Sruthy K Mohan
Associate Professor, Department of Veterinary and AH Extension, CVAS Mannuthy, Thrissur, Kerala, India

Reeja George P
Post Graduate Scholar, Department of Veterinary and AH Extension, CVAS Mannuthy, Thrissur, Kerala, India

Swot analysis and strategies to optimise the buffalo rearing system of the *Kole* lands of Trissur district, Kerala

Sruthy K Mohan and Reeja George P

Abstract
The domestic buffalo remains an indispensable asset in the lives of millions of small holder farmers all over the world. Its functions are exemplified on traditional wetlands due to the synergistic relationship between the landscape of such ecosystems and the innate physical and physiological characteristics of the buffalo. Thus, these animals are crucial players on the livelihoods of farmers residing in these areas that are otherwise inhospitable to other domestic livestock species. The *Kole* lands of Trissur district of Kerala state form part of the larger Vembanad-Kol, a Ramsar site from 2002 onwards. Buffalo keeping for meat purposes is a sustainable livelihood option for farmers of this region. Keeping in mind the need to strengthen sustainable livelihoods that are compatible with the peculiarities of the *Kole* land ecosystem, an investigation into the strengths, weaknesses, opportunities and threats- as perceived by meat buffalo keepers- of this system was undertaken so as to arrive at strategies to optimize the system. The physical characteristics of the buffalo and its synergistic blending of its physiological needs with the peculiarities of the landscape of the *Kole* lands were perceived to be the most important strength of this system. Significant weaknesses centred on the lack of policy and legislative measures to ensure quarantine facilities for animals at the border check-posts, the poorly developed slaughter management procedures, abbatoir and meat inspection facilities in the state. Important opportunities of this system included the current market and high seasonal and festal demand for buffalo meat as well as certain features of the paddy based production system that also functioned synergistically with the buffalo units. Potential threats perceived by the keepers included the lack of adequate policy and legislative reform measures that stood in the way of ensuring the ante-mortem examination of buffaloes ready for slaughter and a framework that encompassed the issue of abbatoir closure due to pollution.

Keywords: *Kole* lands, wetlands, meat buffalo keeping, SWOT analysis

Introduction

The domestic water buffalo technically referred to as *Bubalus bubalis* (Abd El-Salam and El-Shibiny, 2011) [1] is an invaluable asset for millions of smallholder farmers all over the world on account of the multitude of functions and products that it provides on smallholder production systems. Buffalo meat and milk are much sought after products in Kerala; more than 97 per cent of Keralites are non-vegetarian. Buffalo meat has been reported to be quite similar to beef in both its nutritional as well as its organoleptic properties though some authors even argue that it is superior to beef (Kandeepan *et al.,* 2009) [5]. The *Kole* lands of Thrissur are important from the agricultural point of view in that this area is one of the important rice granaries of the state. These wetlands in general are part of the unique Vembanad-*Kole* wetland ecosystem that consists of 151250 ha and had been given the status of a Ramsar site in 2002. The information sheet on the Ramsar Site of the Vembanad-*Kole* Wetland System describes this site as the largest brackish, humid tropical wetland ecosystem on the Southwest coast of India. Wetlands are important in that they perform a variety of functions and services that are crucial to human life. Their main function centres on the replenishment and purification of ground water, production of food through the sustenance of livestock and fish and climate change mitigation. In addition to these unique features, this system is also important in containing the flood waters that could arise in such calamites posing significant threats to human life in the densely populated districts of Alappuzha, Ernakulam and Thrissur districts of Kerala. The importance of the water buffalo in this context is on account of its natural qualities that make it highly suitable for the *Kole* farming system. The traditional landscapes of the *Kole* land provide space for expression of the innate behaviour of the buffalo and also play an important role in minimizing thermal stress by ensuring natural wallowing

Corresponding Author:
Sruthy K Mohan
Associate Professor, Department of Veterinary and AH Extension, CVAS Mannuthy, Thrissur, Kerala, India

areas which are important in ensuring thermoregulation which is very important for the bufflalo. De Rose *et al.* (2009) [3] observed that higher milk yields were obtained in systems that provide for free movement of buffaloes. Keeping in mind the necessity to promote sustainable vocations that are conducive to, or that fit into the natural settings of the *Kole* lands, it is of utmost importance that existing systems on the *Kole* lands be explored so that measures to optimize them can be taken. It was against this background that the present study was undertaken to explore the strengths, weaknesses, opportunities and threats of meat buffalo rearing system currently being operated on these lands.

