

# **LIVE ANIMAL AND CARCASS CLASSIFICATION AND GRADING SYSTEMS FOR BEEF CATTLE, GOATS AND SHEEP IN ZIMBABWE**

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## **INTRODUCTION**

Classification is a system of describing carcasses or live animals according to various criteria that affect quality or yield and dividing each criterion into classes. In Zimbabwe, as in most countries in the region and elsewhere, carcasses of cattle, goats and sheep are classified according to four main criteria, namely, age, sex, conformation and fat cover, with each of these criteria divided into classes. On the other hand, grading involves combining the classification criteria and classes into marketing grades. The main purpose of classification or grading is to put live animals or carcasses into homogenous groups with similar characteristics for purposes of determining values and facilitating market transactions (Webb, 2015). This is done to inform players in the meat value chains as to the yield, quality and edible portion of a carcass. Thus, classification and grading of live animals or carcasses facilitate marketing, trade and price setting. They are also an incentive for livestock keepers to produce slaughter stock that meet market requirements.

Classification or grading of live animals and carcasses is therefore essential in production, marketing and trade in livestock and livestock products. However, the benefits of classification and grading are somewhat limited in Zimbabwe as most slaughter animals are produced in the smallholder commercial and traditional sectors (Tawonezvi *et al.*, 2021) and are sold informally at farm gate, with little or no effective classification or grading according to quality. Thus, the predominant livestock populations are largely bypassed by the formal grading and marketing systems. This benefits largely the traders and middlemen often at the expense of livestock producers. Informal marketing without effective classification or grading also provides few or no incentives to livestock producers to improve their production systems.

This paper discusses the live animal and carcass classification and grading systems for beef cattle, goats and sheep in Zimbabwe. It presents some of the opportunities and limitations of these current grading systems and offers suggestions for improvement.

## 2 CLASSIFICATION AND GRADING OF CARCASSES

The carcass classification and grading of beef cattle, goats and sheep is guided by the Statutory Instrument 182 of 2000. It describes the standards for movement and handling of animals going for slaughter, slaughter procedures, as well as the classification and grading procedures. The systems of carcass classification and grading within these species are discussed in this section.

### 2.1 Beef carcass classification and grading system

The official criteria for classifying and grading of beef carcasses are summarised in Table 1.

#### 2.1.1 Carcass classification

##### 2.1.1.1 Age classification

Age of an animal at slaughter is determined by the number of permanent incisor teeth. It is an important classification criterion to assess the level of tenderness of the carcass, given that as animals age their meat becomes less tender. The degree of ossification of bone is used to further separate age among old animals with full permanent incisor teeth. Among animals with not less than seven permanent incisor teeth present, there are those classified as having no more than limited ossification of the dorsal spinal processes of the thoracic vertebrae (FM), and those classified as having the dorsal spinal processes of the thoracic vertebrae showing marked or full ossification (FA).

There are six age classes as shown in Table 1, but these are collapsed to three classes (0-6, FM, and FA) at grading, thus rendering it unnecessary to classify and record the six individual classes. Review of literature (Chingala *et al.*, 2017; Tawonezvi, 2021) has shown that although young animals produce more tender carcasses than older ones, pastured animals aged 3-6 tooth produce tastier meat than 0-2 tooth pastured animals. Quality considerations, therefore, suggest reducing the number of age classes from the current six classes to only three classes, namely, 0-2 tooth, 3-6 tooth and older animals. This would provide a simpler and more rational basis for age classification and grading than the current system.

##### 2.1.1.2 Sex classification

Slaughter animals are classified into four sex categories shown in Table 1 for carcass of female animals (CO), carcasses of castrated males (OX), carcasses of young bulls of age class 0 showing limited development of secondary male sex characteristics (BY), and carcasses of mature old bulls (BU). However, the major sex effect on meat quality is that of mature bulls showing secondary sex characteristics. Although all the other sex classes are recorded, they are not used in grading. It is therefore unnecessary to record sex, except for adult bulls (BU).

##### 2.1.1.3 Fat cover classification

Carcass fat content is determined mainly as the amount of subcutaneous fat cover assessed by measuring the thickness of the back fat. There are seven classes for fat cover. The rationale for having so many classes is not clear.

