Chapter

Smallholder Goat Production in Southern Africa: A Review

Gracinda Andre Mataveia, Carina Visser and Alcides Sitoe

Abstract

Goats play a crucial role in improved livelihoods and food security in Africa. Indigenous and locally developed types exhibit a wide range of phenotypic diversity, but are commonly well adapted to the harsh environment in which they need to survive and produce. They have various functions in communities in developing countries, from providing food security to being a liquid form of cash and playing a role in ceremonial occasions. The Southern African goat population exceeds 35 million animals, most of which are kept in small-scale traditional production systems in communal areas. These traditional production systems are characterised by informal, lowly-skilled labour, small numbers of animals and limited resources. Most goats are part of mixed crop-livestock systems, where different livestock species and crop farming compliment one another. The productivity and offtake from these animals are relatively low. Some goats form part of agropastoral production systems, with marginally higher management and resource inputs. Both of these systems are dependent on a high degree of variability where the keepers/farmers can exploit various resources as and when necessary. Goats possess a range of adaptive mechanisms that enable them to deal with harsh and challenging environments, making them the ideal species for use in these production systems. This chapter aims to provide background information on the current smallholder management practices of goat keepers in Southern Africa.

Keywords: Communal, smallholder, Extensive, Indigenous Goats, Reproduction

1. Introduction

In Africa, goats are deeply entrenched in almost every African culture [1], particularly within communities that are not able to keep large livestock. Goats offer advantages in animal production as they have a relatively high productivity in harsh environments, use inexpensive feed resources, have a short reproductive cycle and have higher prolificacy when compared to cows [1, 2].

The global goat population has seen a sharp increase over the past decade, and the worlwide population is currently estimated at more than 1 billion animals [3]. Approximately 96% of these animals are meat goats and are found in developing countries in Asia and Africa [4]. Following the global trend, the African goat population has also increased over the last five years to represent 41% of the world's population, and currently approaches 423 million goats. Approximately 35 million of these goats are part of the Southern African population.

Goats have been an important part of humanity since their domestication 10 000 years ago and they have since spread across the globe [5, 6]. Their roles and

relative importance are not static but vary according to the agro-ecological zone, production system and socio-cultural context in which they are found [7]. Goats are one of the most important livestock species in developing countries [8, 9]. Their importance hinges on the fact that they provide meat, hides, fibre, and can be milked for home consumption [1, 10, 11]. Goats are also used for socio-economic purposes, such as festive, religious and ceremonial occasions [7, 12, 13]. They play an important economic role, providing cash-flow and being an accessible source of credit in order to meet immediate social and financial obligations [9]. Goats are therefore often described as the "village bank" [9, 14].

Goats and sheep are the preferred livestock species in dry areas due to their ability to convert poor quality pasture into good quality protein for human consumption [15]. Additionally, because of their small size, goats allow the slaughter and consumption of the entire carcass by a family in few days, without the risk of deterioration due to the absence of conserving/cooling facilities in villages of developing countries [1, 16, 17].

Goats have the potential to decrease poverty in Africa due to the role they play in food security. Through the exchange of goats for agricultural labor, they could potentially increase food security for many people in rural areas where crop production is their main activity and source of food [18]. Goat meat can significantly contribute to food security in terms of preserved (dried) protein, as their meat is of high nutritional value, with superior lean characteristics [19]. Furthermore, food security can be increased through exploiting synergies between crops and livestock, using manure and conversion of crop by-products by livestock [20–22]. Livestock plays an important role in the production of staple foods, such as cereals. They provide fertiliser (via manure) and contribute to land preparation by means of draught power. Additionally, they can be sold to generate cash necessary to buy resources for farming practices [20]. Therefore, livestock can contribute to an increase in both the area of land cultivated, as well as the productivity and efficiency with which crops are produced, resulting in the sustainability of farming systems [20]. It is estimated that worldwide livestock manure supplies up to 23% of gross nitrogen input in mixed crop–livestock systems and approximately 12% for cropping in developing countries [23]. Despite these well-known arguments, the real contribution of goats at household level has not been quantified, as most valuation systems depend on monetary standards which only take the financial contribution into account, and frequently neglect the non-monetary contribution of goats. Thus the real contribution of goats to improved livelihoods due to increased food security, especially for poor-resource communities, is unknown [13].

