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Sustainability through Vegetable Goat Skin Tanning in Mwenezi District in Zimbabwe: Opportunities and Challenges

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Abstract: The study analyzed the opportunities, challenges and mitigation strategies that can be harnessed for sustainable goat skin tanning into leather and subsequent manufacture of Textile substrates in a bid to achieve the proposed sustainable development goal SDG 12 “Responsible Consumption and Production”. It has been observed that hundreds of goats are slaughtered in Zimbabwe every year mainly to provide meat for family subsistence, rituals, and commercial food and the skins remain unutilized as waste products polluting the environment. The largest number is slaughtered in the December Christmas festive season every year. Tapping these resources into good use and training folks of Zimbabwe in vegetable tanning skills and manufacture of textile substrates from the leather product, creates employment alleviating poverty and at the same time achieving the UN sustainable development goal SDG 12 “Responsible Consumption and Production”. The study therefore aims at updating local authorities, government, NGOs, technical training institutions and citizens in Zimbabwe of the gap so that they proffer initiatives and implement strategies for sustainable vegetable tanning of the goat skins into leather a valuable product in the Textile fraternity. The qualitative study unearths the opportunities, challenges, and recommendations for strategies to adopt and promote sustainable vegetable goat skin tanning activities in a selected district in Zimbabwe.

Keywords: Tanning, Vegetable tanning, SDG12, leather, Textile substrate, Sustainable Development.

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INTRODUCTION

Mwenezi is a south eastern lowveld segment of Masvingo jurisdiction, sharing confines with Chivi, Chiredzi, Beitbridge, and Mberengwa neighborhoods. Nurturing of goats for meat production in the region is swelling in popularity since the livelihood agribusiness scheme is backed and sponsored by non-governmental organizations (NGOs) and is monitored by Mwenezi Rural Development Training Centre (MRDTC). Livestock farming is one of the main sources of livelihood for the poor in the tropics and has significant economic importance in most countries in the tropics, including Zimbabwe (Peanda *et al.*, 2020). It is also worth noting that the climatic state of affairs stands considerably contributing to the farming system. Livestock farming is a more appropriate agricultural activity in Mwenezi District and favours breeds that are adapted to the environment (Peanda *et al.*, 2020). Africare’s reason to introduce the small livestock pass on scheme was based on the agro-ecological features of Mwenezi District, particularly climate and topography, human population density and cultural norms (Mudavanhu, 2015), and Mwenezi District is in region 5, and the area is generally hot and dry, the mean annual temperature is 25 degrees Celsius, October temperatures exceed 35 degrees and rainfall is well below 600 mm per

annum. Mudavanhu (2015) further tell us that, these conditions are good for small livestock like goats and chicken, which were chosen by Africare for their pass on scheme. Africare and Plan International establishments donates exceptional breeds of boar goats and put into effect a pass on system in an effort to warrant that no one in the region is left behind in the proposition to aggravate scarceness of food resources and advance the standard of living of all people in the drought wracked District of the country. Subsequently, when these goats are slaughtered in enormous magnitudes for meat, by-products in the interest of skins are not lucratively and diligently exploited in its domicile as they are left for regular, natural cleaning at slaughter points which occasionally nature fails to handle, thereby littering and contaminating the environment. Ramalingam (2016) argue that, nonetheless, if the concentration of waste products increases, nature’s mechanisms become overburdened and pollution problems start to occur. As a consequence of the increasing emphasis on large scale production, considerably greater amounts of waste will be produced (Ramalingam, 2016), and steps will have to be taken to keep this production at acceptable levels. This scholarship thus suggest and advocate vegetable tanning as a key to accomplish and abate to acceptable levels the predominance of effluence, contamination and littering of the surrounding environment by remaining waste goat

skins. Tanning is the practice of treating to transfigure raw animal skins/hides into a much steady, serviceable and pliable textile material-leather. Goat skin treating can be an opportunity to ease poverty in the drought prone Mwenezi District at the same time curtailing overdependence on food handouts from the regime and charity organizations.

