Final Report

Product Sustainability Framework: A Qualitative Scenario Based Analysis to Assess the Feasibility of Replacing the Bovine Leather Palm in Cricket Batting Gloves with a Plant Based Vegan Leather

Dr Lilian Sanchez Moreno & Professor Martin Charter

The Centre for Sustainable Design ®,

Business School for the Creative Industries, UCA

July 2023

Funding provided for the Vegan Leather Cricket Gear project was provided by UKRI via University for the Creative Arts, AHRC Impact Acceleration Account (IAA).

1. Introduction

A comparative assessment using the Product Sustainability Framework (PSF)[1] was completed for a pair of cricket batting pads using bovine leather and a plant based vegan leather (PBVL). More specifically, the study focused on materials used for the palms of the gloves i.e. leather. As such, the study compared a pair of traditional batting gloves using bovine leather (case A) against a pair using a PBVL (case B) - Piñatex leather.[2] The scope of the study included consideration of the manufacturing processes for the overall product e.g. glove assembly as well the bovine leather and Piñatex's supply chain. The supply chain for other materials and components such as the high-density foam (HDF) and polyurethane leather (PU) used for the back of the glove, the thumb protection and Velcro wrist straps, were excluded from the analysis presented in this report. Piñatex leather was selected as this is one of the alternative leathers evaluated under the Vegan Leather Cricket Gear (VLCG) project and is one of the few physical samples that were obtained for the research.[3] Furthermore, a review of leather alternatives for cricket gear, conducted under the VLCG project, indicates that commercially available plant based vegan leathers are primarily used for fashion and clothing rather than for technical applications such as sporting gear.[4] [5] Therefore, this study aims to compare a mature product to a product in early-stage R&D. The PSF is a methodology (see Annex I) that has been developed by an internationally recognised LCA expert, Louis Brimacombe (LB), which aims to provide guidance for assessing product sustainability. It is pertinent to highlight here that the PSF methodology is in early-stage development and is not publicly available. The PSF was used as an alternative to the Life Cycle Sustainability Assessment (LCSA) currently being developed by Orienting[6] project which has experienced delays in its methodology and software development. Moreover, to date, no prior LCA's or Social LCA's have been identified for batting gloves. Therefore, the findings presented in this report, act as a first attempt to assess the sustainability impact of a pair of cricket batting gloves. The PSF covers the social, economic, and environmental aspects of the performance, provenance, and legacy of product:

- Product performance: the product/product's functionality contribute to society and the well-being of society and individuals.
- Provenance in the supply chain: production and component history of the product including, for example, sourcing and employment across the supply chain.
- Legacy of the product: the longer-term impacts arising across the product life cycle including, for example, the results from LCA studies and consideration of product circularity aspects e.g., durability, end-of-life, etc

The PSF aims to provide guidance on the assessment of product sustainability, identify improvement options and stimulate product life cycle thinking. The approach considers the

[1] The PSF forms part of the British Standards Institute's SCP/1 Product Sustainability Framework Working Group
[2] https://www.ananas-anam.com
[3] Challenged associated with procuring PBVL samples and a full report on PBVL testing is available at: https://cfsd.org.uk/wp-content/uploads/2023/04/Final-Vegan-leather-alternatives-22-4-23.pdf
[4] https://cfsd.org.uk/wp-content/uploads/2023/04/Final-Vegan-leather-alternatives-22-4-23.pdf
[5] Based on a non-exhaustive desk research, one sports gear equipment using a plant-based vegan leather has been identified. This is, a boxing glove made from cactus leather. See: https://www.greenmatters.com/p/cactus-leather-boxing-gloves
[6] https://orienting.eu

aspects or attributes of a product that add positive social value (improves quality of life/benefit to society) and which may have negative impacts or trade-offs in different categories or at different stages of the product life cycle.