This chapter aims to review smallholder goat production in Southern Africa. A literature review was performed to discuss the importance of the main indigenous goat breeds and the production systems in which they are kept, as well as the constraints faced by goat farmers.

2. Methodology

This review aims to provide background information on the current smallholder management practices of goat keepers in Southern Africa. For this, relevant information from scientific works (literature reviews, original articles, scientific reports, proceedings, and systematic reviews) related to the topic of interest and related keywords (e.g., "smallholder", "communal", "goats", "reproduction", and "extensive") were searched. The review provides a systematic and comprehensive analysis of the findings, strengths, and limitations of the compiled studies.

3. The role of goats in southern Africa

3.1 Importance of indigenous goats

Goats play a vital role in the cultural, social and economic life of rural communities. Indigenous goat breeds contribute significantly to both food security and to improved livelihoods for various resource-poor communities, especially those in rural and hard-to-reach areas [11, 24, 25]. Althought the information on the real contribution of goats to human food security and livelihoods is scarce [26], their role and relative importance varies noticeably across regions and cultural groups. The role of goats is socioeconomic well-being of people in terms of nutrition, income, savings, insurance against emergencies, cultural and ceremonial purposes [7]. Goats are used to help family members, conduct ceremonies and rituals, make linkages with ancestors, pay bride wealth (*lobolo*), and gain social status. Furthermore, goats play a complementary role to other livestock in the utilisation of available feed resources and provide one of the practical means of using vast areas of natural grassland in regions where crop production is impractical [7, 18]. Goats are multipurpose animals which have been bred for milk, skin, hair, and meat. They can provide meat and milk for human consumption and are one of the easiest and most readily accessible sources of income available to meet immediate social and financial needs of village farmers [5, 9, 18, 27]. Goats are also valued for their productivity, adaptation capacity and disease resistance [28].

A survey by Mataveia *et al.* [29] in Mozambique revealed that goats and cattle are used as investments and status symbols. Additionally, they play a pivotal role in traditional ceremonies [8] and generate income among communal households through sales of goats and their products. Improvement in goat production and commercialization have a positive impact on the whole value chain, including processors and marketers [28, 30–33].

3.2 Southern African goat populations and their distribution

According to FAOSTAT [34], during the last decade there was an increase in goat production globally and currently there are more than 1 billion goats, with Africa contributing 36.2%, Asia 58.2%, Americas 3.5%, Europe 1.7% and Oceania 0.4%. In Southern Africa, goats are the second most important livestock species after cattle [13]. Approximately 96% of the world's goat population is kept in developing countries, of which 64% are found in rural arid (38%) and semi-arid (26%) agro-ecological zones [13]. The top-ten countries producing goat meat are all from Asia and Africa; indicating the importance of goat meat to people in resource-poor areas [5]. In Africa, goat meat production has increased from 1.1 million tons in 2008 to 1.3 million tons in 2017 [4]; of which the majority is produced and consumed locally (within households) [5, 35].

The Southern African goat population currently consists of approximately 38 million goats [36]. There are various goat breeds in Southern Africa, of which the Mashona, Matabele, Tswana, Nguni, Landim [13] and Pafuri [29] are the dominant ones. The goat populations in Southern Africa vary between countries: these variations in goats population are summarised in **Table 1**. Tanzania has the highest number with 18.9 million goats while Botswana has the smallest goat population (1.4 m) in Southern Africa [34].

FAO [37] reported that there is approximately 576 goat breeds currently distributed across the world, with 17% of these in Africa. Although goats are found in all types of ecological zones, they are mainly concentrated in tropical, dry zones. As a result of natural selection, goats exhibit a wide range of physiological diversity

which results in an ability to adapt to different environments [35]. The main breeds of indigenous goats breed in Southern Africa are shown in **Table 2** (**Figure 1**).

Country	Population (in millions)
Angola	4.7
Botswana	1.4
Malawi	8.9
Mozambique	3.7
Namibia	1.9
South Africa	5.2
Eswatini	2.4
Tanzania	18.9
Zambia	2.9
Zimbabwe	4.7

Table 1.
Number of goats in southern African countries from [34].

