MANUFACTURING POLLUTION

Synopsis Series 1: Country and Sector Priorities

Bangladesh: Used Lead Acid Battery Manufacture (ULAB) and Tanneries

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March 2022

SMEP | Sustainable Manufacturing and Environmental Pollution

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SMEP's purpose

The Sustainable Manufacturing and Environmental Pollution (SMEP) programme is funded by the UK's Foreign, Commonwealth, and Development Office (FCDO) and implemented in partnership with UNCTAD (the United Nations Conference on Trade and Development). SMEP aims to improve existing knowledge on the environmental and health impacts of trade-exposed manufacturing across sub-Saharan Africa (SSA) and South Asia (SA) and develop solutions that address complex technical, regulatory, capacity, feasibility, and social challenges.

SMEP builds on a scoping study carried out by Stockholm Environment Institute (SEI) and York University, which identified several key industries in SSA and SA, namely food and beverages, textiles, chemicals, electrical equipment, and metals and the environmental and health impacts of these.

To complement this study, SMEP funded further exploration to obtain country- and sector-focussed insights and unpack these findings into potential areas for future SMEP funding of large-scale targeted research and possible interventions at a regional, country or more granular level.

Synosis overview

As part of the SMEP prioritisation work for South Asia, Pure Earth presented high-priority interventions/solutions to reduce environmental impacts and human health exposure from lead contamination from the Tanneries and Used Lead-Acid Batteries (ULAB) sectors in **Bangladesh**.

This is a synopsis of the main report which is available on request; please email info@smepprogramme.org.

Contents

Used Lead-Acid Batteries (ULAB)

Snapshot focus

Lead exposure negatively impacts I.Q., educational attainment, lifetime learning potential, social behaviour, and child and maternal health. Unsafe used lead-acid battery (ULAB) management and recycling is a major contributor to childhood lead poisoning.

The SMEP business case (2018) highlighted the ULAB sector as the most polluting industry and economic activity in lower-middle-income economies (LMICs), with the highest rank by Disability-Adjusted Life Years (DALYs) of 2,000,000–4,800,000. This built on the World Bank's Country Environmental Analysis for Bangladesh (2006) which identifies lead pollution from unsound ULAB recycling as a priority, as does the Government of Bangladesh's Country Investment Plan for the Environment, Forests and Climate Change (2017). Therefore, it is a cross-cutting issue that severely undermines the government's development goals and investments by their development partners.

Problem statement

ULABs have commercial value as they are readily recyclable into new batteries or other goods. The lead-acid battery (LAB) industry could be a model for the circular economy, but currently ULAB recycling in Bangladesh is divided between registered facilities, which require strong environmental controls and oversight, and illegal, highly polluting, informal recycling.

Bangladesh lacks sufficient formal recycling infrastructure and capacity to handle the amount of ULABs flooding the markets. As a result, informal recyclers are filling the capacity shortfall. The huge market demand for LAB has encouraged unregistered and non-compliant battery manufacturers that have now captured 70 per cent of the local market share (Babu, 2020). The emergence of informal manufacturers has significant implications for ULAB recycling: they have become the major buyers of recycled lead and readily purchase unrefined lead bullion from low-cost, informal recyclers. The informal sector includes undocumented labourers, street hawkers, sellers of banned products, and other small to medium-scale industries operating outside of the law.

The stakeholders interactions revealed that there is minimal monitoring and enforcement of environmental regulations at LAB facilities, even for registered operations. Environmental controls may only be enacted during an inspection but are otherwise bypassed to save costs. Further, foreign-owned facilities, which are unregistered, are not inspected and do not have the necessary environmental controls.

The size of the market for LABs assembled in Bangladesh is approximately U.S. $129 million (BDT 11 billion, or 11,000 crores) per year (Babu, 2020) and is growing at a rate of 12 per cent (Ahmed & Hasan, 2020). Battery manufacturers in Bangladesh also aim to raise their annual exports significantly in the next five years, contributing to the increasing demand for the LAB manufacturing and recycling industries (Dhaka Tribune, 2019).

Methodology

Pure Earth employed somewhat different methodologies to develop suitable pollution mitigation interventions within the Tanneries and ULAB industries in Bangladesh; however, both were grounded on stakeholder engagement and desk research.

