

## The Bovine Hide Industry in Thailand

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### Abstract

*Thailand, as one of the world's major agricultural exporters in many fields, often neglects the usefulness of by-products. Treating hides as a by-product of the bovine industries has held Thailand's own leather industry back. Three major aspects of the bovine hide industry in Thailand are reviewed: background information on cattle and buffalo industry, the current status of the hide transaction chain, and factors affecting the quality of hides. Bovine populations, mostly Thai natives, are kept in small numbers by smallholder farmers as an integral part of crop–animal production systems. The changes in bovine numbers and the development of Thai beef cattle, e.g., Kamphaeng Saen beef breed, during the last three decades have influenced the bovine hide industry. The structure and characteristics of hide transaction chains in Thailand are presented to show the various pathways and steps along the chain that influence such factors as traceability and quality of hides. The nature, causes, and consequences of various types of damage to hides in relation to hide quality are reviewed. Many that occur prior to the hide entering the tanning and industrial sectors, i.e., damages from farming and handling, abattoirs' operations, and hide preserving are likely to remain beyond the scope of quality improvement. Lastly, it is obvious that research for improvement of cattle hide to suit to Thailand is strongly needed.*

The prehistory of leather in Thailand includes various forms of hunting accoutrements and utilitarian items produced from the dried hides of wild animals. With the opportunistic settlement of swampy lands by the *Ban Chiang* agriculturists some 6,000 years ago, leather became a flexible support for pots and presumably various other functions not able to be deciphered from archaeological digs. The more recent waves of migrations over the past two millennia used leather products for storage of preserved products and travel containers, and while much later some influence

from Buddhism is said to have curbed its use compared to that by neighbors, the interdependence of farming and domestic livestock meant that all products from valuable animals were used. Thus leather has been used for military functions, such as scabbards, armor, and howdahs and in the colonial period for carrying cartridges, for temple and other drums, for palace art, and at village level as the usual flexible strap for various innovations. It has also been a significant Thai foodstuff, a tradition that survives in a vestigial form today. However, perhaps the most interesting specialized

traditional use of leather to survive is that related to shadow puppets.

Shadow puppetry, an ancient didactic form of entertainment, uses articulated leather silhouettes on a translucent screen. Common across tens of countries touched by trading Indians from the 12<sup>th</sup> century, such puppets are often associated with regions that also adopted Islam from the traders. The two Thai forms are the now less important Nang Yai in the Central region and, in the South, the popular Nang Talung. While Nang Yai puppets are up to 2 m tall, the Nang Talung are seldom larger than 50 cm and are fine works of art in themselves, even though most audiences never see the leather puppet itself, since they view only the shadow on the backlit screen. In the Indian-influenced South, it remains one of Thailand's most entrenched traditions as a vehicle for expressing views not otherwise condoned publically. Special cattle hide preparation ensures a consistent product according to the standards of tradition with the work of masters being dyed and even shown as art pieces rather than used in plays (Fig. 1). Other leather uses are similar to those of neighbors. The modern tanning industry is only some 60 years old.

This paper reviews three major aspects of the Thai bovine hide industry. First, background information on the cattle and buffalo industry in Thailand is presented to provide a general understanding of the numbers, distribution, structures, and practices across the industry and changes that are taking place. Next, the current status of the hide transaction chains is examined to show the various steps along



**Figure 1. Cow hide shadow puppets from Southern Thailand.**

the chain that influence such factors as traceability and quality of hides. Lastly, factors that affect the quality of hides are considered, with attention to issues where objective assessment and the development of standards are a principal objective.

### **The cattle and buffalo industry in Thailand**

There is a general trend in increasing cattle numbers from 1999 to 2008 (4.9 to 9.6 million head) decreasing buffalo numbers (1.8 to 1.4 million head) across the Kingdom (DLD, 2008a). Chantalakhana and Skunmun (2002) have previously noted such causes as agricultural mechanization replacing draft buffalo power, debt, labor constraints, reduced grazing areas, and government policies that favor intensification of monocropping. Overall, total bovine numbers have risen 63 percent to close to 11 million head in 2008 with the majority

located in the Northeastern followed by the Central and the Northern Regions.