Goat hides are one of the most lucrative principal by-products of the livestock propagated in Mwenezi District. In the region, value-added potential of these goat hides is still untapped for pecuniary gains. The district is losing a substantial source of impending earnings by abandoning the goat hides decomposing, littering and contaminating the surrounding environment. Inhabitants can harness this potential by vegetable tanning the goat skins into lucrative leather, and eventually making completed Textile substrates from the leather and issue the merchandises into the native, regional and universal market hereafter, enjoying their new, innovative segment of the market. Ingestion of leather merchandises into making shoes, belts, wallets, handbags, jackets, travelling requisites and a myriad of other kinds of textile leather articles has a very large claim at local, national, international and global markets.

Goat skin tanning is not diligently sustained in Mwenezi District irrespective of the availability in lavishness of vegetable tannins and goats in the zone, which are tolerable to provide for raw ingredients to provender the sector. There is no remarkable substantiation of goat skin tanning in the District. Vegetable tanned goat skins can be yoked by crafters in the neighborhood to fabricate quality Textile merchandises like belts, bags, jackets, wallets among others. These Textile products can be patronized locally or disseminated at the same time illuminating the canons of living of folks in the locality, since they are a cherished source of proceeds. The study was therefore assumed to sightsee openings, breaks and alleviation strategies that can be oppressed to jump start the vegetable tanning of goat skins into leather for ultimately engineering of Textile substrates in the District.

LITERATURE REVIEW: VEGETABLE TANNING AN OVERVIEW

Vegetable tanning is a process of converting raw skin into a stable, pliable, lucrative and valuable leather material and it involves uses of tannins of a plant origin. Bhavya (2019), argues, vegetable tanning involves usage of tannins extracted from various parts of a plant. Tannins can therefore be extracted from the bark, leaves, roots or flowers of appropriate plants. Effectiveness of vegetable tanning is largely hinged on the percentage of tannins present in the plant extract. The amount of tannins in a plant extracted can be measured successfully either by Folins Denis method, Mass

spectrophotometer, UV detection, Reverse-phase, High pressure liquid chromatography (HPLC), nuclear magnetic resonance and Circular dichroism methods, (Bhavya, 2019; & Reed, 2013). Two stages are involved during the vegetable tanning process notably fixing and penetration. Penetration involves diffusion of tannins into the skin whereas fixing makes the penetrated tannins bind with collagen forming stable material (Bhavya, 2019). Vegetable tanning is influenced by a myriad of factors to include pH, particle size, temperature and mechanical actions. Penetration and fixing of tannins is most significantly enhanced by the pH (Reed, 2013; & Bhavya, 2019). The reduction of pH in tanning liquor increases the potential of collagen fibres to swell and increasing the tendency of tannins to bind with collagen, (Reed, 2013). Temperature is also paramount in the tanning process since its increase causes high transmission of tannins in the goat. Acid and salt content in tannin liquor greatly influences the physical condition of leather (Reed, 2013). Control of pH, temperature, and mechanical actions enhance an ecofriendly manufacture of stable, flexible, lucrative and valuable leather as it releases fewer pollutants that can harm the environment. Hence the current study is an eco-friendly approach which reduces the toxic waste generation when compared to chrome tanning process and thereby reducing environmental impacts by contributing towards greener or cleaner development of leather processing.(Bhavya, 2019).