The objective was to identify solutions to support and improve the formal sector in prioritising environmentally sound management and recycling of ULABs and redirecting the ULABs from an informal to a formal setting. A long list of solutions was developed, falling into two overarching categories:

1. Systems solutions, that provide economic or oversight tools to transition the informal industry to the formal sector and allow for better uptake of technological solutions;

2. Technological advancements, i.e., private sector-based solutions for improving performance within the formal sector.

The long list of possible solutions was run through a prioritisation methodology based on designated criteria (see Table 1 next page), namely:

1. **Order of interventions:** Given current industry dynamics, can the intervention be implemented at this time? Is the industry currently incentivised to take up this solution? Are other interventions needed first to change industry drivers?

2. **Scale of impact:** What is the potential of this intervention to reduce environmental pollution from the battery recycling industry? This considered both the efficacy of the intervention in reducing environmental contamination and the potential for uptake within the industry.

3. **Political and social feasibility:** What stakeholders support is required for this intervention to be implemented?

4. **Market readiness, technological requirements, and economic impact:** Is the necessary technology or material available in Bangladesh? What anticipated costs or economic opportunities would this intervention create for the industry?

Ratings for each prioritisation category were determined through stakeholder consultations and literature reviews. Interventions with a score of 10 or more were shortlisted and analysed in greater depth. Future scopes of work for each prioritised solution were developed through discussion with stakeholders and potential project partners.

Table 1: Long-list of interventions, with prioritization ratings

Solutions	Order of interventions	Scale of impact	Political and social feasibility	Market readiness, technological requirements, and economic impact	1 = Low 2 = Medium 3 = High ...
Battery saw	Low	Medium	High	Low	7
Hammer mill	Low	Medium	High	Low	7
Repurpose waste sulfuric acid into gypsum	Low	Medium	High	Low	7
Treatment of waste sulfuric acid before disposal	Low	Medium	High	Low	7
Hybrid of pyrometallurgical and hydrometallurgical processes	Medium	High	High	Low	9
Single standard for industry environmental performance	High	Medium	High	Medium	10
Deposit Refund Scheme (DRS)	High	High	Medium	Medium	10
Battery swapping stations for e-rickshaws	High	High	Medium	High	11
Adjustment of taxation structure (e.g. removal of Goods and Services Tax GST on ULABs)	High	High	Medium	High	11
Imposition of a green tax	High	High	Medium	High	11

Intervention logic

The issues around ULAB management and recycling in Bangladesh are complex and require exploring different approaches with different stakeholder groups. There is no safe way to recycle ULABs outside of a formal facility, so the proposed interventions aim to shift the flow of ULABs from the informal sector to the formal sector, improve the performance of the formal sector, and reduce the number of batteries consumed by extending battery life by improving the quality of LABs and their care and maintenance.

The prioritisation methodology was initially applied to the proposed long list of solutions. Solutions that scored higher than seven were selected based on their potential for scalability. The table below lists the prioritised solutions with their prioritisation criteria and rating, in four broad categories:

1. Assessment and outreach on economic tools, including: a deposit refund scheme for ULABS (which would have the potential to integrate scrap collectors currently engaged in the informal sector); the imposition of green tax on batteries; and a change in the existing tax structure for registered recyclers.

2. Aligning major LAB suppliers around a single standard for industry environmental performance to enable consumers, particularly organisations that purchase large quantities of batteries, to commit to high performance companies.

3. Battery swapping stations for e-rickshaws. Controlled charging, battery repair, and awareness-building around proper battery discharge and management should increase LABs battery life, requiring fewer new batteries to enter the market. By aggregating collection at one location, batteries that have reached end-of-life would be required to be sent to formal recycling facilities

4. Hybrid of pyrometallurgical and hydrometallurgical processes. This technology could reduce emissions to near-zero, and has moved from the piloting stage to commercial scale in other countries.

Each of the proposed solutions has both upstream and downstream impacts on the LAB industry in Bangladesh (Figure 1). These interventions complement different stakeholders across the private sector and government.