**Table 1: Beef carcass classification and grading system in Zimbabwe**

Carcass classification criteria and classes within criterion					Carcass grades and the classes that constitute them				
Age (no. of permanent incisor teeth)	Sex	Fat cover	Conformation	Carcass damage	Super	Choice	Commercial	Economy	Manufacturing
0 = 0 2 = 1-2 4 = 3-4 6 = 5-6 FM = 7-8 FA = 7-8	CO = Female OX = Castrated male BY = Young bull BU = Adult bull	0 = 0 mm 1 = 1-2 mm 2 = 3-6 mm 3 = 7-12 mm 4 = 13-18 mm 5 = 19-24 mm 6 = >24 mm	5 classes of Fleshing Index, from Highest (A) to Lowest (E), derived from carcass weight to length ratio	1 = Undamaged 2 = <2% of carcass weight trimmed 3 = >2% of carcass weight trimmed 4 = Trimming caused by abscesses and wounds	<u>Age 0-6</u> Fat 2, 3 Conf A, B	<u>Age 0-6</u> Fat 1,4,5 Conf A, Fat 2,3 Conf C	<u>Age 0-6</u> Fat 0,6 Conf A, Fat 6 Conf B Fat 1,4,5 Conf C, Fat 2,3,4,5 Conf D	<u>Age 0-6</u> Fat 0,1,6 Conf C Fat 0,1,6 Conf D Fat 1,2,3,4,5 Conf E	Unclassified carcasses
						<u>Age FM</u> Fat 2,3 Conf A, B, C	<u>Age FM</u> Fat 1,4,5 Conf A, B Fat 2,3,4,5 Conf C Fat 2,3,4, Conf D	<u>Age FM</u> Fat 0,6, Conf A, B Fat 0,1,6, Conf C Fat 0,1,5,6 Conf, D Fat 1,2,3,4,5,6 Conf E	
						<u>Age FA</u> Fat 1,2,3,4,5 Conf A, B, C Fat 2,3,4 Conf D	<u>Age FA</u> Fat 0,6; Conf A, B Fat 0,1,6, Conf C Fat 0,1,2,3,4,5,6 Conf D Fat 2,3,4,5,6 Conf E		

#### **2.1.1.4 Conformation classification**

From the 1970s until recently, carcass conformation was measured solely as Fleshing Index, the ratio of carcass weight to carcass length. The ratios were grouped into five conformation classes, from the highest (class A) to the Lowest (class E) conformation. Recently, however, there has been a growing but still unofficial migration to visual assessment. Carcasses are visually assessed into five categories according to their shape as follows:

A = Ultra convex

B = Convex

C = Linear

D = Concave

E = Ultra concave

The visual assessment is now used in most of the abattoirs in the country. The assessment of conformation using both the Fleshing Index and visual assessment in the same national grading system is problematic. It assumes, apparently without evidence, that the two conformation criteria are identical or highly correlated. There is a need to verify that this is the case.

#### **2.1.1.2.5 Carcass weight and value**

Beef carcasses are weighed hot, i.e., soon after slaughter and after dressing the carcass as specified in the Statutory Instrument. The weight of the carcass after a 24-hr chill is estimated and recorded as 97 % of the hot carcass weight. The financial value of the carcass is therefore based on this estimated cold dressed weight and the price per kilogram for the carcass grade.

#### **2.1.2 Carcass Grading**

Table 1 shows how beef carcass classification classes for age, sex, fat cover and conformation are combined to determine the grade of a carcass. There is substantial variation in carcass quality within grades. For example, Choice grade carcasses vary in fat content from thin (1-2 mm) to fat (13-24 mm), as does the Commercial and Economy grades (0 – 24 mm). These grades also contain carcasses of a wide range of conformation, especially the Commercial and Economy grades. Except for Super grade, all grades contain carcasses of animals of all age groups. There is therefore also considerable quality overlaps between grades especially between the Commercial and Economy grades. With such variation within grades and overlaps between grades, it must be difficult for buyers to order and get carcasses of desired quality based on the grade alone without the buyer being physically present. Otherwise, a buyer will have to specify the desired quality (age, fat cover, conformation) within the grade, which somewhat negates the purpose of grading after classification. Overall, Table 1 therefore raises serious doubt as to the benefits of grading after classification, and the basis for grouping classification classes into the different grades.

Another issue is the use of conformation in carcass grading. Traditionally, conformation has become customary to record in carcass classification systems because it is an important selling point for certain markets, although it has long been established (e.g. Kempster *et al.*,

1982) that the contribution of carcass conformation to saleable meat yield independent of carcass weight and fatness is small. For this reason, many countries do not include conformation in determining carcass value. In Zimbabwe, however, Fleshing Index, as the official measure of beef carcass conformation, is the major determinant of the grade and the financial value of a carcass, with carcass fatness and slaughter age contributing substantially less to carcass grade and price. This means that conformation is grossly overweighted in terms of its contribution to carcass grade and price.