Materials and Method for Vegetable Goat Skin Tanning

The raw goat skin is initially soaked in water in large clay earth pots for a reasonable length of time to scour and unstiffen it. This management procedure emancipates the raw goat skin from obtainable salts, blood, soil and all non-leather making elements among other contaminations. Conversely, there is no sanctioned interval time the goat skin is drenched in water henceforth, its acclaimed that soaking be completed for a sensible length of time to satisfactorily free the raw goat skin of the attached impurities reliably depending on the amount, nature of dirty and stains on it. Yapiei *et al.* (2008), avers that, the soaking time depends on the condition of the skin. The time taken to satisfactorily soak the skin is largely dependent on its thickness. In light of this view, a study by Wemegah (2014) revealed that the pelts were soaked in this solution for about 4 to 12 hours, depending on their thickness. In support of undertaking this procedure first, (Bhavya, 2019) affirmed that, the main purpose of soaking is to remove salt, rehydrate the dry skin and also to remove unwanted materials like blood, soil, dung etc. The purpose of this operation is to increase the amount of water in the hide close to that of the living hide, remove foreign bodies and loosen the skin structure (Wemegah, 2014), and this loosening makes it easier for the tanning agents, fats, dyestuffs and other substances, to penetrate into the skin. Soaking is thus a critical stage, hence cannot be spared during the tanning process due to its critical role in

enhancing the skin's affinity, love and absorption of the vegetable tannins. When soaking is completed, the soaking water is not disposed of either; it's well-kept for later use in during fleshing.

After soaking, the goat skin is limed as the second management practice. The motive behind liming is to free the raw goat skin from outstanding impurities, needless constituents and hair. Liming escalates the pH which is vital at this stage of treatment for epidermis loosening, removal of proteins from the goat skin. It also loosen the hair making it easy to tug off, and eventually trimming of extra and remaining flesh from the skinning process. Wemegah (2010) explicated that the process aids in loosening the hair follicles, which enables the easy removal of the hair from the skins. The liming process, also removes remaining fat making up the skin more desirable and suitable for tanning. Liming procedure therefore further improves the goat skin's affinity, love and absorption of tannins during the leather making process. Dehairing and fleshing is also done to remove extra flesh and allow tannins to penetrate easily, (Bhavya, 2019) and it also loosens the epidermis and also removes soluble skin proteins. Unhairing follows immediately after liming. This procedure involves scrapping and tugging off the hairs from the goat skin. The process is achieved through use of simple blunt scrapping knives. After removing the skins from the liming solution, they are wrung and stretched on asbestos or concrete pipes, (Wemegah, 2020), and the scraping knife will then be used vigorously to remove the hair from the grain side of the pelt.

The remaining and adhering flesh and fat are further removed from the skin by the process of fleshing, which follows immediately after unhairing. This is done by dipping the unhaired goat skins into clay-earth pots with a solution of soaking water, pounded pawpaw leaves and fowl droppings. The mixture is known as 'kadi', (Wemegah, 2020), and the readiness of the goods is judged by its ability to rise to the surface of the mixture. When all the above stages have been satisfied, tanning can be satisfactorily carried out, as the nerve and key function to transform goat skins into a stable and valuable textile substrate-leather. In this step tannins are allowed to interact with the prepared skin which act on collagen and make it stable, (Bhavya, 2019). During this stage, skins are immersed firstly, for about two hours in a weak tannin solution and later immersed in a stronger solution for a maximum of 12 hours. Time taken largely depends on strength of tannin solution as well as the thickness of the goat skin being tanned. Crusting involving drying, softening, and oiling stages comes in after tanning stage. The tanned leather is partially drip dried on a hanging line. Drying and stretching is done to avoid stiffening. The artisans regularly turned and reposition the leathers and sometimes stretching them individually to prevent them from stiffening, warping and over exposure to the sun (Wegmer, 2020). Later, the leather is oiled using groundnut oil. The oiling is done by

dipping a piece of cloth in a bowl of oil and uniformly spreading it on the grain surface of the leather (Wegmer, 2020). Lastly, an aesthetic finish, colour is introduced to the tanned leather through dyeing. After satisfactorily dyeing, leather, is ready for use, sale and subsequent manufacture of Textile substrates.