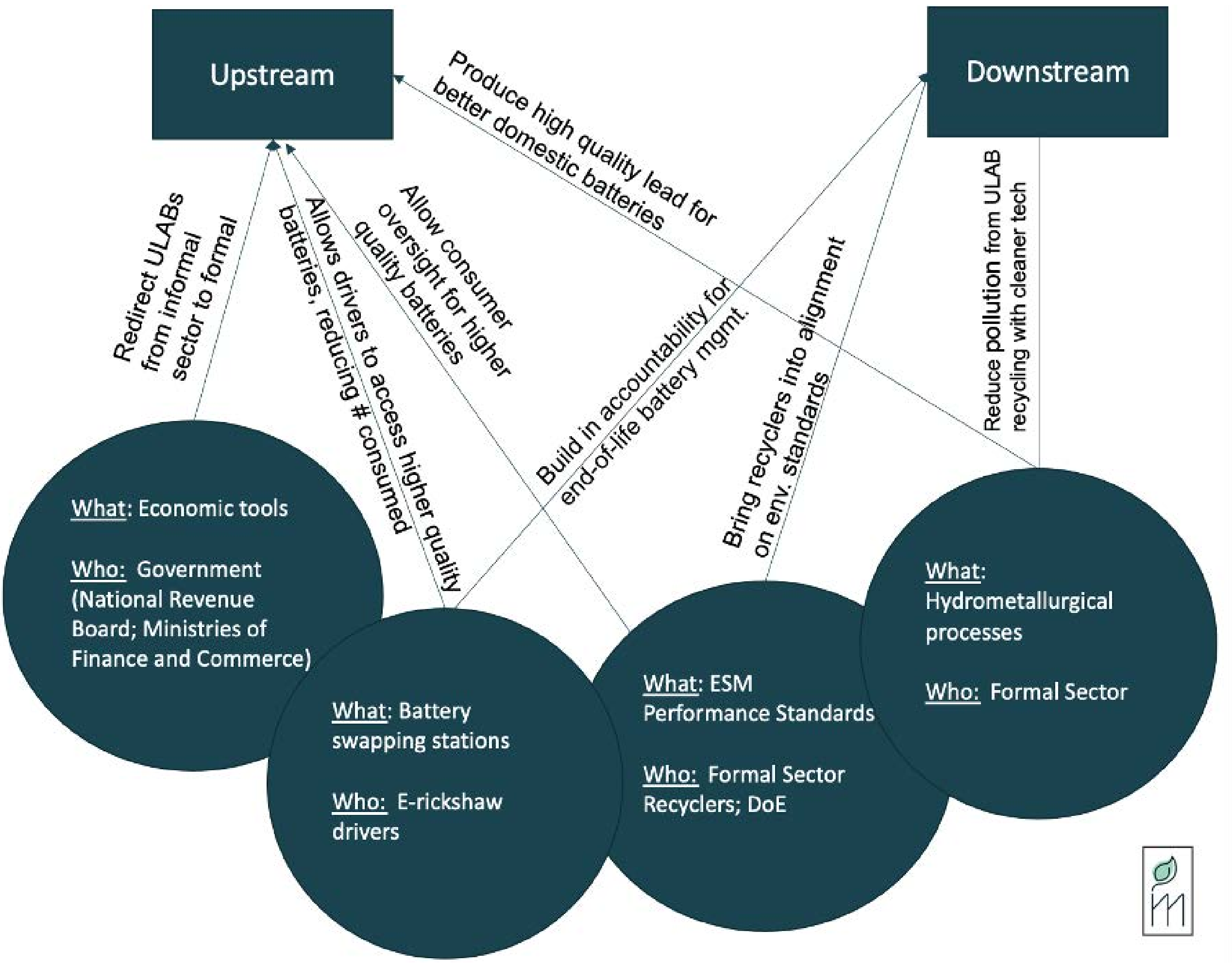

Figure 1: Used Lead-Acid Batteries (ULAB) proposed solutions are interrelated and complementar

Baseline report and annexes available on request to info@smepprogramme.org:

Future Interventions Strategy ULAB Bangladesh Final Report
Pure Earth (2021)

Tanneries

Snapshot focus

The leather industry has substantial importance in the economy of Bangladesh, given its potential for higher value addition and a larger share of export earnings. The leather tanning sub-sector has a high environmental footprint and tends to attract scrutiny from local and international markets.

Testing leather to ensure the absence of hexavalent chromium (chromium(VI), Cr(VI), chromium 6) and other dangerous metals is required by legislation such as the E.U. General Product Safety Directive for safe manufacturing and export. However, since the leather industry is not compliant, readily available raw hides cannot be converted into higher value-added products like leather goods and footwear and exported to the European and American markets.

It is believed that if the industry can be made compliant with the Directive standards, the export earnings from the leather industry (currently around the billion dollars mark) could reach up to 10 billion dollars by 2025 (The Daily Star, 2019).

Problem statement

Effluents from the leather industries are ranked as primary environmental pollutants as they contain more than 40 different chemicals, including heavy metals, acids, and dyes.

