and therefore do not usually see carcase tickets.

All meat traders at retail have identified the need for inclusion of additional characteristics, especially meat and fat colour, in the classification description.

Identification of industry problems

Information on classification characteristics, disease, pregnancy status and bruising has been collected annually in the Kimberley region of Western Australia since 1978. The surveys have highlighted the following.

- The age and fatness of the cattle turned off, suggests that almost all are unsuitable for use as table beef.
- The consistently low percentage of cows and heifers turned off indicates a high death rate in females.
- Carcase weight for age is almost always very low i.e. approximately 50 kg per year.
- The average weight loss due to bruising in 1980 was 16 kg, suggesting a loss of approximately 2.5% of the total carcase weight produced annually.

The availability of this data has prompted the development of a series of trials supported by AMRC to examine the feasibility and economics of weaning Kimberley calves in winter and transferring them to more favourable environments for growing out and finishing. Benefits to both calf growth and survival of dams are anticipated.

An important feature of the development of these uses of objective measurement in the industry has been the need in most cases, to demonstrate them in order to gain their acceptance. Many sectors of the industry are essentially conservative in the adoption of new procedures and the pace of innovation consequently tends to be slow. The progress made in gaining the acceptance of objective specification in the Western Australian beef industry has been gratifying.

CONCLUSIONS AND FUTURE DEVELOPMENTS

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The preceding papers have discussed and detailed the need for objective measurement in marketing, the technical basis for it and the commercial development and uses of objective measurement. This paper will summarise the current position and point to areas of possible future development.

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The present position

Classification has been introduced to a greater or lesser extent in all States and the Northern Territory. The original objectives of the scheme were concentrated on the introduction of automated measuring equipment. They were subsequently modified towards the introduction of manual systems following disappointing results with the automated equipment. Following the successful manual trials the direction of the programme was further modified to concentrate more on the commercial usage of objective measurement especially in trading.

The level of usage today varies widely but is increasing. At the time of writing approximately 85 per cent of cattle slaughtered in Western Australia were being classified.

Considerable advances in the use of classification measurements in producer to processor and wholesaler to retailer trading have been made especially in Queensland, Tasmania and Western Australia. These States have led the way in demonstrating the uses and benefits of classification measurement in the trading area.

There are two elements which have been vital to the successful advances which have been made. Firstly an adequate source of funding to allow the introduction and demonstration of the system to industry is required. This has been forthcoming from both Commonwealth and State Government sources. Secondly the system must have direct benefits to the participants. In spite of the fact that some of the benefits will only be realised in the long term evidence on the second point is already to be seen in the progressively increasing uses of the system that are being made by industry today. Further recognition of the value of an objective system for meat description is evidenced by the recently revised trade descriptions for export meat which are based on objective measurement.

Technical constraints and future development

The current system provides objective measurements or assessments of age, sex, fatness and weight.

A recent unpublished study by the Bureau of Agricultural Economics (D. Porter personal communication) examined a number of factors which may influence prices paid at classification auctions in Western Australia. The factors studied were: sex, age, weight, fat depth, meat colour, fat colour, sale order, sale centre, day of sale, rib eye area, classification length, butt profile, fat distribution, meat texture, fat texture and degree of trim.

Of the above, the following factors were found to be highly significant price determinants; age, weight, fat depth, meat colour, fat colour, meat texture, fat distribution, butt shape and classification length. These factors accounted for approximately 80 per cent of price variation. Sex was not shown to be a significant price determinant in this study probably because of the two selling centres studied, one primarily sells heifers and the other steers in response to major buyer preferences.

The results of this study which involved some 383 carcases, point clearly to the importance of the objectively measured parameters of age, fatness and weight. However, they also suggest that consideration needs to be given to the additional characteristics of fat and meat colour, fat distribution, butt shape and classification length.
To this end standard meat and fat colour chips have been developed in association with industry. They have been distributed to relevant sections of the industry and it is understood that their use is relatively widespread. However, they do suffer somewhat in that there is still a degree of subjectivity in their use and results can vary between assessors. It is obvious that some simple objective method of assessing colour is required.

It is unlikely that there is any relationship between meat texture and eating quality. It is more likely that meat texture is related to meat colour in that dark coloured meat is more likely to appear to have a coarse texture. It seems unlikely then that information on apparent meat texture would be of any benefit in the classification system.

The factors of carcase length and butt shape could be grouped under the heading of conformation. Numerous studies (McIntyre 1977; Kempster et al. 1980) have indicated that conformation has little influence on meat quality or yield of meat from a carcase. However, New Zealand work has indicated that there may be other indices of conformation which are related to yield. It is considered though that in real terms information on conformation would add little to the current method of description.

One factor that has not been researched to a great extent but which could provide additional useful information especially in the area of yield of saleable meat is muscle to bone (m:b) ratio. There are some associations between m:b ratio and breed but the overall effects are not clear as there are conflicting reports in the literature. The increasing use of crossbreds in the industry will further confuse this point. A detailed investigation of m:b ratio and how it can be objectively assessed is considered warranted.

Numerous consumer studies (e.g. Palmer and Frapple 1982) have indicated that consumers see tenderness as the most important eating quality characteristic of meat. Laboratory procedures are available to measure tenderness (e.g. Warner Bratzler shear test) but procedures to assess tenderness in the carcase are not available and, to the authors knowledge, have not as yet been investigated to any degree. While processes such as tenderstretch and electrical stimulation are effective in preventing cold shortening and toughening in chillers it is considered that research into determining methods which can directly measure tenderness in the carcase form would pay handsome dividends.

To date most work has concentrated on the use of objective measurement in the trading of carcases. In practise this is facilitated by the use of carcase tickets or weight sheets which carry the information to the trading partners. However, a considerable amount of product is traded in the form of cuts. Systems of objectively describing cuts have been developed for export trade but it is considered that these currently do not include enough detail for most domestic markets. Carcase branding allows broad quality descriptions to be carried through the marketing chain but again may not contain enough detail for many market situations. Additional work is also required in this area.

CONCLUSIONS

It has been demonstrated that Carcase Classification can be successfully and inexpensively implemented in abattoirs of widely varying throughput and design. It can form the basis of a meaningful trading language between all
sectorsof the industry and the basis for market reform.

One of the most important benefits seen is that it provides the basis of a relatively low cost method of ensuring improved consistency of product for the consumer.

There is a need to relay the information through to the consumer level. Carcase branding systems, where individual colours relate to important and proved quality characteristics, is seen as the method of achieving this aim.

There is a need for ongoing research and development in the areas of:

- the use and inclusion of additional carcase characteristics.
- improved fat measurement techniques.
- improved methods of carcase branding.
- further development of "sight unseen" selling methods.

It is important to realise that carcase classification is still in an evolutionary phase and that the system must remain flexible to allow adaptation to include new technology and changing market requirements.

It is equally important to recognise that the specifications merely provide the tools for improvement and that there is a need to develop and maintain effective systems of monitoring their application.

REFERENCES