Production systems can be classified into three groups:

1. The mixed smallholder bovine-crop production system that account for an estimated 97% of beef and dairy cattle, and almost all buffalo (Chantalakhana and Skunmun, 2002).

2. The grazing systems in crop intensive areas where cattle are herded on stubble and reject lands on a transhumant basis (Skunmun, 2011) or herded between lowland and upland areas according to feed availability (Duanyai *et al.*, 2009) – representing less than one percent of the bovine population.

3. Intensive production systems based on exotic breeds (Chantalakhana *et al.*, 1977b) such as the Kamphaeng Saen (KPS) breed of cattle. Farms raising such breeds vary in size, mostly being between 20 and 100 fattening cattle (Skunmun *et al.*, 2005) and the whole intensive system accounts for only one to two percent of the total, yet is expected to be the most important sector in the future. As this provides the basis for improvements in the Thai leather industry, the KPS breed is introduced in more detail in the following section.

### **Kamphaeng Saen beef cattle**

The native Thai cattle population largely comprised the small Yellow Asian breed with some larger white Indian breeds introduced in the North. With increasing demand for quality beef over the last

2–3 decades, American Brahman breeds were introduced for crossbreeding (Chantalakhana, 1984), followed by other exotic breeds like Charolais, Hereford, and Shorthorn. Each introduced breed had its attractions and eventually a stabilized breed, the Kamphaeng Saen (KPS), was developed from a coordinated research and development program of Kasetsart University, Bangkok, Thailand (Chantalakhana *et al.*, 1977a, 1977b; Tumwasorn *et al.*, 1982, 1993) based on 25, 25, and 50 percent Thai native cattle breed, Brahman, and Charolais breeds respectively. This retained much of the virtues of the high fertility of native cattle, the size and growth rates of Brahmans (Chantalakhana *et al.*, 1977b), and the meat quality of Charolais (Prucasari, 2001). As these animals are less resistant to tropical climates (Chantalakhana *et al.*, 1977a) sound animal management is critical to achieve their genetic potential.

In 1991, the KPS Beef Breeders' Association registered the breed and commenced herd-recording, selection, and marketing (Innurak *et al.*, 2004) and its performance testing led to standard criteria being derived from the top 20 percent of bulls. A Beef Cooperative that assisted with marketing farmer members' KPS beef incidentally produced a large number of fairly uniform hides suited to tanners serving international markets. In many ways this was the beginning of scientific beef production in Thailand, and now traditional hide treatment practices may also benefit from a more scientific approach as there is much potential for improvement, as this paper describes. After production, improvements must also begin with marketing arrangements.

## Bovine marketing in Thailand

Commonly, small farmers in rural areas sell their cattle and buffalo when they need cash, such as after a crop failure. Livestock markets, which numbered 175 in 2009, are registered by Government and include such services as police, animal health, and animal documentation (Office of Livestock Development and Technology Transfer, 2009). The characteristics of such markets are described in several reports (Chanchareon, 1985; Skunmun *et al.*, 2004, Skunmun and Plongrum, 2010) and are not repeated here.