Country	Breed	Sources
Angola	Angola dwarf	[38]
Botswana	Tswana	[38–41]
Malawi	Malawi goats	[38, 42, 43]
Mozambique	Pafuri, Tete, Cabo Delgado and Landim	[12, 38, 41, 42]
Namibia	Capriviti, Ovambo	[44]
South Africa	Boer*, Kalahari Red*, Savanna*, Nguni, Tswana, Venda, xhosa, Swazi Zulu and Tankwa	[32, 38, 45–47]
Eswatini	Nguni and Swazi	[13, 38, 45]
Tanzania	Maasai, Gogo, Small East African, Sukuma, Sonjo, Pare, Kunene and Kavango	[48, 49]
Zambia	Tswanaand Matabele	[38]
Zimbabwe	Matabele, Binga, Chipinge, Matopo, Tswane, Shurugwi and Tsholotsho	[13, 38, 41, 50]

**The Boer, Kalahari Red and Savanna are commercial meat-type goat breeds that were locally developed.*

Table 2.
Main indigenous goat breeds found in southern Africa.

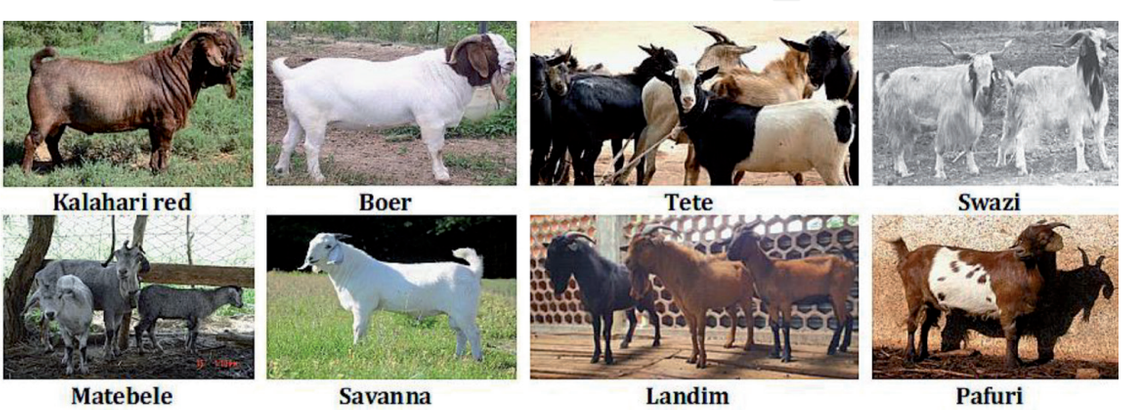

Figure 1.
Some of the indigenous goat breeds found in southern Africa region [51–56].

Breed	Birth		Kid mortality (%)	Body Weight (Kg)							
				Months							
				3		5–6		12		Mature	
	Male	Female		Male	Female	Male	Female	Male	Female	Male	Female
Boer [10, 59, 60]	4.0	3.5	40.6	30–33	22.3	40–50	No	92.0	No	120–140	70–90
Landim [10, 60–62]	2.5	2.3	37.0	9.6	8.2	14.3	12.3	22.0	21.6	50.0	35.40
Swazi [63]	2.0	1.8	30.0	No	No	8.0	No	14.5	No	35.2	30.0
Matabele [8, 13, 64]	2.5	2.5	30.0	No	No	11.3	10.2	18.4	17.5	50–55	39.0
Malawi [13, 43]	2.0	1.8	16.7	9.0	8.9	25.0	No	No	No	29.0	21.0
Pafuri [13, 56]	3.0	2.4	No	8,0	No	10.1	No	16.7	No	60.0	43.0
Tswana [13, 65–67]	4.3	3.6	33.3	13.4	11.4	17.8	16.2	25.39	24.14	44.0	40.0
Kalahari red [68, 69]	2.7	2.0	19.7	9.8	8.3	15.6	12.8	No	No	115	75.0
Savanna [68, 70]	No	No	17.5	30	25	No	No	No	No	No	60.0

Table 3.
Main production parameters of some indigenous goats in southern Africa under communal conditions.

Breed	Age at first kidding (months)	Kidding interval (d)
Boer [59, 76, 77]	15–18.0	234–238
Landim [13, 78, 79]	15–20.0	243–394
Pafuri [78]	15.6	—
Matabele [13, 80, 81]	14–23.0	240
Malawi [13, 82]	15.6–16	330–365
Swazi [63]	11.5	248
Tswana [65]	10.0	365

Table 4.
Doe fertility of indigenous goats in southern Africa under communal conditions.