The presence of Cr(VI), a carcinogenic chemical, and other heavy metals such as copper, mercury and lead in the leather can be hazardous for human health and the natural environment. Other main concerns are cadmium, lead, mercury, antimony, and arsenic. Arsenic is rare, but still found as a biocide used in raw hides and preservation of skins and is both toxic and carcinogenic. Metal complex dyes include chromium (III), copper (II) and cobalt (II) which are bound to the organic molecule matrix. Titanium dioxide (classified as a Category 2 carcinogen) pigments are used to prepare white- or pastel-coloured leather.

Furthermore, heavy metals in finished leather may come from the contact of the hides and skins prepared for manufacturing, the water source, and other mechanical equipment used to assist in leather processing, or in various dyestuffs; for example, extractable nickel is sometimes present during leather processing.

Methodology

Step 1

- The study team first identified problems that lead to the pollution from hexavalent chromium (chromium(VI), Cr(VI), chromium 6) and identified interventions to resolve this challenge.
- The suggested interventions were then assessed in terms of their market and technology readiness. The market readiness analysis assessed the availability, financial cost, and quality of the relevant interventions in the local and international markets.
- The technology readiness section assessed availability, reliability, acceptance, and certifications about the suggested technology.

Step 2

After assessing market and technology readiness, a rigorous political, economic, social, technological, environmental, and legal (PESTEL) analysis was conducted. This analysis focused on the relevant policies and legislation in Bangladesh, as well as current regional and global requirements. It also considered the economic implications of these interventions on the price of leather processing, and social implications, namely the health of workers, consumers, and local communities.

Step 3

After the PESTEL analysis, a total of 15 interventions were assessed. Of these, four were system-level interventions that address broad issues regarding environmental compliance of the tanning industry in Bangladesh. The remaining interventions were chrome-related and focused on eliminating the presence of chrome VI in processed leather. The interventions were assessed through a prioritisation framework, using the following criteria:

i. Order of interventions

ii. Scale of impact

iii. Political and social feasibility

iv. Market readiness, technological requirements, and economic impact

v. Stakeholders understanding and qualification

Table 2: Selected interventions for the leather tanning industry of Bangladesh

Details of solutions	
A. Broad-based solutions	
1	Full commissioning of CETP (Central Effluent Treatment Plant) along with the complete setup of electro-chemicals components as per the tender documents
2	Third-party audit about the performance of the CETP
3	Rationing of water and switching to renewable energy
4	Addressing the problem of solid waste management
B. Cr(VI) related solutions	
5	• Use certified chrome tanning agents from safe sources. • Do not use recycled chromium tanning agents and chrome tanning liquor without a preliminary test for Cr(VI).
6	The use of chromate pigments (yellow and orange inorganic pigments) should be avoided or used after preliminary test for chrome (VI).
7	Contaminated water or contaminated tanning drum with Cr(VI) should be avoided.
8	Oxidation agents, for example, strong bleaching agents such as peroxides and potassium permanganate, should not be used during or even after chrome tanning.
9	• Neutralise down to the lowest-possible pH value (below 5.5) • Use reducing agents like Sodium metabisulfite (Na2S2O5) and Sodium sulfite (Na2SO3).
10	A final washing of the leather should be carried out correctly.
11	The use of excess ammonia before the dyeing process should be avoided.
12	The use of unsaturated fats and oils such as sulfited fish oil should be avoided during the fatliquoring of leather.
13	Obligatory use of at least a small amount of vegetable agent (preferably tara, up to 4 per cent) in re-tanning.
14	Synthetic antioxidants (reducing agents) should be used where it is not possible to apply vegetable tanning agents.
15	Awareness building training, workshops and seminars with the tannery owners, leather technologists, and workers regarding the Cr(VI) formation and its remedies can be useful.

Step 4

Based on the identification and analysis of the major challenges and opportunities for the leather tanning industry of Bangladesh to become Cr(VI) free and more compliant, the study team also developed possible future scopes of work to advance solutions.

Intervention logic

Initially the scope of work for this phase was to focus on solutions relevant to Cr(VI) and other heavy metal-related issues. However, the PESTLE analysis and consultations with relevant stakeholders revealed prominent issues regarding environmental degradation in the tannery industry. Work with the tannery industry by The Asia Foundation confirmed that these issues are more severe and, if addressed, can resolve Cr(VI)-related problems.