Since the 1980s, the use of Fleshing Index in the grading and marketing of beef carcasses in Zimbabwe has been contentious because it favours large-framed breeds, which are predominantly the exotic breeds, and discriminates against small-framed breeds which are predominantly the indigenous types. Fleshing Index is meant to measure objectively the contribution of carcass conformation to meat yield independent of carcass size and fatness. The Fleshing Index in Zimbabwe fails to do this because it is not independent of size of the carcass. Studies in the country have shown that about 65 % of the variation in fleshing index is explained by carcass weight (Tawonezvi *et al.*, 2021). Large breeds and large animals within breeds are classified and graded as having better carcass conformation and therefore fetch higher carcass prices per kilogram than small ones. There are two main consequences of this grading bias. First, small breeds are not preferred by most commercial beef producers, even though they are more productive overall and compete favourably in meat quality compared with the exotic breeds. Second, producers of small breeds often finish their slaughter animals for longer periods to achieve heavier carcass weights and therefore better carcass grades. This however results in the production of old and fat animals, which is less efficient. Thus, Fleshing Index in the Zimbabwean grading system is a major disincentive to the rearing of the more adapted, more productive and predominant indigenous cattle breeds. Fleshing index should not be included in determining the financial value of a carcasses because this would effectively amount to factoring carcass weight twice: as carcass weight *per se* and as weight-dependent conformation and grade. The unbiased market value of a carcass should simply be the product of carcass weight and grade price independent of weight and conformation.

## **2.2 Carcass classification and grading systems for sheep and goats**

Tables 2 and 3 summarise the official carcass classification and grading systems for sheep and goats in Zimbabwe. The systems generally use similar carcass classification criteria as those for beef cattle carcasses, namely, age, fat cover, and carcass conformation. Sex of animal is not included in the classification or grading system. Age of animal at slaughter is determined based on the number of permanent incisor teeth. Carcass fat content and carcass conformation are assessed visually.

The carcass grades are derived from the classification criteria and classes in the same way as for beef carcasses discussed above. Consequently, the challenges faced in the grading of goat and sheep carcasses are similar to those discussed for beef carcasses.

**Table 2: Sheep carcass classification and grading system in Zimbabwe**

Carcass classification criteria and classes within criterion			Carcass grades and the classes that constitute them				
Age (no. of permanent incisor teeth)	Fat cover	Conformation	Super Lamb	Choice Lamb	Standard Lamb	Mutton	Inferior Mutton
0 2 4 6 FM	1 = No fat or lack uniformity 2 = Uniform and fairly well covered 3 = Overfat	A = Well fleshed B = Moderately fleshed C = Lack flesh development D = Poorly fleshed	<u>Age 0-4</u> Conf A-B Fat 1-2	<u>Age 0-4</u> Conf C Fat 1-2	<u>Age 0-4</u> Conf A-C Fat 3 Conf D Fat 1-3	<u>Age 6-FM</u> Conf A-D Fat 1-3	Not classified

**Table 3: Goat carcass classification and grading system in Zimbabwe**

Carcass classification criteria and classes within criterion			Carcass grades and the classes that constitute them			
Age (no. of permanent incisor teeth)	Fat cover	Conformation	Super Goat	Choice Goat	Standard Goat	Inferior Goat
0 2 4 6 FM	1 = No fat or lack uniformity 2 = Uniform and fairly well covered 3 = Overfat	A = well fleshed B = Moderately fleshed C = Lack flesh development D = Poorly fleshed	<u>Age 0-2</u> Conf A-B Fat 1-2	<u>Age 0-2</u> Conf A-B Fat 3 Conf C Fat 1-2 <u>Age 4-FM</u> Conf A-C Fat 1-2	<u>Age 0-2</u> Conf C Fat 3 Conf D Fat 1-3 <u>Age 4-FM</u> Conf C Fat 3 Conf D Fat 1-3	Not classified

There is substantial variation in carcass quality within grades. Most fat cover, age and conformation classes are represented in all grades, indicating that there is very limited separation of carcasses in terms of quality between the grades, especially between the Standard Lamb and Mutton grades.

Similar carcass quality variations and overlaps are apparent in goat grades. For example, all age, fat cover and conformation classes are represented in all the goat grades. Such variations and overlaps also raise doubt as to the benefits of grading after classification.

## **2.3 Improving classification criteria**

### **2.3.1 The need for simplicity**

As mentioned earlier, many stakeholders find the current carcass grading systems complicated and difficult to understand. This is understandable, given the absence of clear differences in quality of carcasses between grades and lack of a clear rationale for combining classification classes into grades. Secondly, Tables 1 to 3 show that there is no need to go into the trouble of recording classification classes that will not be used for grading. For example, age classes are recorded for sheep and goats only to subsequently combine them for grading to three classes (0, 2-4, and 6-FM) for sheep and to two classes (0-2 and 6-FM) for goats. This is also the case with beef carcass grading in which six age classes are recorded only to be combined to three (0-6, FM, and FA) for grading. To save time and cost and for simplicity, the combined classes used for grading should be the same classes recorded at the carcass classification stage.