Materials and Methods
An analysis of the strengths, weaknesses, opportunities and threats of the meat buffalo rearing system in the Thrissur *Kole* lands was under taken in three consecutive steps that involved the preliminary analysis of the meat buffalo rearing systems of Thrissur *Kole* lands, the identification of internal and external factors of the systems and designing of strategies for ensuring the sustainability of the systems as per the procedure described by Weihrich, (1982) [9].

The preliminary analysis of the meat buffalo rearing system of the Thrissur *Kole* lands
The meat buffalo rearing system of Thrissur *Kole* lands and the operational components of this system were identified and defined through triangulation and the use of multiple tools of data collection beginning first with focus group discussions with farmers and veterinary surgeons working in the area of study and experts of Kerala Veterinary and Animal Sciences University. A thorough review of available literature on various studies of the buffalo species was also undertaken to provide the structural frame work for these discussions. The buffalo rearing systems were thus identified and simplified in order to capture the important components of the system and the interaction between various components on the system. Various factors contributing to the effective functioning of the system were broadly categorized as internal and external factors.

Identification of internal and external factors
Attributes of the system that lend themselves to the control and manipulative efforts of farmers were conceptualized as the internal factor whereas those that did not, were referred to as external factors. The internal factors were classified into six categories *viz.,* features of animals, product related qualities, qualities of the production system, the marketing system, marketing environment features and policies and legislation. The external factors were classified into four categories which included those related to policies and legislation, social factor features, marketing environment features and production system features.
Strengths, weaknesses, opportunities and threats pertaining to the meat buffalo rearing system of Thrissur *Kole* lands were

identified through focus group discussions as well as personal interviews with buffalo keepers of the region, veterinarians working in the Department of Animal Husbandry, scientists of Kerala Veterinary and Animal Sciences University. The statements generated through the above process were pretested in a non-sample area before being included in the final interview schedule. A total of 20, 19, 10 and 18 statements pertaining to the strengths, weaknesses, opportunities and threats of the meat buffalo rearing system were thus finalized. These statements were then used in the final interview schedule which was administered to 50 meat buffalo keepers of in the *Kole* lands who were selected through snowball sampling. The responses on whether each statement was a strength, weakness, opportunity or strength were scored on a three point continuum *viz;* agree, disagree and undecided after which these were then ranked based on the mean score of each statement such that the statement with highest mean score was ranked first.

Design of strategies for ensuring sustainability of the system
Suitable strategies for ensuring the sustainability of the system were arrived at by preparing the SWOT matrix as per Weihrich (1982) [9]. The matrix acts as an important tool in identifying interactions between internal and external factors. Strategies are designed so as to ensure that opportunities and strengths were exemplified while threats and weaknesses are minimized. Strategies that were arrived at were as follows:
a. Strength-Opportunity strategies that use the advantages of strengths to exploit opportunities.
b. Strength-Threat strategies that manipulate strengths to diminish the chances and effects of threats.
c. Weakness-Opportunity strategies directed at overcoming weaknesses that prevent the pursuit of opportunities and make use of opportunities to overcome weaknesses.
d. Weakness-Threat strategies that bring to light the limitations that emerge from the combination of weaknesses and threats.