Opportunities brought by Vegetable Tanned Goat Skin

Vegetable tanning of goat skins possess numerous opportunities to the environment and products eventually made from the leather. Vegetable-tanned leather is natural, supple, durable, and environmentally friendly and when coupled with good design and artisanship makes it a sought-after commodity, (Munyai, 2014). The following is a review of some of the properties of vegetable tanned leather. Vegetable tanning is environmentally friendly; meaning any leather products that have been vegetable tanned can be recycled, (Cpoe, 2021). Vegetable tanning is the most suitable ecofriendly process which results in release of fewer pollutants to the environment (Jianzhong, 2009 in Bhavya 2019). Vegetable tannins have special properties such as the ability to precipitate alkaloids and proteins (Farrukh, 2005) and the process is less environmentally hazardous compared to mineral-based tannins such as chromium and aluminum (Gujrathi & Babu, 2007; Mahdi, Palmina & Covington, 2009; & Munyai, 2013). Of note, vegetable tanning reduces pollution problems associated with tanning industry which include treatment of sewage, disposal of old leather and access waste (Sreeram & Ramasami, 2003; & Koloka & Moreki, 2011). It is also worth noting that, the process uses organic material and the waste generated from the process is less harmful to the environment (Gombault & Begeer, 2013). Munyai (2014), adds that, the vegetable tanning agents use renewable resources when managed properly. Some of the plants also produce dyeing agents, which are free from heavy metals.

In some societies vegetable tanning was executed since time immemorial and the craftsmanship was informally and smoothly transmitted over generations enhancing skill perfection. Cope (2021) concur that, vegetable tanning is an age old tradition, so most tanneries have very skilled craftsmen producing and dyeing the leather. Due to the natural tannins used, vegetable tanned products are unique and have their own life, they are not the same for their entire life, but they change, continuously, for the better, (Cope, 2021). Vegetable-tanned leather goods change their appearance over time to look even better, (Munyai, 2014) and the leather becomes older without being ruined and the ageing process does not compromise its resistance which gives it a vintage look.

The process produces rich and warm colours, (Munyai, 2014) and the colors that vegetable tanning produces are rich and warm tones that look completely natural, (Cope, 2021).

Textile substrates made from vegetable tanned goat skin provide much needed comfort to consumers since they are breathable, allowing air and moisture to pass through. Munyai (2014), concur that vegetable tanned leather is breathable, visco-elastic and has good pore size distribution and these properties have not been matched and this make vegetable-tanned leather a unique material. Moreso, leather goods made out of vegetable-tanned leather can be recycled at the end of their life, (Munyai, 2014). Vegetable tanned leathers are more valuable and thus sold at a higher average price compared to chrome tanned leathers, (Cope, 2021). Vegetable-tanned leather goods are more valuable and therefore sold at a higher price, (Munyai, 2014). The benefits outlined in this section, clearly indicate that, if fully harnessed and implemented in Mwenezi district, vegetable tanning of goat skins has the potential to transform the lives of the district folks.

Barriers Faced in Sustainable Goat Skin Tanning

A myriad of factors do affect the sustainable implementation of vegetable goat skin tanning in the district. Challenges such as lack training in vegetable tanning and making of textile substrates/artifacts from the produced leather can be a major challenge impeding the uptake of the innovation by potential artisans in the district. According to Koloka & Moreki (2011), training can be achieved through workshops and field courses aimed at improving the quality of hides and skins, value addition and product development and after attending these courses, artisan tanners are able to produce better quality artifacts which are sold locally and internationally. For potential artisan designers to courageously engage diligently in the practice vegetable goat skin tanning in the district, they should be supported with basic training in the skill execution, vegetable tannins, materials needed, and even the subsequent production of textile artifacts and substrates. Engaging in vegetable goat skin tanning and selling leather and its products to both local and international markets, will in turn reduce pollution by skins at the same time increasing disposable income, thus improving the standard of living and eradicate poverty in furtherance of SDG N0 12 (Responsible Production and Production) and Zimbabwe's vision 2030.