Table 3 shows the production parameters of some indigenous goats in Southern Africa under communal conditions. Because of their small physical size and superior adaptation traits, indigenous breeds are still preferred in the harsh environments of Southern Africa [10]. According to Sebei et al. [57], the major constraints to goat production are the high mortality rates among kids and slow growth among those that survive. The high disease and parasite challenge and low levels of nutrition contribute to the commonly observed poor growth performance resulting in lower production and reproduction performance [58].

The reproductive performance (age at first kidding and kidding interval) of some indigenous goats in Southern Africa are shown in **Table 4**. Gracinda et al. [62] suggested that supplementing goats with highly nutritive alternative feed sources has a positive effect on physiological functions. Supplementation with lupin grain [71] and soybean meal or corn grain [72], can improve reproduction efficiency by reducing the age at puberty and increasing ovulation rates. Energy deficiency decreases kid growth, and has an adverse effect on reproduction [73, 74]. There is a need to supplement the goats utilising the selected species with energy, protein, and phosphorus to meet the nutrient requirement for maintenance and reproduction [75].

4. Goat production systems

In Southern Africa, small ruminant production systems are classified as traditional (communal) or commercial (intensive) production systems. Most local and indigenous goats are kept in small-scale production systems in communal and resource-poor areas [75]. These systems depend on the exploitation of resources in dry-land areas, and a balance between the livestock's requirements and the environment'al resources [83]. Kaufmann et al. [83], also classifies this system as a "social-ecologogical system".

The traditional production system is characterised by informal labour (mostly from a family member), commonly with low livestock numbers per unit area and minimal use of technology and other inputs [84, 85]. The system is often hindered by land and water shortages, infections and predators [29]. The smallholders generally do not have the skills or resources available for animal recording and there is uncontrolled breeding, often resulting in inbreeding. The traditional production system is further divided into two main production systems, namely the mixed crop-livestock system and the pastoral production system [1, 86, 87].

4.1 Mixed crop-livestock system

The mixed crop-livestock system is used in most member states of the Southern African Development Communities Countries (SADC), including Mozambique [13]. This system is characterised by raising a small number of goats together with other livestock, such as cattle, pigs and poultry. Livestock and crop cultivation are maintained as complementary ventures; e.g. animals provide manure that will be available for fertilising the soil for crop production while livestock in return benefit by feeding on crop residues during the time of feed shortages [87, 88]. This system is characterised by low managerial and financial inputs [89]. It is an extensive farming system, with free-ranging, herding and tethering as the main management systems. This system is used by almost all pastoralists in Africa, where goats are frequently kept in mixed flocks with sheep. Children commonly herd goats, while the day-to-day management and care of young stock usually fall to women [1]. Under this system, animals graze communal land and animal herds owned by different families or individuals move from one area to another for grazing and water [87, 90, 91]. The goats graze over large areas of unwanted or marginal lands which are usually ill-suited for agricultural use [87, 92, 93].

In this system, low-skilled labour (often family members and children) are used as the primary goat handlers. They usually herd goats, sheep and cattle (as well as camels) together to graze wayside or waste vegetation. Management is limited to letting the goats out to graze during the day and confining them at night in enclosures, which are constructed using thorn bushes or wooden poles to protect them from theft and predation [92, 93]. There is no controlled breeding and no supplementary feeding or veterinary care for the animals, except for the extension services provided through government institutions [13]. Due to a shortage of water and forage, malnutrition is the primary limiting factor for profitable production of small ruminants, particularly during the dry season [13]. Goat productivity and offtake rates from these systems are typically low. Shortages in nutrients and exposure to diseases, parasites, as well as challenging climatic conditions with frequent and prolonged droughts are responsible for slow growth, which leads to low productivity [94, 95].

4.2 Semi-intensive or agropastoral production system

The semi-intensive or agropastoral production system is typically encountered in urban and peri-urban areas [88]. In this system, the goats usually graze two to four hours daily and then return to their paddocks. Usually, the farmers returning with the flock at night supply tree leaves and/or grass to feed them until the following morning, when they can graze again [93].