2. Process

The process begins by defining the product to be studied. This is followed by outlining the product's overall technical and functional requirements, and/or specific component requirements, such as the batting gloves palm. In discussion with (LB), the cricket batting glove's "product performance", "provenance in the supply chain" and "legacy of the product", which are standard areas within the PSF, were discussed. In turn, this resulted in identifying various sub-topics. From a "product performance" perspective, subtopics identified included: user comfort, breathability, absorption, affordability, and cost. From a "provenance in the supply chain" perspective, sub-topics included: employee rights, supply chain, human rights, education, training records, and animal welfare among others. Lastly, topics identified from a "legacy" perspective included: durability, recyclability, carbon footprint and water footprint. These sub-topics were individually evaluated in terms of their importance to the user (e.g. player) and wider sustainability considerations. The level of importance was qualitatively assessed based on expert knowledge and prior background research conducted for the product and individual materials (bovine leather and Piñatex). The column next to 'importance' indicates how well the current and proposed materials used for the palm of cricket batting pads comply with each sub-topic. This is followed by a 'confidence' score for each case (A and B) which evaluates data reliability. In this context, data confidence is based on, for example, the provision of manufacturing technical data sheets, user feedback and quantitative studies such as LCA's, amongst other sources. If the level of confidence is low, this in turn suggests that further research is needed to produce quantitative data.

3. Analysis

3.1 Product Performance

Table 1 indicates that the main product performance considerations for a pair of batting gloves are: protection, user comfort, grip, weight, breathability and sweat absorption, with the least important being appearance. Within this context, material substitution on the palm is unlikely to affect protection. Therefore, the level of protection provided by the gloves is assumed to be the same for gloves using bovine leather and gloves using Piñatex. Likewise, the product's appearance using Piñatex is expected to remain similar to the bovine leather gloves. However, due to the Piñatex's material composition[7], it is anticipated that breathability, sweat absorption, and grip characteristics will be significantly reduced. Therefore, this could potentially be considered as a deal breaker for the application of this material to replace the use of bovine leather on the palms of cricket batting gloves. Lastly, it is important to highlight that due to the evaluation being a scenario-based study, the findings

[7] Further details on the material composition of Piñatex can be found in the final report on leather alternatives for cricket gear. Available at: https://cfsd.org.uk/wp-content/uploads/2023/04/Final-Vegan-leather-alternatives-22-4-23.pdf

presented in this report are primarily based on qualitative data and should therefore be treated as indicative rather than definitive.

Table 1: Product performance analysis

Performance				**Case A: Bovine leather**		**Case B: Vegan leather (Piñatex)**	
What does the product/functionality contribute to society and the well-being of society and individuals? Social value to the user		**Topic**	**Importance**	**Score** **10=good** **1=poor**	**Confidence:** This is related to existing/available documentation to support score **10= high** **1=low**	**Score** **10=good** **1=poor**	**Confidence** **10= high** **1=low**
	1	Comfort/user	10	9	8	8	Unknown
	2	Functionality (e.g., grip, weight)	10	9/10	9	7	Unknown
	3	Breathability/sweat absorption	10	7	7	5	Unknown
	4	Safety/protection of hands	9	9	8	9	Unknown
	5	Convenience/straps	9	8	8	8	Unknown
	6	Product brand/appearance	7	8/9	9	8/9	Unknown
	7	Affordability/cost	9	7/8	8	6/7	Unknown

3.2 Product Provenance in the Supply Chain

Table 2 indicates that the main considerations for provenance[8] in the supply chain for a pair of cricket batting gloves are employer rights, worker conditions, and human rights across the supply chain. In this context, the Piñatex alternative leather appeared to perform better in relation to employer rights, worker conditions and human rights consideration. The main reason for this is that Ananas Anam[9], the company that produces Piñatex, provides public access to data pertaining to its manufacturing process and supply chain. Conversely, accessing data related to the manufacturing process and supply chain for traditional cricket gear, including the origin of the bovine leather used in cricket gear, has been a challenge not only for implementing the PSF methodology, but throughout the overall VLCG project. As such, based on the lack of supply chain data for traditional cricket gear using bovine leather, Case A has been assigned a low score for provenance in the supply chain.