Animals arrive mainly from small farms and border trade. Those from small farms are mostly sold at the farm gate to middlemen who consolidate animals through several villages until they find their way to a rural market. Few farmers take their animals directly to the market. Cattle and buffalo from legal border trade between Thailand and Laos, Cambodia, and Myanmar have to be held in quarantine at the border before being taken to a market or, if in poor condition, sold to villagers for fattening before later selling. Illegal importation, once rife (Falvey, 1982) with cattle being moved

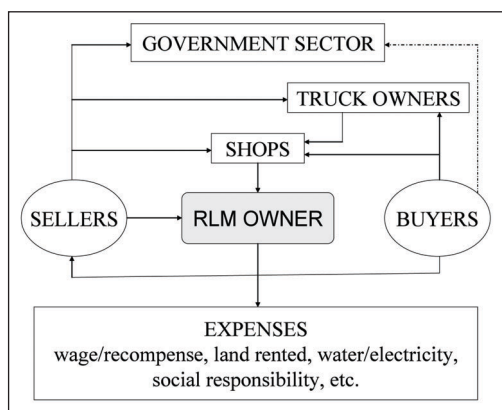
from as far west as the Indian subcontinent to higher priced Thai markets, has decreased markedly in recent years.

At the market itself, animals are tied to a tree, a ground knot, or an overhead rail to allow buyers to make close inspections. Sellers may be individual farmers, professional traders, or opportunistic speculators; buyers are mainly traders servicing slaughter for butchers or abattoirs (about 50%), although others purchase for breeding stock or fattening and resale.

Bargaining starts with the seller providing information about the price and age of animals and individual buyers making counter offers on a one-to-one basis. Negotiations for whole truck loads occur with well-known buyers, following the same honor-system that underpins long-lasting business connections. Sellers pay the market fee and obtain a health certificate from the livestock officer to pass to the buyer with the animals, and if the buyer wants to move animals across provinces, animal movement protocols and fees apply. Thus animals move to one of four destinations – farms (both smallholder and commercial fattening farms), a trader's stockyard for on-selling, to a market elsewhere the next day or to slaughterhouses.

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Livestock markets in small rural communities are big business with over ten million baht (US\$ 330,000) sometimes changing hands in the system described in Figure 2. The system has evolved from traditional negotiation rituals into one that now functions well with equitable arrangements, means of charging for government services,

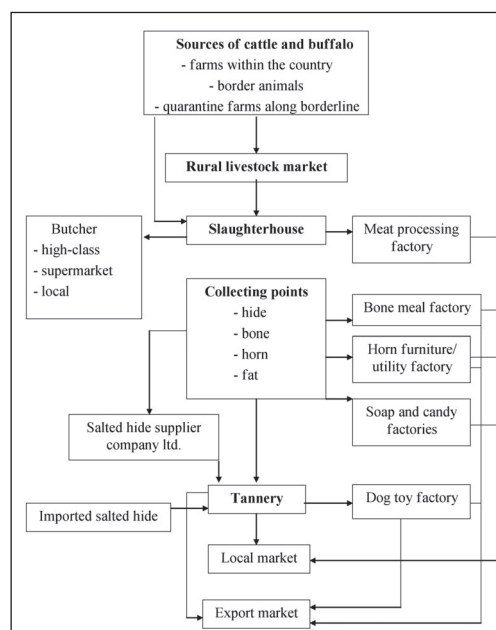


**Figure 2. Money circulation in a livestock market on a trading day (Note: RLM = Rural livestock market).**

and animal health management having developed over the years. However, the transaction chain is not documented well, which means that tracing the origins of animals is difficult if not impossible and thus feedback to producers and traders on quality aspects of non-meat products such as hide are non-existent.

### Hides at the abattoir

The transaction chain of hides starts at the slaughterhouse in the form of the fresh hide (Skunmun *et al.*, 2005) as shown in Figure 3. With restructuring in 2002 of abattoirs to place all under the Ministry of Agriculture and Agricultural Cooperatives, improved figures became available which indicated that of some 791 registered abattoirs, 594 were municipal abattoirs and 197 privately owned. Non-registered abattoirs continue to exist – possibly 40 operate in Bangkok for cattle and buffalo at present.



**Figure 3. Transaction chain of bovine hides.**

In 2009, there were 1,649 abattoirs in Thailand; 1,282 were specific for large livestock, the rest included the slaughter of pigs. Among these only two met international quality standards (Office of Livestock Development and Technology Transfer, 2009). About one-third of abattoirs (583) acquired a slaughter certificate for meeting minimum requirements.