Tethering is a widespread practice of small ruminant management by smallholders in Southern African countries such as Mozambique [29], Zambia [13] and South Africa [59]. This system is used to protect animals from theft and to prevent them from destroying crops and also allows farmers to conduct other activities [13]. Goats are often tethered in the morning and herded in the afternoon when children have returned from school. In this management system, water is provided when the goats are moved to shelter at night and supplementation is limited (i.e. salt or mineral bricks), or absent. The only supplements, (which are provided infrequently) are household scraps, small quantities of grains or their by-products [62].

Both these traditional systems make use of a high degree of variability – in terms of composition and nutritional value of forage, quantity and quality of the water supply, accessibility of supplements, veterinary care and any other resources. The variability is almost seen as an advantage and is used to keep production costs low by strategically selecting available resources at specific time points.

5. Adaptive mechanisms of goats

Approximately 70% of Southern African goats are kept under traditional management systems where the farm structure comprises of about twenty goats [33]. The resultant goat productivity is relatively low due to minimal inputs, poor infrastructure, undefined marketing channels and multiple breeding objectives [29, 96]. Goats are popular and most preferred by smallholder due to their ability to deal with a range of climatic condition including disease challenges, inadequate feed resources and low management [3, 97]. Devendra [98], pointed out the important criteria in Southern African region for the selection of the suitable type of animal to be grown. In the criteria were included the environments (semi-arid and tropical), limited feed resources, differences in energy requirement and digestive efficiency among ruminants.

5.1 The physiological adaptation of goats to harsh environments

Goats are resistant to heat stress, droughts, food and water scarcity as well as diseases; they can maintain production and reproduction performance under harsh environmental conditions. This is in part due to their smaller body size which enables efficient utilisation of low-quality forage and their tolerance to water scarcity and ability to retain superior thermoregulation [38, 99, 100]. Climate change is expected to increase the frequency, intensity and length of droughts with a negative impact on rural areas, especially in sub-Saharan Africa where the human population is mostly dependent on rain for crop and livestock production [101]. However, indigenous goats have developed mechanisms, which allow them to adapt to high environmental temperatures and to achieve thermo-tolerance in extremely challenging environments [38, 102]. These mechanisms include physical, physiological and biochemical changes, such as a reduced feed intake and metabolic heat production [99, 103].

There is ample evidence that livestock and indigenous breeds that evolved in stressful tropical environments have a range of unique adaptive traits that enable them to survive and be productive and reproductive [102, 104, 105]. These goats feed primarily from browsing fodder, as potential sources of affordable feed for ruminants in developing countries. This is especially true during dry seasons, due to the ability of the available foliage to remain green and maintain its protein content, making these fodder potential sources of energy and protein to the goats [39].

5.2 Adaptation to heat stress and drought conditions

Heat stress is an element that negatively affects livestock production and reproduction performance [99]. However, goats are considered less susceptible to heat stress than cattle because of their small metabolic size and their capacity to conserve water [106, 107]. Indigenous breeds of small ruminants in arid zones, such as the black Bedouin goats and Barmer goats herded in the deserts of Sinai (Middle East) and Rajasthan (India), can survive without drinking water for several days, often only drinking water once every four days [107, 108]. Desert goats have been reported to have a superior ability to withstand dehydration, and are considered among the most efficient ruminants in this regard [109]. The biological mechanisms that enables desert goats to cope with droughts depend on their ability to withstand dehydration and to minimise water losses via urine and faeces [99, 108].

Most indigenous goat breeds are physically small which help them to regulate water loss and heat gain in scorching environments [103, 110]. Their colour adaptation of the integumentary system also helps them to reflect heat [103]. Various morphological traits, such as body size and shape [108], coat and skin colour, hair

type, and fat storage aid goats in their superior adaptation to harsh environments [103, 106, 111]. Typically, dark-coated animals have higher heat loads than light-coloured ones [112] and the light-coloured coat is deemed superior in tropical regions [113]. Additionally, skin pigmentation provides protection for deep tissues against solar short-wave radiation in tropical regions [114].