Defects such as holes, cuts and bruises on goat skins resulting from manual hand slaying/slaughtering mostly done on rocky surfaces can also be a challenge affecting the quality of leather and artifacts produced. Hand slaughtering is the common practice in Mwenezi district and it causes cuts and holes on the goat skin adversely impacting on its quality and market. Tools used are usually rudimentary and of inferior qualities causing damage to hides and skins during slaying and slaughtering, (Amde, 2017), and cuts and holes reduce the value of a hide or skin. Machine slaying/slaughtering is henceforth recommended to reduce the prevalence of cuts and holes on the goat skins and this call for support

in the provision of such technological innovative resources. Sustainable vegetable goat skin tanning Mwenezi district can also be affected by a high prevalence of defects on skins due to livestock diseases and bruises occurring as animals scratch themselves for comfort. In favour of this challenge, Kassa (1998) in Amde (2017), avers that, a considerable proportion of pre-slaughter defects that accounts for 65% are directly related to skin diseases and caused by the ectoparasites; as to the secondary damage that occurs when the animal scratches itself to relief itching. Sarcoptic mange and goat pox can also adversely impact on vegetable tanning. Sarcoptic mange have a wide geographic distribution in many goat and sheep rearing in arid and semi-arid areas of Ethiopia, (Amde, 2017), Sheep and goat pox is a viral disease of sheep and goats which is highly contagious, (Amde, 2017), and healing of skin affected by pox is slow and permanent scars can be left. Skin defects of this nature affects the quality of leather produced causing little economic gains and revenue for the artisan. Extensive vaccination of the goats can therefore minimize to acceptable levels the prevalence of the diseases and resulting skin defects.

Conceptual Model

The study explores the opportunities, challenges and intervention strategies for sustainable vegetable tanning of goat skins by Mwenezi district folks. This study resonates with the design thinking toolkit model. Tischimmel (2012) expatiates that, design was always a catalyst for innovation processes in product and service development. Design thinking is a human-centered approach to innovation that draws from the designer's toolkit to integrate the needs of people, the possibilities of technology, and the requirements for business success (Vendraminelli *et al.*, 2022). Design thinking can transform the way organizations develop products, services, processes, and strategy (Magistretti *et al.*, 2022). Today, Design Thinking is understood as a way of thinking which leads to transformation, evolution and innovation, to new forms of living and to new ways of managing business (Tischimmel, 2012). The design thinking methodology conveys together what is wanted from a social opinion of view with what is technically achievable and economically feasible. In case of the current study, it allows the District folks to use creative tools and vegetable extracts to treat goat skins into valuable leather. Subsequently, they can manufacture textiles substrates for trade as individuals or teams, which are a lucrative business home and far wide, which can sustainably transform the lives of the people at the same time attaining the United Nations SDG.12 'Responsible Consumption and Production'. Thus, the Design thinking model sanctions collaboration were craftsman in the area have the opportunity to work as teams in the business of tanning goat skins into leather and also the subsequent manufacture of textile substrates from the processed skins. (Tischimmel, 2012), reaffirms the involvement and participation of impoverished

communities in the whole design process, from identifying the problems and challenges, to idea generation, prototyping and evaluating the design outcomes.

METHODOLOGY

The qualitative research design and a descriptive case study were adopted by the researchers in this undertaking. A questionnaire, semi-structured interviews and focus group discussions (FGD) were used to solicit and gather data from the participants. A non-participant observation approach was also used in this study to validate the questionnaire, interview and focus group results. The study also used secondary data that the researchers collected from journals. The population comprised management and the training department of a selected Training institution in the district, and selected potential goat skin tanners in the district. Purposive sampling was used to select 40 potential tanners across the district, 1 administrator and 3 trainers from the selected training institution. Data on the opportunities and challenges hindering the kick start of sustainable goat skin tanning in Mwenezi district were amassed and presented verbatim. Pseudonym codes were used for protecting the identity of participants'. The article is therefore based on the following research questions:

- How can vegetable goat skin tanning improve the lives of the District folks?
- What barriers impede District folks from carrying out vegetable goat skin tanning activities?