### **2.3.1 Improving accuracy of visual carcass assessments**

The carcass classification for conformation and degree of carcass damage (bruising) in cattle as well as conformation and fat cover in goats and sheep are assessed visually in Zimbabwe without any mechanisms in place to aid and standardise the assessments. This makes these visual assessments subjective and prone to human error and preferences of individual graders. In other countries in the world, visual assessments are accompanied with the use of reference photographs to standardise classification and minimise subjectivity. The use of reference photographs is recommended for adoption because they increase accuracy and reliability of these assessment criteria.

## **2.4 Elements for improving the carcass classification and grading systems in Zimbabwe**

There is need to revise the carcass classification or grading systems in Zimbabwe to comprise the following elements (Tawonezvi, 2021):

- Improved carcass classification or grading systems developed, based on evidence to minimise undue human error. A classification or grading system should be considered as a living system. There will be need for its refinement as new information and technologies become available. In this regard, it is important to note that the basic structures of the classification and grading systems for beef, goat and sheep carcasses in Zimbabwe have changed little for decades, with the current Statutory Instrument not having been revised for over 20 years.
- There should be clear differences between carcasses in different classes or grades and uniformity of carcasses within classes or grades.
- Classification or grading should be consistent and unbiased, not unduly favouring carcasses of certain animals or breeds over others.
- The classification or grading system should be easy to understand and to follow by stakeholders in the value chains
- It should be implemented according to clearly laid out regulations on slaughter, carcass dressing and classification procedures. The regulations need to be enforceable

and accessible to all stakeholders to achieve fairness, discipline and integrity in the management of the system.

- Implementation of the classification or grading system should be managed and monitored by institutions (public or private) with adequate and sustainable material, financial and human resources. Such institutions should collaborate with other institutions with identifiable comparative advantages, such as livestock research and development institutions, and relate well with all stakeholder entities in the value chains. When well designed and institutionalised, the classification/grading system can be financially self-sustaining.

The impacts of good and functional classification and grading systems include the following (Tawonezvi, 2021):

- Such systems facilitate organised marketing, trade and quality-based pricing. This provides incentives to livestock keepers to produce slaughter animals that meet market demands.
- Participation of the majority smallholder producers of cattle, sheep and goats in the formal marketing systems can be achieved, especially when accompanied with targeted extension and advisory services as well as appropriate production and marketing incentives.
- Classification and grading systems are currently little understood by many stakeholders (farmers, retailers, consumers, policy makers). Developing good and functional systems that are simpler and easy to understand across stakeholder groups in the value chains is possible. Such systems will lead to their increased participation and enhance their understanding of how the classification/grading systems work. This is expected to spread more widely the benefits from livestock production, marketing and trade, thus increasing the number of households benefiting. The current classification and grading systems have only benefited a limited number of stakeholders in the value chain, mainly commercial producers, abattoir operators and traders.
- Good classification/grading systems will have clearer policies, regulations and institutional arrangements, which will incentivise producers and facilitate orderly marketing.

## **2.5 Opportunities in the current carcass classification and grading systems**

### **2.5.1 Promoting inclusivity**

There are opportunities to develop production systems that do not only focus on commercial livestock producers but also deliberately promote the participation of smallholder producers, who are the main sources of slaughter stock in the country. This would include production and finishing systems that do not discriminate against the indigenous and other locally adapted breeds in line with global efforts of promoting utilisation of these animal genetic resources. This will encourage the majority smallholders rearing predominantly indigenous



breeds to participate in commercial livestock production and marketing, thus enhancing national livestock production and productivity.

### **2.5.2 Leveraging on public-private partnerships**

Until the late 1990s, slaughterhouses and the business of classifying and grading carcasses and selling the carcasses to retailers were the preserve of government. Following liberalisation of the national economy, several private abattoirs have been established and this has resulted in a substantial increase in demand for grading services provided by government graders. Government graders have not been able to provide adequate services because of limited resources. Consequently, maintenance and supervision of the grading standards have generally deteriorated. At the same time, many of the private abattoirs have not been able to provide the tools that they are supposed to provide, such as roller markers, marker pens, stamps and ink pads. These challenges have contributed to the unregulated adoption of visual conformation assessment in beef carcasses and the absence of carcass markings in most of the abattoirs in the country.