Results and discussion
Perceived strengths of meat buffalo rearing system
It was evident from data in Table 1 that the strengths of the meat buffalo rearing system of the Thrissur *Kole* lands were on account of the hardy nature of the buffalo, its disease resistance and immunity and the fact that these animals needed less care when compared to cattle. The unique features of the production system such as the facility for wallowing and grazing of the animals that were synergistic with the requirements of the buffalo in general were also perceived to be important strengths of this system. Further perusal of the data data also brought out the fact that qualities of carabeef were perceived as less important strengths of the system by the respondents, though these may have been important to people who purchased this product.

Table 1: Perceived strengths of meat buffalo rearing system

Sl. No.	Statement	Category	Mean score	Rank
1	Disease resistance and innate immunity of buffaloes	Animal features	3.00	I
2	Less care when compared to cattle	Animal features	3.00	I
3	Wallowing facilities of *Kole* lands	Production system	3.00	I
4	Grazing facilities of *Kole* lands [3]	Production system	3.00	I
5	High nutritional value of grass fed animals	Production system	2.94	II
6	Opportunity for organic animal rearing	Production system	2.94	II

7	Docile nature of the buffalo making handling easier	Animal features	2.88	III
8	high feed conversion ratio	Animal features	2.88	III
9	Tolerance of the buffalo to extreme conditions	Animal features	2.88	III
10	Buffalo rearing is a part of our culture	Social system	2.81	IV
11	No separate shelter required	Animal features	2.75	V
12	No religious taboos for carabeef	Social features	2.75	V
13	Better flavour of carabeef	Product features	2.69	VI
14	High growth rates of buffalo calves	Animal features	2.63	VII
15	Lean nature of carabeef	Product features	2.63	VII
16	Low cholesterol content of carabeef	Product features	2.50	VIII
17	Traditional preference for dark skinned animals due to medicinal property	Social features	2.19	IX
18	High demand for offal meat in bakeries	Product features	2.00	X
19	Slaughter at recommended age	Social features	2.00	X
20	High demand for "head meat" of buffaloes	Product features	1.88	XI

Analysis of various factor categories under the strengths of the meat buffalo rearing system (Table 2) indicated that animal features were the dominant perceived strengths of the system. More specifically, the disease resistant nature of buffaloes coupled with the fact that they needed generally less care were the animal features that were perceived as the strengths of the system. Sreelakshmi (2013) [8] also reported that a SWOT analysis of the Kasargod dwarf cattle rearing system also shed light on the fact that the higher disease resistance of Kasargod cattle was the perceived strength of this breed. Production system features also dominated the strengths of this system and among the various items, the innate features of the *Kole* lands providing for wallowing and grazing of the buffaloes were important strength of this system. This is all the more important considering the fact that the water buffalo is highly sensitive to change in temperature and temperature fluctuations can significantly alter the physiological condition of animals.

Table 2: Factor category matrix of the strengths of meat buffalo rearing system

Factor Category	Item number from Table-1	3	4	5	6				Factor category Mean	Factor category Rank
Production System features	Mean score	3.00	3.00	2.94	2.94				2.97	I
	Within category rank	I	I	II	II					
Factor Category Animal features	Item number from Table-1	1	2	7	8	9	11	14	2.86	II
	Mean score	3.00	3.00	2.88	2.88	2.88	2.75	2.63		
	Within category rank	I	I	II	II	II	III	IV		
Factor Category Social factor features	Item number from Table-1	10	12	17	19				2.44	III
	Mean score	2.81	2.75	2.19	2.00					
	Within category rank	I	II	III	IV					
Factor Category Product features	Item number From Table1	13	15	16	18	20			2.34	IV
	Mean score	2.69	2.63	2.50	2.00	1.88				
	Within category rank	I	II	III	IV	V				

Social features were also important strengths of the system though to a less extent. Among the social features, a traditional preference for black skinned animal products in Ayurveda and lack of any taboos with regard to the consumption of carabeef in the state were important strengths. It was noteworthy to note at this juncture that carabeef is an important food item in the health conscious literate state of Kerala. This may be on account to the fact that carabeef is protein rich but low in cholesterol (Desta, 2012) [4].