FINDINGS

The study explored the opportunities, challenges and possible intervention strategies for sustainable vegetable tanning by Mwenezi District potential artisans. Going through results, open ended questionnaire, interviews, and focus group discussions data was categorized into thematic components derived from the research questions that pursued to answer the research problem. The study therefore transcribed the following themes: Opportunities that can be brought by vegetable tanning of goat skins in the region, barriers deterring potential artisans from engaging in vegetable tanning activities, and possible ways that can be abetted to captivate in vegetable tanning of goat skins, thereby, enhancing the attainment of sustainable development goal (SDG) No.12 'Responsible Consumption and Production'. At the same time, this warrants smooth implementation of the Design Thinking model consenting artisans to labor as either individuals or teams in tanning goat skins by vegetable tannins and ultimately fabricate textile substrates/artifacts from it for pecuniary gains. There is a great need for the district to tap into its unexploited potential to redefine the role of state, which is fostering domestic investment and local demand, promoting regional markets, and deepening structural reforms to assist in increasing domestic resource mobilization to improve business climate (FES, 2011; & Lopez, 2013)

Opportunities Brought by Vegetable Tanning of Goat Skins in the District

Results of the study divulge that a splendid proportion of the participants coincide with the opinion that, it was of pecuniary economic gains to tan goat skins by procedure of vegetable tannins and subsequently manufacture textile artifacts from it, though potential artisans were not captivated it on board. Most participants alluded to the subsequent when they answered to the questionnaire, interview and FDG:

As a resident of Mwenezi District, I have the joy and keen interest to engage in vegetable tanning of goat skins as the craftsmanship has the benefits of occupying me, creating employment for me, making me self-reliant, increasing my disposable income, and eventually raising my standard of living. (Potential artisan A)

Engaging in goat skin tanning is quite thrilling awesome as it sometimes require us to work as teams during treatment stage, making of products from finished leather and eventually marketing of products. Such collaborative opportunities enrich our craftsmanship, interactive skills, and also development of the concept of 'unhu'/'ubuntu' is most us. (Potential artisan B)

A greater percentage of participants further raised their concern and interest in vegetable tanning of goats skins as they divulge in their questionnaire, interview and FGD responses that:

Vegetable tanning of goat skins is a cost effective innovative idea due to the extensive availability of resources in the district. Tannins are readily available as extracts from plant species occurring and thriving in the region's natural ecosystem. Skins from the special breeds of goats reared in the district and slaughtered solely for meat are also readily available and unexploited. Tools as resources required for vegetable tanning are simple and cheap to acquire in the district, for example clay-earth tanning pots (Hari) can be cheaply secured from local producers. Vegetable tanning industry therefore can also provide for a valuable market in the pottery sector in the District. (Potential artisan C)

Participants' further reiterates that vegetable tanning of goat skins has among others the following opportunity:

As compared to other methods of tanning, vegetable tanning is less effluent hence referred to as green and eco-friendly to the environment. Vegetable tanning process if harnessed fully will instead check on extremely high pollution rates caused by rotting goat skins left at slaughter points. (Potential artisan D)

Generally, participants showed that sustainable vegetable goat skin tanning has a myriad of opportunities hence they displayed keen willingness to engage in the trade if they are equipped with the requisite skills, knowledge and expertise to execute the task.

Barriers hindering Potential artisans from venturing in vegetable goat skin tanning

The bulky of the participants revealed that lack of skills training, lack of resources, competition from developed nations and poor quality goods, skins are the setbacks deterring them from engaging in this lucrative business. The following were the responses from potential artisans:

Despite the numerous opportunities brought by vegetable tanning of goat skins into valuable leather, most if not all of us in the District can't venture into the innovative idea smoothly since we lack the valuable expertise to execute the task. We did not receive either informal training from our elders or formal training from institutions of learning on how the process is executed. No training programs on vegetable tanning of goat skins and manufacture of artifacts are offered in the District institutions of learning. (Potential artisan E)