One way to address this challenge is to explore the possibilities of establishing partnerships between the public sector and private sector entities (PPP) in ways that restore and sustain the viability of national carcass classification and grading services. This could include part of the usual levies paid by livestock owners for the grading of their animals sold through public auctions or slaughtered at registered abattoirs. The responsibility and cost of classification and grading need to be shared accordingly.

## **3 CLASSIFICATION AND GRADING OF LIVE ANIMALS**

Formal classification and grading of live animals occur only in beef cattle marketed through public auctions in smallholder farming areas of the country. Although some cattle and small stock are also sold through auctions by private companies, the classification and grading systems used are largely unknown except that grading of slaughter animals is intended to reflect expected carcass grades. It has however been observed (Tawonezvi *et al.*, 2021) that the terminology used by some private auctions suggests that they discriminate against indigenous breeds. This includes terminologies that identify animals that look indigenous as "Communal", even though such animals may have been reared commercially. Such animals generally attract lower prices per kilogram.

Table 4 summarises the live animal classification and grading system used at public auctions in smallholder areas. The names of the grades date back to the 1960s, although the classification criteria and the classes that make up the grades have changed somewhat over time. Unlike carcass classification and grading, there seems to be no official regulations guiding the live animal classification and grading system. Currently, age, sex, body condition and live weight are the main criteria used in classifying and grading the animals. The grades shown in Table 4 are unnecessarily complex. Many producers and other stakeholders, probably most, are unlikely to follow and understand these grades and to make production

or marketing decision based on them. For example, only condition score and live weight separate the grades, while age and sex classes overlap across the grades.

**Table 4: Classification and grading system for live cattle auctioned in smallholder farming areas in Zimbabwe**

Live animal classification criteria and classes within criterion				Live animal grades and the classes that constitute them				
Age (no. of permanent incisor teeth)	Sex	Condition score (CS) <sup>a</sup>	Live weight	Chiller	GAQ (Good Average Quality)	FAQ (Fair Average Quality)	X (Compound)	Inferior
0 1-2 3-4 5-6 7-8	Young bulls Mature bulls Cows Heifers Steers Oxen	1= very thin 2= thin 3= good 4= fat 5= overfat	All animals to weigh at least 255kg	0-6 teeth CS 5 All sexes except mature bulls and cows Live weight >340 kg	0-7 teeth CS 4 All sexes except mature bulls and cows Live weight >320 kg	0-8 teeth CS 3 All sexes Live weight >300 kg	CS 2 All sexes Live weight >255 kg	Animals below aforementioned grades

<sup>a</sup> See Table 5 for description of condition scores

Table 4 shows that an animal can attain the required condition score and age for a given grade but get downgraded if its weight is light for that grade. This results in better grades and financial values in larger animals and breeds and increases the variation in quality among animals in lower grades. It also confirms the generally observed better grades and prices for the exotic than the smaller indigenous breeds and the difficulty for indigenous cattle to attain the ideal (Chiller) grade. Thus, there is bias against indigenous breeds in both carcass grading and live animal grading, which discourages the commercial production and marketing of the so-called “Communal” cattle. Despite this clear bias, systems that include weight in determining marketing grade of live animals or carcasses continue to be developed for us (Box 1).

**Box 1: Indigenous cattle, goat and sheep breeds will be discriminated against if live weight is included in determining marketing grades**