[8] Provenance in this context refers to origins in production and component history including for example, supply chain.

[9] https://www.ananas-anam.com/about-us/

Table 2: Product provenance in the supply chain evaluation

Provenance in the supply chain:				Case A: Bovine leather		Case B: Vegan leather	
Production and component history including, for example, responsible sourcing/employment across the supply chain.		**Topic**	**Importance**	**Score** **10=good** **1=poor**	**Confidence** **10= high** **1=low**	**Score** **10=good** **1=poor**	**Confidence** **10= high** **1=low**
	1	Employee rights (fair wages)	8	5 (Unknown)	5 (U-Unknown)	8	8
	2	ESG report	5	6 (Unknown)	6 (U)	Unknown	9
	3	Supply chain	8	6 (Unknown)	6 (U)	8	9
	4	Human rights	8 (DB-Deal breaker)	6 (Unknown)	6 (U)	8	9
	5	Education/training records	4	6 (Unknown)	6 (U)	8	8
	6	Animal welfare	6	6 (Unknown)	6 (U)	10	10
	7	Accreditation Responsible sourcing	7	Unknown	6 (U)	10	8

3.3 Product Legacy

Table 3 highlights the main considerations for the cricket batting gloves' legacy: durability, carbon footprint and water footprint.[10] Based on expert judgment and materials testing within the VLCG project and the Circular Cricket Gear project[11], gloves using bovine leather were assigned a higher durability score compared to Piñatex. Aligned to this, a player survey conducted as part of the CCG project, indicated that based on 42 respondents, 38% of players kept their existing gear produced from bovine leather for more than 8 seasons, followed by 36% keeping it for 2-3 seasons, which indicates that traditional gear appears to be highly durable.[12] Furthermore, the same survey indicated that in relation to reliability and durability, user perception of plant based vegan leathers (PBVL) remains low. Early testing conducted by the University of Cambridge on alternative leathers for cricket gear concluded that in its current state, the PBVL (Piñatex) proposed for this study is not suitable for replacing bovine leather in gloves: hence the low score assigned for durability (see Table 3). Nonetheless, regarding the carbon and water footprints, the gloves using the proposed PBVL scored significantly higher compared to traditional gloves utilising bovine leather, as the proposed PBVL is made from a by-product from the pineapple industry which requires less water and chemical usage for processing, compared to the bovine leather industry. Lastly, neither of the materials (existing bovine leather and proposed Piñatex leather) presented in this analysis are assumed to be from recycled at end-of-life thus receiving an equally low score for this category.

[10] Consideration for the cricket batting glove's legacy were selected based on assumptions discussed between LB and LSM.

[11] https://cfsd.org.uk/projects/ccg/

[12] Player survey report available at: https://cfsd.org.uk/wp-content/uploads/2023/04/Final_Players_Vegan_Cricket_Gear-27-04-23.pdf

Table 3: Product legacy evaluation

Legacy of the product:				Case A: Bovine leather		Case B: Vegan leather	
The longer-term impacts arising from the product stages including results from LCA studies and/or circular economy/resource efficiency considerations.			**Importance**	**Score** **10=good** **1=poor**	**Confidence** **10= high** **1=low**	**Score** **10=good** **1=poor**	**Confidence** **10= high** **1=low**
	1	Durability/how long the product is kept in use	9	7	8	3	5
	2	Recyclable/reuse	8	1	10	3	5
	3	Carbon footprint	9	5	8	8	8
	4	Transport impact in supply chain	6	3	9	3	5
	5	Water footprint	9	3	8	8	5