The slaughtering operator for cattle and buffalo is usually a Muslim – as is common across Indian-influenced parts of Asia, from whom the meat obtained is acceptable for all beef consumers. Family slaughterhouses often outsource laborers some of whom are

*This paper reviews three major aspects of the Thai bovine hide industry.*

unskilled; slaughtering, hide removal, and dissecting carcasses is conducted during the night. To date, hides have mainly been a byproduct of slaughterhouses.

Raw hides entering the processing chain may be either fresh or preserved. The fresh hide, termed “green hide”, is sold to a hide collector within a day – any longer and bacterial action destroys the hide. Preserved hides are salted usually in a cement tank where they may accumulate for many months before selling. Hides are first categorized by size and the number and position of knife cuts and holes and then trimmed of excess parts such as the head, ear, tail, and hoof – all prior to salting – as this is the product demanded by purchasers. Salting starts with putting a layer of salt on the tank floor unfolding the hide hair-side down and adding salt to the flesh side, and repeating this as each hide is added to a height less than three-fourths the tank height to allow room for the moisture drawn out of the hides. The process is not standardized.

### Hides at the tannery

Bangkok tanneries have been relocated to Samutprakarn province – about 35 km away – to control the odor and waste treatment. In 2002, of some 152 registered tanneries only 6–7 percent were large-scale operators, 70 percent operated only wet-

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blue leather, and 30 percent followed a comprehensive system from basic tanning to finished leather. By 2009, there were 103 tanneries in total. All were family owned and operated with specific techniques handed down from ancestors. Most raw hides (some 70–80 percent) are imported, although some tanneries use solely local material. Large-scale tanneries service large size hides imported from Western beef producing countries and prefer these imported products for various reasons including: local slaughtering methods cut the windpipe and artery rendering that part of the hide unusable; hides often come with parts of the head, ear, tail, or hoof attached which are not wanted; defects from insect damage, injury, or scars that can be visually detected only after tanning increase the price risk; tricks used to increase the weight of hide reduce its quality; the need to pay within 3 days compared to 3 months; the absence of tax for imported hides; and a national shortage of local buffalo hides.

Although the tanners import a large amount of cattle and buffalo hides, some small-scale export is also evident (Table 1) (DLD, 2008b). The hides imported and exported are in different forms of raw hides as well as processed wet-blue hides. Other imports include the hides from pigs, sheep, and goats, while the other exports include the skins from pigs, dogs, and cats.

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**Table 1. Hide imports and exports in Thailand.<sup>1</sup>**

| Year           | Cattle hide  |               | Buffalo hide |               | Other hide   |               | Import value<br>(million THB) |
|----------------|--------------|---------------|--------------|---------------|--------------|---------------|-------------------------------|
|                | (million kg) | (million THB) | (million kg) | (million THB) | (million kg) | (million THB) |                               |
| <b>Imports</b> |              |               |              |               |              |               |                               |
| 1999           | 90.62        | 4,666.98      | 34.16        | 947.72        | 6.56         | 73.07         | 5,687.77                      |
| 2008           | 116.53       | 9,096.73      | 5.19         | 211.02        | 8.81         | 398.84        | 9,697.59                      |
| <b>Exports</b> |              |               |              |               |              |               |                               |
| 1999           | 0.25         | 30.72         | 0.61         | 23.71         | 0.11         | 3.44          | 57.87                         |
| 2008           | 16.99        | 561.33        | 0.57         | 30.19         | 0.03         | 1.05          | 592.58                        |

1. Source: DLD (2008b).

### Hide purchasing

Until about three decades ago hide collection was in the hands of a few families, which constrained upstream traders as the system was sometimes enforced through violence. Today a wider number of traders and new communication technologies have encouraged improvements in the quality of hides supplied to tanneries. New traders have entered by offering slightly better prices, advance payment or deposits, honesty in trading practices and paying on time. Consolidators purchase hides after inspection and classification of hides obtained from their collection depots and pay suppliers within three days and selling to a tannery.