Perceived weaknesses of the meat buffalo rearing system
Contrary to the results obtained with respect to the perceived strengths, perceived weaknesses were mainly centred around the lack of quarantine facilities and insufficient staff at the border check posts, besides lack of a proper policy on slaughter in the state.

Table 3: Perceived weaknesses of the meat buffalo rearing system

Sl. No.	Statement	Category	Mean score	Rank
1	Lack of quarantine facilities at border	Policies/legislations	3.00	I
2	Lack of proper slaughtering legislation	Policies/legislations	3.00	I
3	Lack of sufficient staff at border	Policies/legislations	3.00	I
4	Lack of facilities for meat inspection	Policies/legislations	2.94	II
5	Lack of a stable pricing mechanism	Marketing system	2.88	III
6	Quality of meat from animals	Product features	2.69	IV
7	Lack of traceability of meat animals	Marketing system	2.69	IV
8	Lack of modernized abattoirs in state	Policies/legislations	2.69	IV
9	No grazing area in *Kole* lands during cultivation period	Production system	2.56	V
10	Lack of training	Policies/legislations	2.50	VI
11	Amphistomosis due to increased snails	Production system	2.44	VII
12	Lack of facilities for by-product use	Policies/legislations	2.44	VII
13	Lack of good beef breeds in India	Policies/legislations	2.38	VIII
14	No transportation facilities to markets	Marketing system	2.13	IX
15	Lack of live animas marketing facilities	Marketing system	2.00	X
16	Poor grass quality	Production system	1.94	XI

17	Saturated markets at festival times	Marketing system	1.94	XI
18	Fear of consuming meat due to fear of life style diseases	Social features	1.81	XII
19	No cold storage facility in local markets	Marketing system	1.13	XIII

Market saturation due to festival centred marketing by producers and the poor quality of grass on the *Kole* fields were weaknesses that were perceived as less important.

Analysis of data on the factor categories with regard to statements on the perceived weaknesses of the meat buffalo rearing system revealed that they centred on policies and legislation, primarily lack of quarantine facilities, legislation and staff at the border check posts. Product features especially the quality of meat coming from the other states was also a significant weakness which was not surprising considering the fact that quarantine and other screening mechanism at the check posts were also significant weaknesses of this system.

Table 4: Factor category matrix of the weaknesses of meat buffalo rearing system

Factor Category	Item number from Table-3	1	2	3	4	8	10	12	13	Factor Category Mean	Factor category Rank
Policies and Legislation	Mean score	3.00	3.00	3.00	2.94	2.69	2.50	2.44	2.38	2.74	I
	Within category rank	I	I	I	II	III	IV	V	VI		
Factor Category Product features	Item number from Table-3	6								2.69	II
	Mean score	2.69									
	Within category rank	I									
Factor Category Production system features	Item number from Table-3	9	11	16						2.31	II
	Mean score	2.56	2.44	1.94							
	Within category rank	I	II	III							
Factor Category Marketing system features	Item number from Table-3	5	7	14	15	17	19			2.13	IV
	Mean score	2.88	2.69	2.13	2.00	1.94	1.13				
	Within category rank	I	II	III	IV	V	VI				
Factor Category Social features	Item number from Table-3	18								1.81	V
	Mean score	1.81									
	Within category rank	I									

Poor marketing facilities in terms of poor transportation facilities and facility for marketing of animals were weaknesses of less significance. Mutibvu *et al.* (2012) [6] also observed that market chains for livestock and livestock products were rather weak. However, it is important to develop livestock market as these markets provide enabling and transforming environments that help small scale farmers develop into commercial producers (Coetzee *et al.*, 2005) [2].

Perceived opportunities of meat buffalo rearing system

Perusal of data in Table 5 reveals that high price of male buffaloes during Muslim festivals was an important opportunity of the meat buffalo rearing system. The establishment of farmer level small scale slaughter houses as well as various schemes of NABARD and legislations to standardise the age of slaughter were perceived as being the least important opportunities of this system.