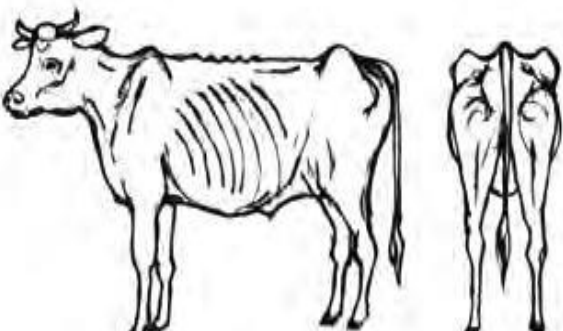
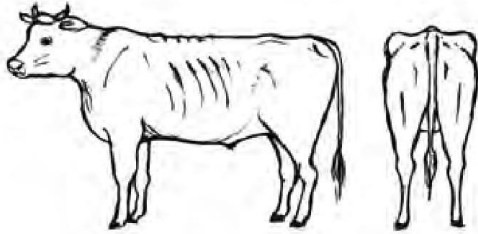
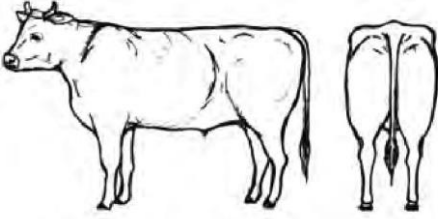
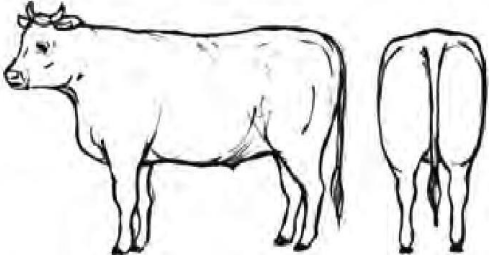
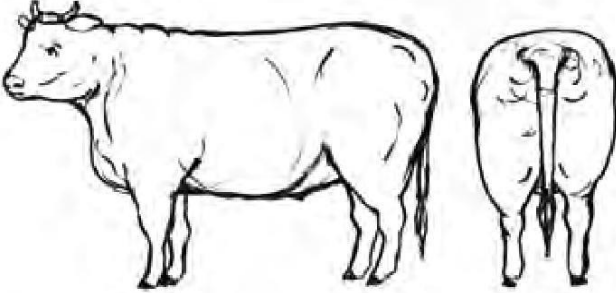
It is noteworthy that the harmonised regional grading systems for live cattle, goats and sheep developed recently by COMESA (2019) include weight in determining marketing grade. It also includes visual conformation in which large-framed animals are classified as having better conformation than small ones. Such grading systems will discriminate against small animals and breeds and will perpetuate the current bias against indigenous livestock, which are predominant, are more adapted and relatively more productive overall than the exotics. They also disadvantage the majority livestock producers.

Like carcass weight, live weight should also not be included in the determination of grade price because this amounts to factoring live weight twice in establishing the market value of an animal. Removal of these biases in grading and marketing systems can be expected to result in more realistic market prices of indigenous breeds, which should encourage their commercial production. Given the numerical strength of indigenous cattle, goats and sheep in the country over the exotics, their promotion and commercial utilisation can have a huge impact on the livestock sector. This calls for a major revision of the live animal and carcass grading systems and a paradigm shift in the way in which animal breed resources are managed and marketed in the country.

Another important consideration is the relationship between carcass grading and live animal grading. Ideally, live animal grades should reflect the expected carcass grades. Analysis of the findings in Table 1 for beef carcass grading with those in Table 4 for live cattle grading suggests some congruency between the two grading systems, Secondly, the use of different systems of grading live animals according to farming sector brings confusion in the production and marketing chains and can result in biases against animals from one sector, as seems to be the situation at present. There is therefore a need to remove such dichotomy.

Body condition in live animals is assessed visually, as is the case in the rest of the world. This assessment, being subjective, is also prone to human error and to preferences of individual graders. In other countries in the world, the condition scoring is assessed with the aid of reference photographs to standardise classification and minimise subjectivity. The use of reference photographs to aid assessment needs to be considered for adoption in the country. Table 5 gives a draft template to aid visually assessed body condition scores. Final standard photographs, preferably in colour, will need to be agreed upon by consensus among stakeholders.

Table 5. Draft template for visual assessment of body condition in live cattle

Body condition score	Description	Pictorial representation (in colour)
1. Very thin	Backbone prominent Hips and shoulder bones prominent Ribs clearly visible Tail-head area recessed Skeletal body outline	
2. Thin	Backbone visible Hip and shoulder bones visible Ribs visible faintly Tail-head area slightly recessed Skeletal outline bony	
3. Moderate	Hip bones visible faintly Ribs generally not visible Tail-head area not recessed Body outline almost smooth	
4. Fat	Hip bones not visible Ribs well covered Tail-head area slightly lumpy Body outline rounded	
5. Over fat	Hip bones showing fat deposit Ribs very well covered Tail-head area very lumpy Body outline bulging due to fat	

(Source: [www.publish.csiro.au/?act=view\\_file&file\\_id=SA0501209.pdf](http://www.publish.csiro.au/?act=view_file&file_id=SA0501209.pdf))

## **6 TO GRADE OR NOT TO GRADE LIVE ANIMALS AND CARCASSES FROM THE CLASSIFICATION SYSTEMS?**

As observed earlier in this paper, classification involves describing carcasses or live animals according to set criteria and categorising them into classes based on clearly defined quality attributes to ensure more consistent meat quality and consumer satisfaction. This means that carcasses or live animals of similar composition and quality, regardless of size, are classified in the same category to reduce the variation between carcasses and ensure more consistent end products. Classification also leads to improved efficiency as livestock keepers have a financial incentive to improve production methods and produce the most desired carcasses by consumers and traders. It further allows for standardised description of live animals or carcasses, which facilitates price setting, marketing and trading without the buyers having to be physically present. Thus, classification on its own provides sufficient information for production and marketing decisions.