4. Conclusions

The PSF is a methodology that is in the early stages under development and is not publicly available, but it has proven to be a useful tool to qualitatively evaluate some of the social, economic, and environmental trade-offs associated with replacing the bovine leather used for the palms of cricket batting gloves with a pineapple leather (Piñatex). Due to the lack of data and qualitative nature of the PSF, the findings should be considered as indicative rather than definitive. Nonetheless, the assessment highlighted that while the overall performance of the product under a PBVL scenario appears to be reduced when compared to the use of bovine leather, the products overall 'provenance in the supply chain' is substantially improved. Additionally, when using Piñatex, there appears to be an improvement in the product's legacy, specifically in relation to the material's carbon footprint and overall waste from production.[13] In turn, while substituting the use of bovine leather with Piñatex is not viable in relation to the material's current performance, further material development to improve its breathability and sweat absorption could pave the way for implementing material substitution as a means to enhance the product's overall provenance in the supply chain and legacy.

The PSF also helped to identify some of the data gaps that need to be addressed to conduct a quantitative assessment, primarily in relation to the provenance in the supply chain and legacy of the product. Lastly, the experience of applying the PSF to a practical example highlights that it is a useful 'thinking tool' to support 'quick and dirty' decision making related

[13] Compared to the majority of PBVL companies, Ananas Anam, the company that produces Piñatex appears to be open to sharing data regarding their products' environmental and social impact. While complexities exist for quantifying Piñatex's carbon footprint for example, to accurately compare it to bovine leather, Ananas Anam's website indicates that Piñatex does not require additional environmental resources for raw material> the reason for this is that Piñatex is already produced from agricultural waste. Furthermore, it does not use chemicals on the cradle2cradle list of banned substances within its production and claims to have a reduced water usage compared to that of bovine leather. For further details, see: https://www.ananas-anam.com/responsibility/
For full list of C2C banned list of chemicals, see:
http://www.c2c-centre.com/sites/default/files/C2CCertified_Banned_Lists_V3_121113.pdf

to product sustainability at the early design and development (D&D) stage. However, further work is required to fully develop the PSF process, user guidance and alignment with other standardised methodologies for it to be adopted as part of the D&D process.

Annex I: Product Sustainability Framework – Methodology Development (Louis Brimacombe)

The proposal here is to set out a framework methodology to provide guidance on the assessment of product sustainability and is based on the SCP/1 Product Sustainability Framework Working Group. The context of this proposal is that the term sustainability is widely used, or claimed, because of certain product credentials but this is often focussed on a limited scope of a product's impacts or benefits without wider consideration of multi-criteria assessments needed across the product life cycle.

Sustainability assessment needs to address the social, economic and environmental aspects of a product and should consider these aspects in relation to three focus areas of the product life cycle. The stages across the life cycle can be summarised as:

- Product performance - what does the product/functionality contribute to society and the well-being of society and individuals.
- Provenance of the supply chain - production and component history including, for example, responsible sourcing/ employment across the supply chain
- Legacy of the product – the longer-term impacts arising from the product stages including results from LCA studies and/or circular economy/resource efficiency considerations.

The aim here is to stimulate product life-cycle thinking to consider what aspects or attributes of a product add positive social value (improves quality of life/ benefit to society) and which aspects may have negative impacts or trade-offs of impacts perhaps in different categories or different stages of the product life cycle.

It is recognised that methodologies such as LCA, and other environmental assessment techniques are well-established and will help contribute to product sustainability assessment but there also needs to be consideration of the social and economic impacts, that equally can affect quality-of-life. This framework sets out that social, economic, and environmental aspects eventually lead to, or contribute to, social consequences and these are be embodied in an overall assessment of Social Value (SV).

In this respect the definition of Social Value is extended to include the well-being of individuals, groups, and society. Each of these should be part of the consideration of product sustainability and be applied in each of the analysis phases (Provenance, Performance, Legacy).