Hide prices vary between localities although size of hides is the key determinant. Skunmun *et al.* (2005) reported survey data indicating that the weight of the green cattle hide of small size was set at 11–15 kg, medium at 16–24 kg, and large at 25 kg and above. For wet salted hides, six hide collectors in the Northeast used the weights of less than 15 kg, 15–18 kg, and more than

18 kg for small, medium, and large sizes, while four traders in the West specified the weights of 8–12 kg, 13–22 kg, and more than 22 kg. In addition to these classes, there is an extra large or ‘jumbo’ size that commands a 20 percent premium; 25 kg and 40 kg for green hides of cattle and buffalo respectively. In contrast, for a cattle hide weighing less than 8 kg, the price per kg was reduced by 50%. In practice, three-size and two-size systems are used for the purchase of cattle hides, but only the two-size system for buffalo hides, i.e., small and large sizes. Green buffalo hides of small size were less than 25 kg in the Northeast (six traders), less than 28 kg in the Central (two traders) and the North (three traders), and less than 35 kg in the West (5 traders), while that for large sizes was 25 kg and above, 28 kg and above, and 35 kg and above respectively.

*Commonly, small farmers in rural areas sell their cattle and buffalo when they need cash, such as after a crop failure.*

But it was found that small and large sizes of wet salted buffalo hides were less than 30 kg and 30 kg and above only. Beyond that price-by-size classification, the defects on the hide piece caused by slaughter and storage affect the price as well. For example, 50–60 percent of the total price is deducted for the hide having a cut or a hole in the mid piece or for a hide showing rot.

As hide prices are easily controlled by downstream traders, the Association of Tanning Industry of Thailand has established its own hide trading company to protect against oligopolistic trading. Its standard hide sizes differ from those of traders; cattle hides are 8–12 kg for small, 13–15 kg for medium, and 16–18 kg for large, including over 18 kg for extra large or jumbo and for buffalo, the sizes are 15–29 kg for small, 30–39 kg for large, and 40 kg and above for extra large. The buffalo hide of less than 15 kg does not meet the minimum standard size and its price is reduced by at least 50 percent. In addition, if a lot of salted hide enters the tannery with severe damages found on many hide pieces, the next lot from that trader will either be rejected or have a price penalty imposed.

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When changes in the price of hides are made by the downstream trader in response to supply and demand or government regulations, information is forwarded through successive traders up to the upstream seller, but it takes 5–7 days before it is effectively in place. Changing the price of salted hides affects that of the green hides as well. The hide collectors are skilled in applying for permission for the hide movement under the government regulations for the control of infectious diseases from provincial veterinarians at both the place of origin and destination for the hides. The veterinarian at the origin determines whether the permit should be issued. If there is no problem, he will consider an appropriate duration for travel that must be less than 24 hours after the date and time of issue of the permit and will immediately inform the provincial veterinarian at the destination. When the truckload of hides permitted for movement reaches the destination, the trader has to give the permit to the provincial veterinarian on arrival.

### Further processing of hides

Value-added products made from bovine hides in Thailand may be divided into

five groups. Tanneries produce processed leather pieces in different forms on demand mainly as the wet blue leather, finishing leather, and the inner layer of hide for export or for local use. Small and medium enterprises produce leather products, such as household furniture, car seats, shoes, bags, and belts, using finishing leather obtained from the tannery as the material for production. Dog toy/chew factories use mostly the inner layer of buffalo leather, which as local buffalo hides decline in availability is now being replaced by plastic dog toys. Specialist food factories, while not common, maintain traditional production from buffalo hides to produce such crispy food products as “Nang Pong”, a delicacy eaten with green chili paste. Cattle leather is used in puppet making for the traditional shadow show ‘Nang Talung’ (‘nang’ means hide in Thai); this culture is prevalent only in the southern part of Thailand contiguous with other Indianized parts of Southeast Asia (Thongphan, 2000). Of the two or three layers of cattle hides, only the thinnest layer attached to outer side of the hide is used for making shadow-play figures following a process probably introduced from India during the great Indian trading period along the coasts to Singapore.