On the other hand, grading involves combining classification classes and categorising the animals or carcasses into uniform groups of similar quality and characteristics for purposes of determining value and facilitating market transactions. Because grading is derived from classification, the benefits of grading are similar but not identical to those of classification. In classification the emphasis is to provide the meat industry and consumers with a choice of carcasses in terms of composition and physical attributes, with no indication of perceived meat quality. Consequently, a carcass classification system is based on the principle that producers, retailers and consumers differ in terms of their perceptions and expectations of carcass and meat quality, and subsequent eating experience. Classification is therefore intended to allow for individual variation in choice of the perceived quality. In a carcass grading system, on the other hand, an indication of perceived meat quality is provided for the different grades. The challenge is that perceptions of meat quality often do vary between individuals and between consumer categories. For this reason, some countries in the SADC region and elsewhere in the world have increasingly considered to only classify carcasses without grading them. The second reason is that grouping carcass classes into grades somewhat negates the process and cost of having classified them, and that classification alone can be better and more precise than grading in meeting the meat attributes preferred by different consumers.

Review of literature on carcass classification and grading systems in the SADC region has shown that, compared with classification alone, grading generally increases variation between carcasses put in the same grade (Tawonezvi, 2021). The grading systems in Zimbabwe confirm this. Grading has also been the major source of discrimination against indigenous breeds because of their smaller size compared to the exotic breeds and the inclusion of weight in determining grades. There is therefore a strong case for developing stand-alone classification systems without grading for both live animals and carcasses.

Where the use of marketing grades is preferred, it will be important to (i) develop grading systems that are simpler and easier for stakeholders to understand than is the situation currently, (ii) ensure greater uniformity of carcasses or live animals within grades than is the case in the current grading systems, (iii) minimise quality overlaps across grades, and (iv) ensure that the grading system does not unduly favour certain breeds over others. Live animal or carcass weight should not be included, either directly or indirectly, in determining grade. The unbiased market value of an animal or a carcass should simply be the product of live weight or carcass weight and grade price that is independent of weight. It is unlikely that any grading system will be able to address all these requirements adequately to satisfy the preferences of different consumers. Therefore, a system of classification without grading remains the more realistic, simpler and unbiased option than a grading system.

## **7 PROPOSALS FOR HARMONISED CLASSIFICATION SYSTEMS IN THE SADC REGION**

In March 2021, the African Union Inter-African Bureau for Animal Resources (AU-IBAR), commissioned a study to develop harmonised classification and grading systems for both live animals and carcasses for cattle, goats and sheep in the SADC region. The study was in recognition of the concerns of a SADC regional workshop held in Seychelles in March 2020 regarding (i) the importance of harmonised classification and grading of ruminant livestock in the region, and (ii) the need to facilitate regional integration and trade in livestock and livestock products in the SADC region as a free trade area. The Seychelles workshop had also recognised some of the challenges of the live animal and carcass classification and grading systems in the region that seem to underrate the performance and potential role of indigenous livestock. Development of harmonised and unbiased classification and grading systems for live animals and carcasses in the SADC region was therefore seen as essential. The study reviewed literature in the member states and elsewhere to identify commonalities and differences between their grading systems. Several stakeholders within the SADC member states were consulted. Details of the findings of the study were presented in Tawonezvi (2021) and are summarised in this paper.

The study recommended the establishment of harmonised regional classification systems and the classification criteria for carcasses to be the same as those for classification of live animals, except that fat cover in carcasses is replaced by condition score in live animals (Table 6).

The study also proposed to harmonise and standardise several aspects of live animal and carcass classification systems in the region, including the following:

- Harmonised live animal and carcass classification criteria, together with standardising their names and descriptions across species
- Harmonised live animal and carcass classification classes, together with standardising their names and descriptions, and how they are recorded across species

**Table 6. Proposed classification criteria and their assessment in cattle, goats and sheep**

Classification criterion	Carcasses	Live animals	Type of assessment
Age	√	√	Number of permanent incisor teeth
Sex	√	√	Visual
Fat cover	√	-	Back fat depth (mm) for cattle carcasses Visual subcutaneous fat cover for goat and sheep carcasses (with the aid of standard photos)
Conformation	√	-	Visual (with the aid of standard photos)
Body condition	-	√	Visual (with the aid of standard photos)
Carcass damage	√	-	Visual (with the aid of standard photos)

Such standardisation is necessary for simplicity. The use of the same classification criteria and their classification classes across species will simplify matters and help avoid confusion. This will also facilitate training and capacity building of the graders and other value chain actors. Table 7 summarises the proposed classification systems. The proposed classification criteria are intended to assess quality aspects of carcasses and live animals and it is important to note that live weight or carcass weight are not included in the classification systems. Therefore, the classification systems *per se* do not discriminate against any breeds.