Vegetable tanning of goat skins needs tannins extracted from plants as resources, however most of the potential artisans lacks knowledge on the suitable plants, methods of extraction and subsequent preservation of the tannins. Moreso, prospective artisans lacks knowledge on the tools used for tanning and their respective uses. Lack of this crucial knowledge is one of the major factors impeding us from engaging in tanning activities in Mwenezi District. (Potential artisan F)

Staff at a local training centre agrees with the prospective tanners that sustainable implementation of vegetable goat skin tanning activities in the District is derailed by a number of obstacles. Responding to the interviews, questionnaire and FGD administered, some of them had this to say:

Even if prospective artisans are equipped with technical vegetable goat skin tanning skills through training, and they venture in the business innovation, they cannot survive in the business due competition from developed nations. This is so since we have an influx of cheap leather and Textile leather products from developed nations like China and Dubai among others in the District and country over. (Staff 1) One of the prevailing problems today is the quality of the goat skins which adversely impacts on the quality of the leather eventually produced. Most goats in the district are affected by skin diseases that affect the quality of the leather produced. As such, poor quality leather

trade less both at local and international market. (Staff 2)

An administrator at a local training institution has this to say:

Classes at the institution are highly threatened by viability issues. He adds that, even if training is to be instituted in vegetable tanning and related crafts, classes will have 2 or 3 trainees. This low uptake affects the viability of classes. (Administrator)

The administrator also highlighted the following during the interview session:

Sustainability in the development of the vegetable goat skin tanning sector in the District is also hindered by lack of proper policies being ushered in by the powers that be. (Administrator)

Another participant laments that:

Tanned goat leather and subsequent manufactured textile substrates of the district can suffer stiff competition by global markets and denial by prospective consumers as goats are frequently infected by mange and lice that down grade the skin quality. (Staff 3)

The above responses reveals that, despite the opportunities that can be brought by vegetable goat skin tanning, prospective artisans are not ready to take the initiative on board due to impediments ranging from lack of skills, lack of resources, competition from developed nations, and goat skin diseases among others.

DISCUSSION

The study findings clearly reveal that the potential of vegetable goat skin tanning is not exploited for economic gains and transformation of the lives of the citizens' in Mwenezi District despite the availability in abundance of inputs to feed the system. The researchers observed that no vegetable goat skin tanning activities are being conducted throughout the District, a serious draw back towards the attainment of the United Nations Sustainable Development Goal (SDG, 12), 'Responsible Consumption and Production' and fulfillment of the employment creation mantra of the regime government. It was largely revealed that, lack of knowledge and skills training impacted on the uptake of the business activity by people of the District. Participants reveals that, knowledge and skills training is quite essential for equipping prospective artisans with methods of extracting the tannins from suitable plants as well as sustainable ways of preserving them. Notwithstanding that, skills and knowledge are vital in understanding the technology tools needed for sustainable vegetable tanning and their proper integration in the process. A study by (Abadi, 2000) , on current problems of the leather industry in Ethiopia, concur with findings of the current study that, lack of skills, technology,

intermediate inputs and processing equipment are problems and constraints for development, of the leather industry. Results of the study shows that no training programs have been conducted in the District so far to empower prospective artisans with the skills and knowledge to extract tannins apply technology and execute the task.

Even if people are keen and willing to embark on vegetable tanning in the District, the study realized that they will also suffer stiff competition from established tanning companies from the developed societies. The influx of cheap quality leather and leather textile substrates in the District and country over from China among others will affect the local tanning sector. These societies provided the goods at reasonably low prices since they mass produced at low cost due to advances in technology and skills training. Abadi (2000), in his study, identified stiff competition among the exiting tanners as one of the major problem faced by emerging tanners in Ethiopia.

Qualities of the goat skin were also identified by the study as another major constraint in the development of the leather sector in the district. The results of the study reveal that goats in the district are poorly managed for example; they are affected by ticks, lice and mange which eventually affect the quality of the skin. Paenda et al (2020) suggests that, livestock production support systems should prioritize the provision of vaccines and diseases control, especially in susceptible areas. Poor quality goat skins calls for higher costs in processing and production of low quality leather that will sell at low prizes adversely affecting the producer's competitiveness at both local and global market. To substantiate the findings of the current study, Abadi (2000) concur that, poor quality materials are expensive to process and result in a high percentage of low grade products including rejects leading to serious losses in earnings.