### Factors affecting quality of cattle hides

In addition to live weight, gender and growth rate affect hide quality as does the presence of the hump on *Bos indicus* cattle (Ballard, 2001). But in the Thai case, it is overwhelmingly preservation and preparation techniques that affect hide quality. Hide curing by treatment with common salt to

arrest bacterial and enzymatic decomposition (Minnoch and Minnoch, 1979) follows four general methods; green salted or pack cure, brine cure, vat cure, and a hide processor device (similar to a concrete mixer). In Thailand, most hide collectors use the vat curing method (Skunmun *et al.*, 2005) described earlier.

Effectively all hides are brine cured as the crystalline sodium chloride simply draws moisture from the hide, which then dissolves the salt such that all hides are under brine. The hide curing drum approach that uses a rotating container with internal spiral blades and wash screens to facilitate washing and chilling is perhaps the most advanced technique although it has only recently been standardized. Other innovations that enhance reliability time and/or cost efficiency (Bailey *et al.*, 2001) include use of electron beam technology as approved by USDA for use in the US meat industry since 1999.

Defects in hides from developing countries leads to international marketing price penalties. Some countries with large populations of cattle, such as Brazil (Pistori *et al.*, 2006) and South Africa (Ballard, 2001), have realized the value of hide and leather and have instituted policies to upgrade raw hide quality. However, as for Thailand, Brazil is starting from a low base; while it is the world’s number one beef exporter, the highest quality of Brazilian leather accounts for only 8.5 percent of all hides compared to 85 percent in USA.

As pointed out by FAO (2001), managerial activities on-farm unnecessarily damage

hides through such actions as hot branding, barbed-wire fencing, methods of animal restraint, and rearing animals with sharp horns. Additionally rough handling, injurious fittings, and unsanitary conditions in any transport of animals can cause scars, bruises, or wounds on the hide. Other defects such as flecks and spots on cattle hides caused by lice continue to be an issue even in developed countries like Britain and Norway (Nafstad and Grnsth, 2001a, 2001b; Cole *et al.*, 2003; Hadley *et al.*, 2005).

Two major issues in Thailand are knife cuts and hide rot from poor salting (Skunmun *et al.*, 2005). These issues have been faced elsewhere and improvements introduced as described by Tancous (1986) for USA by means of setting out a chronology of management changes in cattle production

beginning with disease and injury management and proceeding to slaughter, hide removal, curing, and storage. Yeh and Perng (2005) classified surface defects using digital imaging (Table 2) that allows a national standard for leather transactions to be developed, and the approach has now been modified for use in Brazil (Pistori *et al.*, 2006). While the forms of hide damage and their classification by digital images has been recommended in Thailand (Skunmun *et al.*, 2005), the process requires further work that will be reported in a separate paper.

The system that may be expected to be developed in Thailand can be gleaned from that suggested by Minnoch and Minnoch (1979) for USA based on the grading table, as follows.