Central Effluent Treatment Plants (CETPs) and solid waste management are the core environmental problems the industry is currently facing, as they interfere with the Bangladesh industry's ability to secure Leather Working Group (LWG) certification, without which products cannot be exported to the European and American markets. Addressing these issues will get buy-in from industry stakeholders, including the government, since focus on these issues supports the holistic improvement and overall environmental management of the industry.

After deliberation between SMEP, Pure Earth and The Asia Foundation, four broadband solutions that would significantly impact the industry's future are proposed, as per Figure 2.

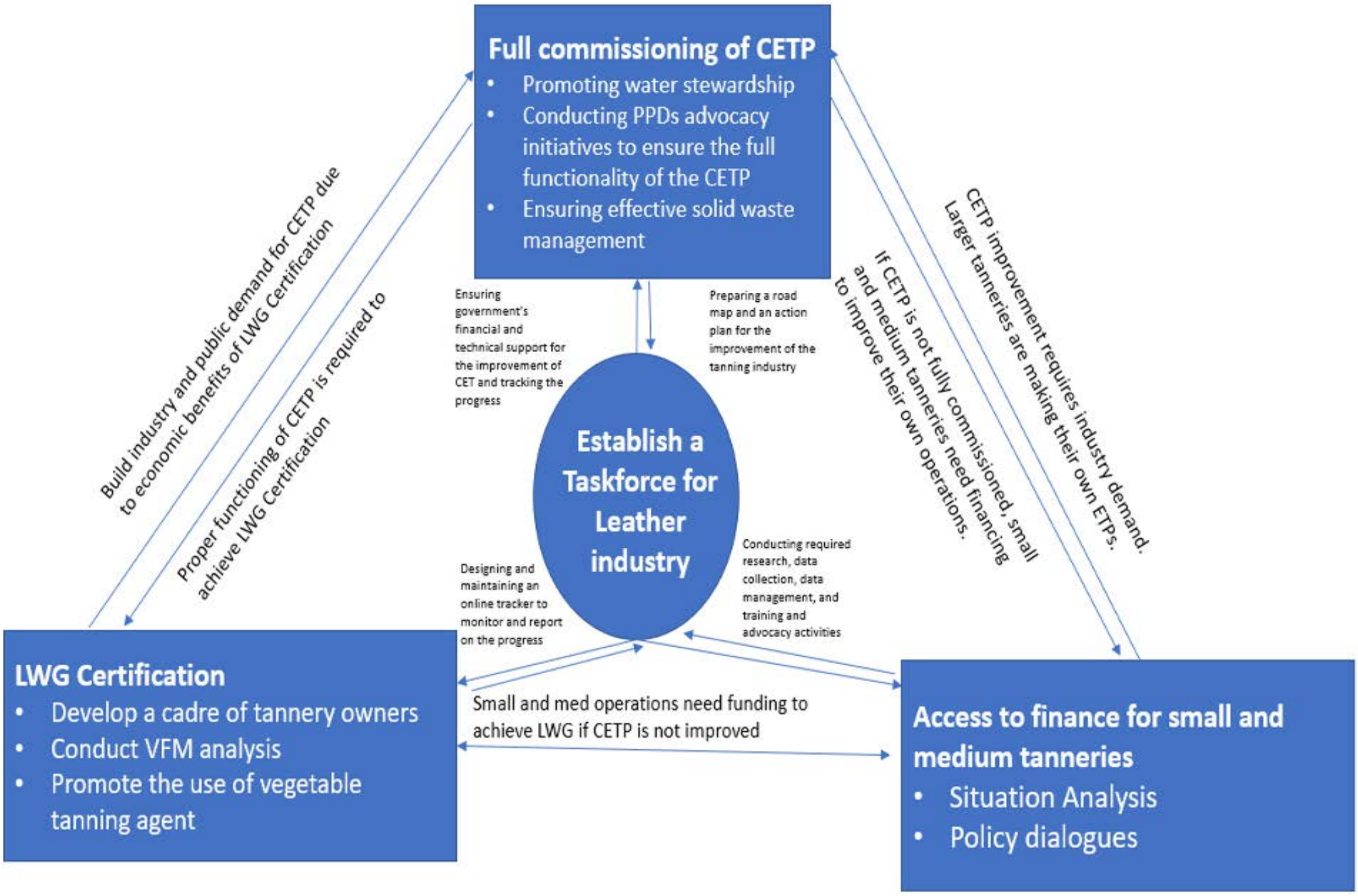

Figure 2: Broadband solutions that would significantly impact the Leather industry's future

Baseline report and annexes available on request to info@smepprogramme.org:

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