Table 5: Perceived opportunities of meat buffalo rearing system

Sl. No.	Statement	Category	Mean score	Rank
1	High price of male buffaloes during Muslim festivals	Market for current product	3.00	I
2	Above 90 per cent of Keralites are non vegetarian	Market for current product	3.00	I
3	Paddy cultivation in *Kole* lands provide crop residues	Production system features	3.00	I
4	Establishment of government slaughter house in every block will reduce the influence of intermediaries	Policies and legislations	2.75	II
5	E- commerce and the opportunity for direct marketing	Market for current product	2.63	III
6	Decentralized slaughter waste management facility	Policies and legislations	2.63	III
7	Good demand for hide in leather industry	Market for current product	2.50	IV
8	Set up small scale rural slaughter house for farmers	Policies and legislations	2.13	V
9	New schemes (NABARD) for meat buffalo rearing	Policies and legislations	1.81	VI
10	Policies for standardization of slaughter age	Policies and legislations	1.75	VII

Table 6: Factor category matrix of the opportunities of meat buffalo rearing system

Factor Category	Item number from Table-5	3					Factor Category Mean	Factor category Rank
Production system features	Mean score	3.00					3.00	I
	Within category rank	I						
Factor Category Market for current product	Item number from Table-5	1	2	5	7		2.78	II
	Mean score	3.00	3.00	2.63	2.50			
	Within category rank	I	I	II	III			
Factor Category Policies and legislation	Item number from Table-5	4	6	8	9	10	2.21	III
	Mean score	2.75	2.63	2.13	1.81	1.75		
	Within category rank	I	II	III	IV	V		

Perceived opportunities of the meat buffalo rearing system stressed upon the market for current products more specifically the high price for male buffalo especially during Muslim festivals. Musemwa *et al.* (2008) [7] also observed that cattle are also kept for special socio-cultural functions such as weddings, funerals and special occasions. Further, the fact that over 90 per cent of Keralites are non-vegetarians also contributed to the dominance of market for current products among the various factor categories in the perceived opportunities of this system.

Perceived threats of meat buffalo rearing system

Table 7: Perceived threats of meat buffalo rearing system of the Thrissur *Kole* lands

Sl. No.	Statement	Category	Mean scores	Rank
1	Slaughtering of diseased animals	Policies/ legislations	3.00	I
2	Cold slaughtering of animals	Policies/ legislations	3.00	I
3	Closing abattoirs due to pollution problems	Policies/ legislations	3.00	I
4	Substitution of carabeef with beef	Policies/ legislations	2.88	II
5	Mix inspected and non-inspected meat	Policies/ legislations	2.88	II
6	Disposal of plastic/solid waste in *Kole* lands	Social features	2.88	II
7	Misuse of *Kole* lands for waste disposal	Social features	2.88	II
8	Difficulty in detecting adulteration of carabeef in meat market	Policies/ legislations	2.81	III
9	Dumping of meat effluent in *Kole* lands	Social features	2.81	III
10	Disposal of bio-waste in *Kole* lands by septic tank cleaners	Social features	2.75	IV
11	Increased drought due to climate change	Production system	2.75	IV
12	Influence of intermediaries in meat market	Market environment features	2.75	IV
13	Slaughtering of animals in illegal slaughter	Policies/ legislations	2.63	V
14	Lack of lairage for anti-mortem examination	Policies/ legislations	2.63	V
15	Eutrophication in *Kole* lands	Social features	2.56	VI
16	Habitations of hawkers along the bunds	Social features	2.50	VII
17	Antibiotic residues in meat	Policies/ legislations	2.38	VIII
18	Chance of theft male buffalo calves	Social features	2.06	I

Perceived threats of the meat buffalo rearing system included slaughter of diseased animals and dead animals, and closing of abattoirs due to pollution problems. Lack of policies and legislations associated with regard to the substitution of carabeef with beef in meat markets and mixing of inspected and non-inspected meat were threats that were perceived to be less important. Various forms of contamination of the *Kole* lands with animal, human and other waste were social issues that were reported as fairly important threats to the system. Factor category matrix analysis (Table 8) revealed that among the various categories, policies and legislations was perceived as the major threat to the system. This was followed by production system features within which the increased chances of draught in the *Kole* lands due to climatic changes and consequent effect on animals was a significant threat.