**Table 2. Seven types of leather defects.**

| Type of defects | Defect appearance and definition                                                               | Mark or scar of leather defect                                                                                                                                                                                                                 |
|-----------------|------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Thin spots      | Spots like scars with a diameter of $\leq 1$ mm                                                | Hair root, over buffing, pinhole, putrid spot, dermatitis                                                                                                                                                                                      |
| Spots           | Spots like scars with a diameter of $> 1$ mm                                                   | Thorn scratch, nail mark, fish eye effect, chrome stain, salt stain, cure stain, putrefied                                                                                                                                                     |
| Lines           | A line-type scar with a width of $\leq 1$ mm                                                   | Vein, fat fold, crack, healed scratch, wring felt mark                                                                                                                                                                                         |
| Strips          | A line-type scar with a width of $> 1$ mm                                                      | Brush mark, score knife, neck wrinkle, iron mark                                                                                                                                                                                               |
| Holes           | Hole damage                                                                                    | Dig damage, grub hole, bullet mark                                                                                                                                                                                                             |
| Patterns        | Animal breeding mark                                                                           | Brand mark                                                                                                                                                                                                                                     |
| Irregulars      | No regular appearances as in any of the above types or several types of defects mixed together | Wart, foul (contamination, pipe grain, flay mark, putrefied, oil burn), shade variation, water stream mottle, scratch, chafe mark, hook mark, gear mark, not uniform abrasion, parasitic speckled (tick, mange, insufficient salt), dung stain |

*Value-added products made from bovine hides in Thailand may be divided into five groups.*

**Grade I:** It is the prime grade. It is a correct pattern and well cured, free of holes or cuts, slips, warts, broken grain (over 2.5 cm long), deep scores or gouges, although rear shanks can contain one hole below hock that measures less than 2.5 cm. Sellers finding cuts and holes less than 7.5 cm from the edge of the hide can trim them out and deliver the hide as Grade I, provided it does not spoil the pattern of the hide.

**Grade II:** Any hide that is off-pattern, contains a hole or cut, a deep score or gouge (located above a straight line drawn through the break in the hair of the fore and hind flanks), a grain break (over 2.5 cm), and warts (area no larger than 45 cm). A seller should not deliver over 15 percent Grade II with Grade I, unless so specified in the contract.

**Grade III:** Any hide that contains hairslips, five holes and/or deep scores and gouges, one hole or cut 15 cm, insufficient cure, pepper box warts over 45 cm, or any defect

covering one-third or more in area. Sellers should not deliver Grade III hides without consent of the buyer.

**Rejects:** Untannable hides are predominantly rotten hides and should not be delivered to a buyer.

Included in the ‘Trade Practices for Proper Packer Cattlehide Delivery’ issued by Leather Industries of America and the United States Hide, Skin & Leather Association in 1985, such guidelines have improved returns for both suppliers and purchasers. The Republic of China has also initiated a similar process (Yeh and Perng, 2005). The history of such developments in Thailand is checkered, beginning in 1977 when the Ministry of Industry set up a quality standard for cattle hides; this was revised and declared in the Government Gazette (Ministry of Industry, 1984) as shown in Table 3. Since then, additional standards relating to the humped cattle have been promulgated but do appear to be widely known.

## Conclusion

Having reviewed the structure and characteristics of the hide transaction chains in Thailand it is clear that improvements

**Table 3. Classification of quality grading for raw hide in Thailand.<sup>1</sup>**

| Classification | Cuts and/or holes on piece     |                 | Hair             | Excess fat |
|----------------|--------------------------------|-----------------|------------------|------------|
|                | Prime portion                  | Other           |                  |            |
| Grade I        | Not found                      | Not found       | No hairslips     | Less       |
| Grade II       | Allow 2 defects except at butt | Allow 3 defects | No hairslips     | Fair       |
| Grade III      | Allow 2 defects except at butt | Allow 3 defects | Little hairslips | Much       |

1. Source: Ministry of Industry (1984).

in the quality of Thai leather can be made. Research for improvement has been focused on the obvious difference in quality of hides from KPS Beef Breeders' Association and the traditional system, which argues for research suited to Thailand, which will form the basis of other papers. In addition to processing domestically produced cattle and buffalo leather of increasing quality, it is expected that Thailand will remain a processing center for cured hides exported from other countries with continuing rising standard in processing.

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