It turned out that the proposed classification system in Table 7 is similar to the system used in Lesotho, Namibia and South Africa with the following modification:

- Age classes 0 and 1-2 tooth to be combined to make a class 0-2 tooth, as explained in section 2.1.1.1 in this paper.
- Fat cover in beef carcasses to be assessed objectively, *i.e.* by measurement of backfat thickness. Fat cover in goats and sheep to be assessed visually.
- Carcass damage classification to include class 0 for undamaged carcasses
- Body condition score in live animals to be based on the 5-point classification system used worldwide

It was therefore proposed that the classification system used in the three countries be the template for developing a regional system. The regulations for carcass classification in the three countries could also be used as templates, which should be revised to include a section on live animal classification.

As mentioned previously, the aid of reference photographs will be necessary in visually assessed classification criteria for both live animals and carcasses. The classification system proposed as template already has these reference photographs except body condition scoring in live animals. The photographs in the existing regulations may however need to be reviewed and revised accordingly. Secondly, the proposed regional live animal and carcass classification systems should be considered as living systems and an important starting point. There will be need for refinement of the systems as new information and technologies become available.

The classification systems should be improved based on scientific evidence. The following aspects are considered important in the improvement process:

- The classification system should try to reduce the use of subjective assessments of the carcass quality criteria by introducing new and more reliable technologies, such as Visual Image Analysis (VIA) when it becomes affordable.
- There is need to evaluate both pre- and post-slaughter handling procedures especially in indigenous livestock that can influence meat quality beyond the current focus on age and fat content.
- Indigenous breeds usually have leaner and smaller carcasses, therefore post-slaughter procedures and chilling processes may be different from those currently designed for larger exotic animals. This should be investigated and considered as necessary in future revisions to the carcass classification systems
- Ideally, carcass classification should include measurement of other meat quality attributes, such as tenderness, juiciness and flavour for which indigenous livestock have clear advantages over some of the exotic breeds being promoted in the country. Currently, no mechanisms are available to measure these meat attributes directly. Research will be necessary to develop techniques for measuring them readily as part of carcass classification. Knowledge of consumer preferences will also be an important consideration in this regard.
- Therefore, research will be necessary, together with regular reviews of the classification system, allowing improvements and new technologies to be incorporated into the classification system. There will be a need to ensure that no breeds are discriminated against, and biases need to be removed along the value chains, so that no stakeholder group benefits unduly against another group.

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**Table7: Proposed harmonised regional live animal and carcass classification systems for beef cattle, goats and sheep**

Classification criterion	Carcass classification classes			Live animal classification classes		
	Cattle	Goats	Sheep	Cattle	Goats	Sheep
Age (dentition)	0-2 3-6 >6	0-2 3-6 >6	0-2 3-6 >6	0-2 3-6 >6	0-2 3-6 >6	0-2 3-6 >6
Sex	Entire males > 2 tooth	Entire males > 2 tooth	Entire males > 2 tooth	Entire males > 2 tooth	Entire males > 2 tooth	Entire males > 2 tooth
Fat cover	0 = 0 mm 1 = 0.1-0.9 mm 2 = 1.0-3.0 mm 3 = 3.1-5.0 mm 4 = 5.1-7.0 mm 5 = 7.1-10.0 mm 6 = >10.0 mm	1 = No fat 2 = Very lean 3 = Medium 4 = Fat 5 = Slightly over fat 6 = Over fat	1 = No fat 2 = Very lean 3 = Medium 4 = Fat 5 = Slightly over fat 6 = Over fat			
Conformation	1 = Very flat 2 = Flat 3 = Medium 4 = Round, 5 = Very round	1 = Very flat 2 = Flat 3 = Medium 4 = Round, 5 = Very round	1 = Very flat 2 = Flat 3 = Medium 4 = Round, 5 = Very round			
Carcass damage	0 = No damage 1 = Slight 2 = Moderate 3 = Severe	0 = No damage 1 = Slight 2 = Moderate 3 = Severe	0 = No damage 1 = Slight 2 = Moderate 3 = Severe			
Body condition				1 = very thin 2 = thin 3 = moderate 4 = fat 5 = overfat	1 = very thin 2 = thin 3 = moderate 4 = fat 5 = overfat	1 = very thin 2 = thin 3 = moderate 4 = fat 5 = overfat