Reducing feed intake is another way to decrease heat stress in warm environments as the heat increment due to feeding, especially in ruminants, is a significant source of heat production [115, 116]. Goats are one of the ruminant browsers that suffer least during droughts [117]. This is due to their ability to survive on a diet constituted normally of browsing, which is least affected by the drought [102]. If the drought persists, the carrying capacity of the veld will inevitably fall but it will still be able to support goats longer than other herbivores, such as sheep and cattle, due to the goats' capacity to reduce their metabolism and to maintain this low metabolic requirement [38, 102]. The ability of goats to survive prolonged periods of water deprivation also allows them to graze far from watering sites and to exploit available pastures optimally.

5.3 Adaptation to feed scarcity

The adaptation of goats during periods of feed shortage can be via the following processes: low metabolic requirements, their capability to decrease their metabolism, increased digestive efficiency, an ability to utilise high-fibre feed and the deposition of nutrients in the form of fat as feed reserve [102].

Goats have low metabolic requirements during a period of shortage of natural pasture [38]. They can adjust to a low energy intake by reducing their energy metabolism [108, 118] and are thus able to maintain their body weight in times when food is scarce. A low metabolic requirement is an advantage if the quantity and quality of vegetation are inadequate. The improved temperate breeds are more productive than indigenous tropical breeds if ample high-quality feed is available; however, they lose weight and have increased mortalities when the environment becomes challenging and they must graze on poor quality veld. Under the same circumstances, adapted indigenous animals still grow and other physiological processes continue, such as reproduction and milk yield [102]. The adapted tropical animals recycle nutrients more efficiently than improved temperate breeds and their metabolism is reduced when the animal is losing weight [107].

The ability to reduce their metabolism permits goats to survive even after prolonged periods of severely restricted food availability [38, 102]. Their selective browsing behaviour [108] and an efficient digestive system allow the goats to maximise food intake and scarce nutrients [118]. Adejoro and Hassen [119] showed that the intake and digestibility of low quality foods could be increased by adding urea to that diet. Therefore, there is a favourable association between the improved reutilising rate of urea and better digestion of such food in desert goats.

Silanikove [108] reported the digestive efficiency of indigenous goats and their ability to utilise high-fibre feed. Goats have superior digestive efficiency compared to sheep and cattle when using high-fibre low-quality forages because of the longer mean retention time in the rumen [98, 120]. They can also eat more tannin-rich material and can thus utilise plant species that cannot be consumed by sheep [100, 108]. Goat breeds that are indigenous to semi-arid and arid areas can utilise low-quality high-fibre feed more efficiently than their exotic equivalents and also outperform indigenous sheep and cattle breeds [121]. For instance, indigenous desert black Bedouin goats outperformed Swiss Saanen goats in terms of digestive efficiency when fed on roughage diets in both controlled environments [121] and under natural conditions in a harsh environment [122].

Ruminants accumulate energy in adipose tissues when the quality and quantity of feed is sufficient, and mobilise it to meet energy requirements during periods of shortage [123, 124]. In a tropical environment, the rainy seasons alternate with dry seasons. The capacity to accumulate fat during the rainy seasons for its subsequent use for maintenance and biological functions (like pregnancy and lactation) in the dry season is an essential strategy for survival [124]. The typical vegetation of grass and shrub during the dry and rainy in Southern Africa are shown in **Figures 2** and **3**, respectively.

Figure 2.
A typical vegetation of grass and shrub during the dry season.

Figure 3.
A typical vegetation of grass and shrub during the rainy season.

Figure 4.
A herd of veld goats during dry season.

In Southern Africa, the veld quantity and quality are highly variable and represent the main limitation of livestock production [125]. In addition, the grassland is affected by seasonality, where the dry seasons are generally long and characterised with low quantity and quality veld [74]. A herd of veld goats are shown in **Figure 4**.

6. Conclusion

Most indigenous and locally developed goats in Southern Africa are kept in small-scale production system in communal areas. The goat keepers exploit the severe variability of these systems (in terms of nutrition, water availability, environmental factors and livestock resources) to make strategic choices to keep production costs as low as possible.

Due to their ability to adapt to harsh environmental conditions and different foods, goats can maintain sufficient levels of production and reproduction performance in adverse climates. Goat keepers need to strike a careful balance between human-animal-environment interactions to ensure that goats maintain their essential contribution to the livelihoods of limited-resource populations in developing countries.

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Conflict of interest

The authors declare no conflict of interest.

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