Table 8: Factor category matrix of the threats of meat buffalo rearing system

Factor Category	Item number from Table-	1	2	3	4	5	8	13	14	17	Factor category Mean	Factor category Rank
Policies and legislation	Mean score	3.00	3.00	3.00	2.88	2.88	2.81	2.63	2.63	2.38	2.80	I
	Within category rank	I	I	I	II	II	III	IV	IV	V		
Factor Category Production system features	Item number from Table-	11									2.75	II
	Mean score	2.75										
	Within category rank	I										
Factor Category Marketing environment	Item number from Table-	12									2.75	II
	Mean score	2.75										
	Within category rank	I										
Factor Category Socialfeatures	Item number from Table-	6	7	9	10	15	16	18			2.63	III
	Mean score	2.88	2.88	2.81	2.75	2.56	2.50	2.06				
	Within category rank	I	I	II	III	IV	V	VI				

Quantified SWOT matrix for factor categories of the meat buffalo rearing system to arrive at relevant strategies to optimise the meat buffalo rearing system

Table 9: Relevant strategies for meat buffalo rearing system

Sl. No.	Strategy	Mean score	Rank
1	Strengths - Threats	2.70	I
2	Strengths - Opportunities	2.66	II
3	Weaknesses - Opportunities	2.57	III
4	Weaknesses - Threats	2.54	IV

Analysis of the strategies from the quantified SWOT matrix indicated that specific strategies emphasizing both the strengths of the production system with opportunities offered by both the production system and markets could prove decisive for this system. Further, stress on the opportunities provided by the production system and minimizing weaknesses inherent in the policy and exploring opportunities in the market for the products could prove beneficial for the system. It would also be beneficial to exploit the strengths of the production system by addressing threats in the policy area through effective implementation of regulation. Minimizing inherent weaknesses in policy is of at-most importance in thwarting the potential threats posed by poor implementation /lack of effective policies in this sector.

References

1. Abd El-Salam MH, El-Shibiny S. A comprehensive review on the composition and properties of buffalo milk. Dairy Sci. Technol 2011;91:663-699.
2. Coetzee L, Montshwe BD, Jooste A. The marketing of livestock on communal lands in the eastern cape province: constraints, challenges and implications for the extension services. S. Afr. J Agric. Ext 2005;34(1):81-103.
3. De Rosa G, Grasso F, Pacelli C, Napolitano F, Winckler C. The welfare of dairy buffalo. Italian J Anim. Sci 2009;8(1):103-116.

4. Desta TT. Introduction of domestic buffalo (*Bubalus bubalis*) into Ethiopia would be feasible. Renewable Agric. Food Syst 2012;27:305-313.

5. Kandeepan G, Biswas S, Rajkumar RS. Buffalo as a potential food animal: Review. Int. J Livestock Prod 2009;1:001-005.

6. Mutibvu T, Maburutse BE, Mbiriri DT, Kashangura MT. Constraints and opportunities for increased livestock production in communal areas: A case study of Simbe, Zimbabwe. Livestock Res. Rural Dev. [online] 2012;24(9). Available: http://www.lrrd.org/lrrd24/9/muti24165.htm. [2 Sept. 2017].

7. Musemwa L, Mushunje A, Chimonyo M, Mapiye C, Muchenje V. Nguni cattle marketing constraints and opportunities in the communal areas of South Africa: review. Afr. J Agric. Res 2008;3(4):239-245.

8. Sreelakshmi CM. Attitude towards conservation and adoption of practices among the keepers Pookode, of Kasargod cattle. M.V. Sc thesis, Kerala Veterinary and Animal Sciences University 2013, 216.

9. Weihrich H. The TPWS Matrix: A tool for situational analysis. Long Range Planning 1982;15:54-66.