Environmental impacts (EI's) can lead to social impacts and so it is valid that these can be included as a social value (SV) metric. So, for example, LCA results would help to inform the social value assessment and would likely be part of the Legacy phase of the assessment. Or alternatively any localised environmental impact assessments might be included in the Provenance or Performance phase (to be defined as part of 'scoping' the approach).

EI's can lead to negative social value (GHG emissions contributing to climate change potentially contributing to flood/storm/hurricane damage so disruption to people's lives) as

well as positive (products which enhance biodiversity or remove or mitigate carbon emissions).

The UN SDGs could also be used as a template to guide on SV parameters to be included in the scope of the Framework but parameters should not be limited to the SDGs, and indeed may be contributors to (or subsets) of the SDG's.

Social Value can be positive and negative (or high/low if preferred). Aspects which improve quality of life or bring improvements in 'well-being' (or perhaps levels of joy) may be regarded as positive, whilst aspects that worsen quality of life (perhaps bringing misery) maybe regarded as negative.

There will be both qualitative and quantitative aspects of the SV assessment and the level of priority and influence of the different aspects of the assessment can be set out in the framework methodology and must be transparent in the reporting and presentation of results.

The outputs of the PSF will be sets of results that indicate where the product has positive and negative sustainability credentials, and where there may be missing information and data that is needed to better understand the assessment.

One of the intended outcomes of the PSF would be to help identify the questions that need to be answered (and promote being able to access to information) to fill the gaps in understanding sustainability across the supply chain and to support decision making.

It is not intended that an assessment will indicate "absolute" sustainability, more likely that both positive and negative attributes will be identified to support decision making and, more crucially, to identify where significant improvements can be addressed.

There may be aspects of SV based upon product 'user' experience or 'user' preferences, particularly within the product performance phase. For example, products which are efficient/convenient/time saving/aesthetically appealing/good tactility/flavour etc, might add positive SV, but some of these, although valid to include in the scope, may be subjective/qualitative and the practitioner should explain how these might affect the interpretation of results and any sensitivity analysis.

There will need to be some care not to politicise aspects of social value, but to try and define aspects of improved or reduced social value that would be hard to contest politically (for example, the safety performance of products, or H&S performance of the supply chain in Provenance). This will be partly solved by transparency in reporting and by the 'users' or practitioners defining their goals, scope and priorities in their social value assessment.

The implications of Economic aspects such as affordability (initial cost vs life cycle cost) and perhaps externality costs (cost to society, or remediation costs) could be included in the scope as a part of the social value assessment (Affordability/Initial cost - probably in the Performance phase).

Within the Legacy phase as well as LCA aspects of circular economy/resource efficiency can be considered where the SV of products may be retained, for example through durability which can help to maintain social value of the product function for a long duration, or at the end-of-life phase, the continued SV contribution through reuse, remanufacturing, and recycling.

Dealbreakers are those negative social aspects which can render the product unacceptable in sustainability terms, for example unsafe or dangerous products, perhaps where the provenance indicates that child/slave labour has been used, or perhaps toxicology of the product. In the prioritisation of the social value parameters, the practitioner can set the thresholds of unacceptability.

Aspects of the assessment phases (Provenance, Performance, Legacy) may be supported by demonstrating accreditation to recognised responsible sourcing schemes or by alignment with existing standards.

The product sustainability framework should be accessible and available to a wide range of stakeholder groups including small and large businesses, product users, product designers and manufacturers. This accessibility is enabled because the framework can be applied at both basic and advanced levels, where the basic level may set out the criteria and the priorities and embed the knowledge, which is readily available, but which may also indicate that further information and data gaps need to be filled to complete the assessment (and in order to fully understand the wider social value impacts).

More advanced users may have capability and/or access to the detailed data across the supply chain and, for example, the results of LCA studies. One possible use of the PSF is that it can set out the questions of smaller (less-well-resourced) user groups in a systematic way that can then be directed to providers in the supply chain, and/or from data available from experts or publicly available on the Internet.