Class viability was also identified as a major constraint impeding training of prospective artisans in the district training institutions. One of the administrators at a local training center highlighted that, when they introduced tanning programs at the institution, it had only three takers. Cost of training such a low class becomes high as a result; they abandoned the curricula program to date.

Despite, all the challenges revealed by the study, harnessing properly, and vegetable tanning of goat skins into leather and production of substrates can be a game changer relevant for transforming the livelihood of the people of Mwenezi district. The sector comes with opportunities such as employment creation, increasing the family disposable income, collaboration activities with local and international players promoting exchange of ideas, practices and values, promoting and increasing the sales of local pottery sector, reducing pollution and

eventually attainment of the UN SDG12 'Responsible Consumption and Production' among others. To enjoy fully these benefits, Abadi (2000), alluded that, an immediate solution should be sought for by all concerned parties of the leather industry.

CONCLUSIONS

The study conclusively showed that vegetable tanning of goat skins is not a common practice in Mwenezi District in Zimbabwe. Based on the findings of the study, the following barriers impede on the sustainable introduction of the industrial sector in the region:

- A significantly larger percentage of the potential tanners' populace is not trained to carry out the activities. Thus, they lack relevant skills to embrace the tools, resources to carry out the process.
- Most if not all the potential tanners in the District lacks knowledge of plant species that provides adequately the effective tannins, method of extracting the tannins from plants and also the ways of using and preserving the tannins.
- The influx of cheaper leather and Textile leather substrates from developed communities like China in the District and country at large affects sales of locally produced leather and its products.
- Poor management and upkeep of goats' breeds in the District affects the quality of the skin, leather and leather products manufactured. This impact on sales of the goods and its subsequent viability. Abadi (2000) avers that, hides and skins are downgraded as a result of various ante-mortem and post-mortem factors, including poor animal husbandry, disease and parasites, bad slaughtering and flaying techniques, and bad practices in curing, collection, transportation, storage and general handling.
- Training of potential tanners is less feasible due to low takers.
- Engagement in the business sector is not prominent in the district due lack of sound policies from the powers that be.

Faced with these challenges, potential tanners of the district are not at liberty to engage in the lucrative business sector of vegetable tanning of goat skins despite the following revealed opportunities:

- Employment creation and all its benefits.
- Collaboration with local and international teams and its benefits.
- Increasing sales of the local pottery industry with provides for clay tanning pots.
- Check on pollution rates as they will sustainably utilize the raw goat skins traditional thrown away and left at slaughter points to rotting and for natural cleansing.
- Attainment of the UN SDG12 'Responsible Consumption and Production'.

Recommendations

To exploit the potential idle revenue that can be realized by vegetable tanning in Mwenezi District, the researchers made the following recommendations:

- The government and charity organizations should proffer and sponsor training activities for the district folks in the tanning sector. Curriculum planners should lobby for the inclusion tanning as a subject and a cross cutting theme in other learning areas across all levels of education in the district and country. This will provide the needed skills for carrying out the tanning process as well as knowledge of the technological tools and tannins to be used in the sector.
- To curb the influx of cheaper leather and its Textile substrates from developed countries, and promote local produce, the government should impose stiff penalties on smugglers and also impose high traffic duties on such imported products.
- To ensure viability of tanning training programs in the district, the government should provide grants and loans to the trainees. Subsidizing the training cost will attract more trainees in classes.
- Quality of goat skins have to be improved through training farmers on good farming practices. The government is therefore mandated to provide animal husbandry extension service work to carry out the routine training activities in this regard. Regular vaccination and dipping of goats should be ensured to guarantee production quality goats' meat and skins.
- The powers that be are recommended to craft and enforce policies that promote small medium enterprises (SMEs) like vegetable tanning of goat skins.

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